

SANFORD MAIN WTP IMPROVEMENTS



PROJECT MANUAL

VOLUME II

AUGUST 2020



CITY OF
SANFORD
FLORIDA

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GENERAL REQUIREMENTS

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SECTION 01000

PROJECT REQUIREMENTS

1. GENERAL

1.01 Description

A. Scope of Work

1. The Work to be done consists of the furnishing of all labor, materials, and equipment, and the performance of all Work included in this Contract.
2. A summary of the Work associated with this Project is presented in Section 01010, "Summary of Work".

B. Work Included in the Project

1. The Contractor shall furnish all labor, superintendence, materials, plant 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 necessary local building permits except as provided in Section 01065, "Permits and Fees". 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 Engineer, and in strict accordance with the Contract Documents.
2. ***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.
3. ***The cost of incidental Work described in these Project 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.***

4. The Contractor shall provide and maintain such modern plant, 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 workmanship, materials, and equipment, prior approval of the Engineer notwithstanding.
5. The work shall be carried out in such a way as **to limit interruption of operation of existing utilities and treatment facilities to less than four (4) hours during low demand periods (10 pm - 5:30 am)** and absolutely no interruption of water, wastewater, reclaimed water, biosolids or other service to the Owner's customers will be allowed. All required temporary power, control, bypasses, and other appurtenances shall be provided by the Contractor as part of the cost of performing the Work.

C. Public Utility Installations and Structures

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, vaults, manholes, 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, wastewater, 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 public 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 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 public utility installations and structures from damage during the Work.** Access across any buried public utility installation or structure shall be made only in such locations and by means approved by the Engineer. The Contractor shall so arrange his operations as to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor shall be repaired by the Contractor, at his expense. No separate payment shall be made for such protection or repairs to public 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 Contract 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 prices bid for the various Contract Items. No separate payment shall be made therefor.

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 Contract 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.
6. The Contractor shall, at all times in performance of the Work, employ acceptable 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 the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least seventy-two (72) 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.
9. Utilities that may be encountered are as follows:
 - a. City of Sanford Utilities Department
 - b. Florida Power and Light
 - c. AT & T
 - d. Florida Public Utilities
 - e. Spectrum (Brighthouse Networks)

1.02 Drawings and Project Manual

A. Contract Drawings

1. When obtaining data and information from the Contract Drawings, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings. Specifications shall generally supercede information given on the Contract Drawings but in all cases, the more stringent or costlier option shall be assumed to govern in the Bid. The Owner shall exercise his right, as a tax-exempt entity, to recover sales tax in accordance with Article 1.37 of Section 00100, "Instructions to Bidders", Article 1.04 of Section 00300, "Bid Form" and State Law.

B. Copies Furnished to the Contractor

1. After the Contract has been executed, the Contractor will be furnished one (1) complete set of Contract Drawing (22 inches by 34 inches), the Project Manual (contract requirements and specifications) and all addenda, upon request.

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 reproducible Contract Drawings (22 inches by 34 inches) and one (1) reproducible copy of the specifications.
2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefor 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 Contract 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 therefrom, nor from rectifying such conditions at his 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 or 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

1. The Technical Specifications consist of three (3) parts: General, Products, and Execution.
2. The General part of a Specification contains "General Requirements" which govern the Work.
3. The Products and Execution parts modify and supplement the General Requirements 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 Contract 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 Contract 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, the interpretation of these Specifications shall be made upon that basis.

1.03 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 Trench Safety Act as listed in the Bid and 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

1. 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 workers are employed on the Project.

1.04 Materials and Equipment

A. Manufacturer

1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request and at the Engineer's option, that the manufacturer or subcontractor deal directly with the Engineer.
2. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
3. Any two (2) 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 in ample quantities to ensure the most speedy and uninterrupted progress of the Work so as to complete the Work within the allotted Contract Time.
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.

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 (1) 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 corrosion resistant thermoplastic cases, properly labeled (indelible and weatherproof) and equipped with good grade cylinder locks and duplicate keys.

2. Spare parts shall be furnished as specified herein, and in the individual equipment specification sections, and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.
3. Each piece of equipment shall be provided with a substantial nameplate (indelible and weatherproof), 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 the 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.

1.05 Inspection and Testing

A. General

1. 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. An electronic copy (PDF) 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.
2. 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 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.

3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
4. The Contractor shall be fully responsible for the proper operation of equipment during testing 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.

B. Costs

1. ***All inspection and testing of materials furnished under this Contract will be provided by the Contractor,*** unless otherwise expressly specified.
2. ***The cost of shop and field tests of equipment and of 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. Certificate of Manufacture

1. ***The Contractor shall furnish to the Engineer authoritative evidence in the form of a certificate of manufacture*** that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.
2. Three (3) 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.

D. Shop Tests

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements 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. Shop tests, where specified, shall be witnessed by the Engineer.

2. Three (3) copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be submitted to the Engineer for approval.
3. ***The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.***

E. Start-up Tests

1. As soon as conditions permit, ***the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.***
2. If the start-up tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to demonstration tests, make all changes, adjustments, and replacements required. The furnishing Contractor shall assist in the start-up tests as applicable.

F. Demonstration Tests

1. ***Prior to Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.***
2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests, at no additional cost to the Owner. The Contractor shall assist in the demonstration tests as applicable.

1.06 Lines and Grades

A. Grade

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Contract Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Engineer will establish bench marks and baseline controlling points. Reference marks for lines and grades as the Work progresses will be located by the Contractor to cause as little inconvenience to the prosecution of the Work as possible. The

Contractor shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions placed by him contrary to this provision.

B. Surveys

1. ***The Contractor shall furnish and maintain, at his own expense, stakes and other such materials.***
2. ***The Contractor shall check such reference marks*** by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.
3. ***The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the reference marks*** set by the Engineer, and shall be solely responsible for the accuracy thereof. He shall, however, be subject to the check and review by the Engineer. Field engineering and surveying shall be in accordance with Section 01050, "Field Engineering".

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 re-establishing 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 shall bear the cost of re-establishing them if disturbed or destroyed.

1.07 Adjacent Structures and Landscaping

A. Responsibility

1. ***The Contractor shall be entirely responsible and liable for all damage or injury as a result of his 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. Protection of public and private property shall be provided by the Contractor as specified in the General and Supplementary Conditions and as specified herein.

3. 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 Contract Drawings, and the removal, relocation and reconstruction of such items called for on the Contract Drawings or specified shall be included in the various Contract Items and no separate payments will be made therefor.
4. The Contractor is expressly advised that the protection of buildings, structures, tanks, pipelines, monitoring wells, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility.
5. 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. Reference is made to the requirements of Section 00800, "Supplementary Conditions", the pre-existing condition survey described in this section, Section 01380, "Construction Photographs", and Section 01390, "Preconstruction Video Recording".
6. The 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.
7. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the Engineer 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.
8. Prior to the beginning of any excavations the Contractor shall advise the Engineer of all structures on which he intends to perform work or which performance of the project work will affect.

B. Protection of Trees

1. All trees and shrubs shall be adequately protected by the Contractor with boxes and otherwise and in accordance with ordinances governing the protection of trees.
2. Excavated materials shall be placed so as not to injure such trees or shrubs.
3. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at its proper season and **at the sole expense of the Contractor.**

C. Lawn Areas

1. Lawn areas shall be left in as good condition as before the starting of the work.
2. ***Where sod is to be removed, it shall be carefully removed, and later replaced, or the area where sod has been removed shall be restored with new sod.***

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.
2. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the Owner and Engineer.
3. 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 therefor, as part of the overhead cost of the work, and no additional payment will be made therefor.

1.08 Protection of Work and Public

A. Barriers and Lights

1. During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents.
2. The Contractor shall provide suitable barricades, red lights, "*danger*" or "*caution*" or "*street closed*" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public.

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. ***In the vicinity of hospitals, schools and golf courses, special care shall be used to avoid noise or other nuisances.*** The Contractor shall strictly observe all local regulations and ordinances covering noise control.

3. ***Except in the event of an emergency or for critical tie-ins to existing utilities, work shall be restricted to between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday except for legal or City holidays.***
4. Proper and efficient prosecution of the work, particularly to avoid unacceptable shutdown of existing utility service, may require operations during the night. Written permission of the Owner shall be obtained before starting such items of the work.
5. ***No deliveries are to be made to the site before 8:00 a.m. nor after 3:00 p.m.*** Delivery vehicles may not arrive before 8:00 a.m. and are to be limited to normal work days.
6. The Contractor shall not create a public nuisance in accordance with Article 1.33 of Section 01120, "Special Project Procedures".

C. Access to Public Services

1. 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 all fire hydrants, valves or manholes.

D. Dust Prevention

1. ***The Contractor shall prevent dust nuisance from his operations or from traffic*** by keeping the roads and/or construction areas sprinkled with water at all times.

1.09 Cutting and Patching

- A. The Contractor shall do all cutting, fitting and patching of his portion of the Work that may be required in accordance with Section 01045, "Cutting and Patching".

1.10 Cleaning

- A. The Contractor shall execute cleaning, during progress of the Work, and at completion of the Work, as required by the General Conditions and Section 01710, "Cleaning", and Section 01800, Miscellaneous Work and Cleanup".

1.11 Miscellaneous

A. Protection against Siltation and Bank Erosion

1. The Contractor shall arrange his operations and construct erosion control devices to minimize siltation and bank erosion on the construction site and on existing or proposed water course and drainage channels.
2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as directed by the Engineer which results from his construction operations.
3. The Contractor shall review the requirements of Section 01560, "Environmental Protection", and Section 01570, "Temporary Erosion and Sedimentation Control".
4. ***The Contractor shall properly and legally dispose of all surplus material, including soil, in accordance with local, state and federal regulations.***

B. Protection of Wetland Areas

1. Under no circumstances shall surplus material be disposed of in wetland or watercourse areas as defined by the Florida Department of Environmental Protection (FDEP) or the wetland or watercourse areas surrounding the Project Site.
2. The Contractor shall review the requirements of Section 01560, "Environmental Protection", and Section 01570, "Temporary Erosion and Sedimentation Control".

C. Existing Facilities

1. The Work shall be conducted to maintain all Owner utilities and traffic lanes in operation during the Project.

D. Use of Chemicals

1. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfection, polymer, reactant, or of other classification, must show approval of either EPA or USDA.
2. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

E. 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 work that such other contractors may complete their work at the earliest date possible.
 4. The Contractor shall review the requirements of Section 01040, "Project Coordination".
- F. 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 this Project.

1.12 Owner's Representatives

- A. The Owner will appoint the Resident Project Representative (RPR) and Project Manager (PM) as the Owner's representative as defined in the General and Supplementary Conditions.

1.13 Pre-Existing Conditions

- A. ***The Contractor shall conduct a pre-existing conditions survey of each of the existing structures, adjacent properties, and existing land improvements in the vicinity of or potentially effected by the Work.*** The survey shall establish the state of the property before construction as a basis for any claims of damage that may occur.
- B. This survey shall include comprehensive photography and video recording of structures; spot elevations of grades and tops of walls; nearby water courses, wetlands, landscape features; driveways and walkways; and shall make note of any identified previously damaged areas. Photographs and video tape shall be subject to review and approval by the Owner and shall be in accordance with Section 01380, "Construction Photographs" and Section 01390, "Preconstruction Video Recording".

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01010

SUMMARY OF WORK

1. GENERAL

1.01 Work Covered by Contract Documents

- A. The Work to be performed under this Contract consists of the construction of **Water Treatment Plant Improvements at the Sanford Main WTP**, (3701 Country Club Road, Sanford, FL 32772) for the City of Sanford, Florida as shown on the Contract Drawings and as specified herein.
- B. The Contractor shall furnish all of the materials, supplies, tools, equipment, labor and other services necessary for the construction and completion of the **Sanford Main WTP Improvements** that generally consists of, but is not limited to, the following elements:
 - 1. A new 2-story Main WTP Operations Building to include an Operations Center Control room, meeting/breakroom, laboratory, administrative offices, high service pumping room, restrooms, reception area, electrical and mechanical rooms, chemical storage rooms, etc.
 - 2. Installation of pumping, piping, valving and metering systems.
 - 3. Installation of chemical feed, storage and pumping systems.
 - 4. Electrical, controls and instrumentation system improvements.
 - 5. Diesel engine driven generator with weatherproof enclosure.
 - 6. SCADA System modifications.
 - 7. Site work, yard piping, stormwater management system improvements, plant internal roadway improvements, signage, landscaping, sodding, irrigation system and miscellaneous appurtenances and ancillaries.
 - 8. Lighting systems.
 - 9. Facility wall, fencing and security systems.

10. Demolition of two on-site buildings (the existing WTP operations/pumping building and the one-story office building) and all associated infrastructure and the legal disposal of all demolished materials after the new Main WTP Operations Building is constructed and all systems and equipment have passed demonstration tests and are operational.
 11. Miscellaneous appurtenances and ancillaries.
- C. All fees, permits and licenses for the permanent construction which are required by regulatory agencies or authorities, including fees for the review of Contract Documents prior to construction, will be procured by the Contractor at his expense.
 - D. The Contractor shall perform the work complete, in place, and ready for service, and shall include repairs, testing, clean-up, replacements and restoration required as a result of damages caused during this construction.
 - E. ***The Contractor shall be required to obtain and pay for a building permit from the City of Sanford Building Department*** for the improvements to be constructed as part of this Contract.
 - F. ***The Contractor shall also be responsible for all fees associated with the City of Sanford and any FPL inspections and energizing of services and equipment.***

1.02 Contract

- A. This Project shall be constructed under a “***lump sum***” contract.
- B. Construct the Project for the total price stipulated in the agreement subject to authorized change orders only. A written change order will be required authorizing and ordering the work and specifying the amount and terms of payment “***prior***” to execution of any extra, additional or changed work.
- C. If the Contractor proceeds performing additional, extra or changed work without an executed Change Order, it is understood and agreed by the parties that ***the Owner has no obligation to subsequently pay for the extra or additional work under a subsequent claim or any other basis*** and that by executing the Agreement, the Contractor waives rights to make subsequent claims for extra or additional work if he proceeded without a signed Change Order in performing the work.

1.03 Project Work Sequence

- A. The Contractor shall consider the proposed construction sequence, identified in Article 1.14 of Section 01000, “Project Requirements”, when making his Bid and incorporate all related costs in the Bid Price.

- B. ***The “down” time of the “existing” potable water production facilities and chemical feed/metering systems shall be minimized,*** as the Sanford Main WTP needs to produce potable water for the residents and customers of the City of Sanford.
- C. The Contractor shall establish his work sequence based on the use of crews to facilitate completion of construction and testing of the proposed improvements within the specified Contract Time identified in the Agreement.
- D. The detailed work sequence, including the Contractor’s plans for provision of temporary facilities, shall be submitted to the Engineer ***no later than ten (10) calendar days after the Notice to Proceed.***
- E. The Engineer and Owner reserve the right to change the construction sequence during construction, if in the opinion of the Engineer and Owner, that the change is made in a timely manner that allows the Contractor adequate time to schedule materials, equipment and labor for the execution of the Work involved in the sequence of the Work from that stated in the Contractor’s submitted construction schedule/sequence.

1.04 Contractor Use of Premises

- A. The Contractor shall confine operations at the Project Site to the areas permitted by the City of Sanford, the Contract Documents and all applicable laws, ordinances, and permits. If additional storage or work areas are required, ***they shall be obtained by the Contractor at no additional cost to the Owner.***
- B. The Contractor shall not unreasonably encumber the site with materials or equipment. The City and Engineer shall designate all areas that can be used by the Contractor.
- C. The Contractor shall not load structures with weight that will endanger the structure.
- D. The Contractor shall assume full responsibility for the protection and safekeeping of products and materials at the job site, ***including all Owner Direct Purchased products, equipment and materials.***

1.05 Construction Schedule

- A. Construction Schedules shall be generated in accordance with the requirement of Section 01311, Construction Progress Schedules”.
- B. ***Within ten (10) calendar days after the Notice to Proceed (NTP), the Contractor shall submit a detailed Construction Schedule of all major activities*** needed to complete the project in accordance with the details outlined in the Contract Documents.

1.06 Preconstruction Meeting

- A. ***The Engineer will schedule a preconstruction meeting no later than fourteen (14) calendar days after the date of the Notice to Proceed (NTP).*** This meeting shall be attended by the Engineer, Contractor, and Owner.
- B. The purpose of the meeting shall be to review shop drawing procedures, construction methods, administrative procedures, project site conditions, to establish a construction schedule, etc.
- C. Location of the Meeting: A central site, convenient for all parties designated by the Engineer.
- D. The Contractor shall refer to Section 01200, "Project Meetings", for further details.

1.07 Progress Meetings

- A. ***Progress meetings will be held every thirty (30) days or less with the first meeting thirty (30) days after the preconstruction meeting or thirty (30) days or less after the date of Notice to Proceed.***
- B. Location of the meetings: Project construction field office of the Contractor at the Sanford Main WTP.
- C. The Contractor shall refer to Section 01200, "Project Meetings", for further details.

1.08 Coordination

- A. The Contractor shall be fully responsible for the coordination of his work and the work of his employees, subcontractors, manufacturers' representatives, and suppliers and to assure compliance with schedules.
- B. The coordination requirements of this Section are in addition to the requirements of Specification Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions (Construction)" and Section 1040, "Project Coordination".
- C. It is the Contractor's responsibility to coordinate with all the utilities regarding locates, testing or relocations.

1.09 Work under Other Contracts - NOT USED

1.10 Facility Security Requirements

- A. The Contractor is hereby advised that the Sanford Main WTP is designated as a **"limited access"** facility and has adopted stringent security requirements. **"Background checks" for all employees working on the Project** shall be provided in accordance with Section 00425.
- B. Prior to beginning construction activity, **the Contractor must provide the City Utility/Public Works Department and the Engineer with a name list and pictures of all personnel (including subcontractors) expected to be on-site during the construction of this Project.**
- C. The Contractor and major subcontractor's permanent employees **shall be required to carry ID cards (photo, company name, position, person's name, etc.)** with them at all times during project construction. Non-identified personnel will not be allowed at the Facility to perform work. Any missed time, cost and loss of construction schedule due to Contractor employees not being identified, **shall be borne solely by the Contractor and the Contract Time and Cost will not be adjusted.**
- D. Contractor personnel may, from time to time, be required to show state-issued identification in order to be allowed entrance to the facility. Vehicles and personnel may be searched prior to obtaining access to the site. **Personnel not on the Contractors list will not be allowed access to the facility.** As such, the Contractor is highly encouraged to keep and maintain a current list of personnel expected to be on-site on a daily basis.
- E. All delivery drivers **must** check in with the Contractor and provide a valid state driver's license as identification.
- F. Delivery vehicles will not be allowed in the facility unless identification is provided.
- G. Any missed time, cost and loss of construction schedule due to Contractor employees not being identified, shall be borne solely by the Contractor and the Contractor Time and Cost will not be adjusted.

1.11 Subcontractors

- A. The Contractor shall not employ any subcontractors against whom the Owner or the Engineer may have a reasonable objection.

- B. The name, addresses and experiences of the proposed project subcontractors shall be submitted with the Bid and also to the Engineer for the Engineer's review prior to any Work being performed by the subcontractor.

1.12 Working Hours

- A. Working hours for the Resident Project Representative (RPR) are an eight (8) hour period between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday. Any work beyond this time period is to be requested, ***in writing, at least seventy-two (72) hours in advance and paid for by the Contractor (in advance) within five (5) days of the additional work at the standard billing rate for the RPR times a multiplier of 1.50.***
- B. ***Any work required on Saturday or Sunday shall be requested in writing at least seventy-two (72) hours in advance.*** All requests must be approved by the Engineer and Owner in advance. Under emergency conditions, a verbal request may be made with a follow-up written request. ***This additional RPR time shall be paid for by the Contractor (in advance) within five (5) days of the additional work at the standard billing rate for the RPR times a multiplier of 2.00.***

1.13 Contractor's Superintendent

- A. The Contractor's Superintendent shall have a ***minimum of ten (10) years of related construction experience of the nature required by this Construction Project and shall be English-speaking.*** The Contractor shall submit the résumé of the superintendent to Engineer for approval prior to the Preconstruction Meeting.
- B. The Contractor shall have a ***superintendent on-site at all times*** Work is being performed by the Contractor or subcontractors at the Project Site. The Superintendent does not have to be on-site during the maintenance of the Contractor's equipment.

1.14 Operation of Existing Utilities

- A. Existing utilities (water, wastewater, reclaimed water, etc.) must remain operational during the construction of the Project Work.
- B. The Contractor shall coordinate all construction activities with the Owner and all applicable utilities.

- C. ***The Engineer and Owner shall be given a “written” seventy-two (72) hour notification regarding tie-ins to existing utilities*** as part of this Project. The Contractor shall conduct such activities in accordance with the Owner’s requirements relating to the operation of utility systems.

1.15 Demolition

- A. The Contractor, as part of the Project Work, shall demolish two on-site buildings (the existing WTP operations/pumping building and the one-story office building) and all associated infrastructure and legally dispose of these materials after the "new" Main WTP Operations Building is constructed and all systems and equipment have passed their demonstration tests and are operational.
- B. Remove all materials and equipment from areas indicated for demolition. Seal abandoned lines that remain in place. Remove all existing unused wires. Disconnect existing electrical services and controls to items being removed or relocated.
- C. ***Dispose of all removed materials and unwanted equipment (as directed by the Owner) and dispose of them in a legal manner.***

1.16 Damage

- A. All damage to buildings, structures, pipes, ducts, equipment, fixtures, etc. shall be properly repaired by the Contractor, to the satisfaction of the Owner and Engineer, ***at no additional cost to the Owner.***

1.17 Electrical Interlocks

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, the Contractor shall provide wiring diagrams and coordinate between the various subcontractors and suppliers so that proper wiring of the equipment involved is effected.

1.18 Disturbed Areas

- A. Restore all areas disturbed by construction to a condition at least equal to the preconstruction condition including, but not limited to, all landscaping, grassing, driveways, roads, fences, irrigation systems, traffic control devices, and other improvements.

- B. Maintain ingress and egress to the treatment facility site and all properties adjacent to the construction and minimize inconvenience to abutting property occupants.

1.19 Cutting and Patching

- A. Cutting and patching for inspection and testing and the payment therefore shall be as specified in Section 00700, General Conditions, Section 00800, Supplementary Conditions and Section 00805, FDEP Supplementary Conditions (Construction).
- B. The Contractor shall, at no additional expense to the Owner, perform cutting and patching necessary to the completion of the Project. The Contractor shall perform cutting and patching in a manner to prevent damage to the structure or previously completed work.
- C. The Contractor shall refinish all surfaces as necessary to provide an even finish. Refinish continuous surfaces to the nearest intersection.

1.20 Owner Furnished Products

- A. The Owner shall exercise his right, as a tax-exempt entity, to recover sales tax in accordance with Article 1.37 of Section 00100, "Instructions to Bidders", Article 1.04 of Section 00300, "Bid Form" and State Law.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01019

CONTRACT CASH ALLOWANCES

1. GENERAL

1.01 Description

A. This Section discusses the contract cash allowances for the following items:

1. Treatment System operational and compliance monitoring equipment.
2. Computer hardware, software, printers, scanners, etc.
3. Project building permit and miscellaneous equipment and materials.
4. Operations Building, Training Room, Breakroom and miscellaneous furnishings.

B. ***The Contract Cash Allowance funds are owned by and are, property of, the City of Sanford and may or may not be used during the construction of the proposed improvements.***

1.02 Cash Allowance for the Operating and Compliance Monitoring Equipment, Computer Hardware/Software, Building Permit and Miscellaneous Equipment and Materials

A. Costs included in the Allowance

1. Direct costs to the Contractor for:
 - a. The purchase of “new” treatment system operational and compliance monitoring equipment, computer hardware/software, printers, scanners, laboratory glassware/equipment, refrigerators, the project building permit, cleaning and maintenance and cleaning items, and other miscellaneous equipment, materials and ancillaries required for completion, implementation and optimization of the Sanford Main WTP improvements requested by the Owner or Engineer.
 - b. Delivery of the aforementioned materials/equipment to the Project Site.

- c. Installation of the equipment, materials, etc., as required, when directed by the Engineer.
 - 2. All costs directly or indirectly related to the costs outlined in Article 1.02(A)(1) above including taxes, overhead, profit, insurance, bonds, supervision and equipment rental provided such costs are identified and approved by the Owner and Engineer prior to the start of the Work.
 - 3. Cost of Shop Drawings, product data, and procedure description submission to the Engineer for approval, as necessary.
- B. Compliance Monitoring and Miscellaneous Equipment and Materials Cash Allowance
- 1. Included on the Bid form, as Item No. 7, is the sum of \$130,000 for the purchase of the items identified above in Article 1.02(A)(1) for the Sanford Main WTP Improvements as requested and approved by the Owner and Engineer.

1.03 Cash Allowance for the Operations Building Furnishings

A. Costs included in the Allowance

- 1. Direct costs to the Contractor for:
 - a. Office Furnishings including, but not limited to, the following: desks, tables, credenzas, chairs, filing cabinets, book cases, blinds, high definition TV's/monitors, visual display boards, trash cans, floor mats, office supplies, etc.
 - b. Training Room Furnishings including, but not limited to, the following: computer compatible tables/desks, tables, chairs, cabinets, trash cans, filing cabinets, podium, blinds, computers, projector, screen, etc.
 - c. Breakroom Furnishings including, but not limited to, the following: refrigerators, microwave, kitchen appliances, blinds, water cooler, tables, chairs, trash cans, etc.
 - d. Miscellaneous furnishings throughout the building.
 - e. Delivery of the aforementioned materials/equipment to the Project Site.
 - f. Installation of the equipment, materials, etc., as required, when directed by the Engineer.

2. All costs directly or indirectly related to the costs outlined in Article 1.03(A)(1) above including taxes, overhead, profit, insurance, bonds, supervision and equipment rental provided such costs are identified and approved by the Owner and Engineer prior to the start of the Work.
3. Cost of Shop Drawings, product data, and procedure description submission to the Engineer for approval, as necessary.

B. Operations Building Cash Allowance

1. Included on the Bid form, as Item No. 10, is the sum of \$100,000 for the purchase of the items identified above in Article 1.03(A)(1) for the Sanford Main WTP Improvements as requested and approved by the Owner and Engineer.

1.04 Cash Allowance for FPL Service

A. Costs included in the Allowance

1. FPL service installation costs associated with providing power to the new WTP improvements.

B. Operations Building Cash Allowance

1. Included on the Bid form, as Item No. 8, is the sum of \$35,000 for the FPL installation services purchase of the items identified above in Article 1.04(A)(1) for the Sanford Main WTP Improvements.

1.05 Payment

- A. Upon receipt of approved invoice from the Engineer submit three (3) copies of the equipment manufacturer's invoice with the next application for payment.
- B. The City of Sanford, Florida, is exempt from State and local sales taxes. The Contractor shall review Article 1.36, "Taxes", of Section 00100, "Instructions to Bidders", and is responsible for reviewing the pertinent State statutes involving sales tax and complying with all requirements.
- C. Pay the invoice within ten (10) calendar days of receipt of payment from the Owner.
- D. ***Any of the miscellaneous cash allowance funds not spent during the course of the project shall be deducted from the Contractor's final application for payment via a Project "Close-out" Change Order.***

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

1. GENERAL

1.01 Payment

- A. Payment for all work done in compliance with the Contract Documents, ***inclusive of furnishing all labor, equipment, materials, tools and performance of all operations relative to construction of this Project***, will be made on a “lump sum” basis for the quantity of work installed as outlined on the Bid Form (Section 00300) and under the Pay Items listed herein. ***Work for which there is not a Pay Item will be considered incidental to the Contract, and no additional compensation will be allowed.***
- B. The Total Base Bid Amount for the Work is intended to establish a total price for completing the Work in its entirety.
- C. Additions, deletions, modifications or changes to the Work, as defined by this Contract, will be performed by Change Order according to the General and Supplementary Conditions and will be paid for on the basis of the Cost of the Work.

1.02 General

- A. The Owner reserves the right to alter the Contract Drawings, modify incidental work, as may be necessary, and increase or decrease quantities of work to be performed to accord with such changes, including deduction or additions to the Scope of Work outlined in the Contract Documents. Changes in the work shall not be considered as a waiver of any conditions of the Contract nor invalidate any provisions thereof. Changes resulting in changes in the scope or quantities of Work or time or other conditions of work will be basis for consideration of a Change Order which is to be negotiated and executed before proceeding with the work. A supplemental agreement between the Contractor and the Owner will be required when such changes involve a net increase or decrease of more than twenty-five percent (25%) in the total contract amount. ***Work which has not been authorized by a written Change Order will not be subsequently considered for additional payment.***

- B. ***Any items not shown or omitted that are required for a complete installation shall be furnished and installed by the Contractor at no additional cost to the Owner.***
- C. Quantities necessary to complete the work, as shown on the Contract Drawings or as specified herein, shall govern over those shown on the Bid Form.
- D. The Engineer will make measurements and determinations as necessary to classify the Work within Pay Items and determine the quantities for pay purposes. Such decisions shall be final after three calendar (3) days if the Contractor does not submit a written notice as defined below.

“If the Contractor differs with the Engineer's classification of the Pay Items or determination of quantities of the Pay Items, he must notify the Engineer, in writing, within three (3) calendar days of the time that the Contractor is informed of the Engineer's decision. Otherwise, the Owner will not consider any such difference as a claim for payment.”

If the Owner or Engineer determines that the quantities for each respective Pay Item does not represent the work completed and accepted to date, the application for payment will be returned to the Contractor for revision. The Contractor may submit, in writing, an explanation to justify the quantities used in the application. The Contractor only needs to address the Pay Items not approved by the Owner or Engineer. Further review by the Owner and Engineer will determine the quantities allowed on the pay application.

- E. ***Work shall not be considered complete until all testing has been satisfactorily completed and the item of work has demonstrated compliance with Contract Drawings and Documents (specifications).***
- F. A ***preliminary*** monthly application for payment shall be submitted to the Engineer for review ***five (5) days prior to the submittal*** for approval of the Contractor's monthly payment request.
- G. The quotations for the Work are intended to establish a total price cost for completing Work in its entirety.
- H. Thrust blocks or mechanical restraints are not separate pay items.
- I. No additional payment will be made for sheeting and shoring, well pointing or other methods of dewatering excavations.
- J. Payment for repair and replacement of existing utilities will be included in the “*lump sum*” or “*unit price*” Bid Amount for the related construction Bid Item.

- K. Payment for lump sum items shall be on a percentage of the completed and accepted work for a particular item, as determined by the Engineer.
- L. Failure on the part of the Contractor to construct any item to the plan or authorized dimensions within the specification tolerances shall result in: (1) Reconstruction to acceptable tolerances at no additional cost to the Owner; (2) Acceptance at "no pay"; or (3) Acceptance at a reduced final lump sum payment, all at the discretion of the Engineer.
- M. The Contractor shall take no advantage of any apparent error or omission in the Contract Drawings or Specifications, and the Engineer shall be permitted to make corrections and interpretations, as may be deemed, necessary for fulfillment of the intent of the Contract Documents. ***The Contractor shall verify the quantities in the field "prior" to ordering materials. The Owner and Engineer shall not be responsible for restocking fees resulting from the Contractor over-ordering materials or from ordering materials/equipment prior to Engineer "approved" shop drawings.***
- N. The quantity for a payment item will be revised only in the event that it is determined to be substantially in error or if the City is attempting to recover sales tax on large ticket items. An error shall be deemed substantial if the quantity will increase or decrease in excess of five percent (5%) of the original quantity for that item or the amount due for that item will increase or decrease in excess of \$1,000 (whichever is smaller). In general, such revisions will be determined by final measurement or plan calculations or both as additions to or deduction from plan quantities specified within these Contract Documents.
- O. Use of Procurement Cards - NOT USED
- P. Taxes
1. ***The City of Sanford is exempt from state and local sales tax.*** The City of Sanford, Florida, has the following tax exemption certificates assigned:
 - a. Certificate of Registry #59-6000425 for tax-free transactions under Chapter 32, Internal Revenue Codes.
 - b. Florida Sales & Use Tax Exemption Certificate Number 69-11-035140-54C.
- Q. Sale Tax Recovery
1. ***The City reserves the right to delete items within the Solicitation and purchase said items directly from a supplier (Owner Direct Purchase) without further competition in an effort to benefit from the City's tax exempt status.***

2. Sales Tax Recovery

- a. The Owner reserves the right to purchase materials associated with any project in order to recover sales tax in the exercise of its tax free status.
- b. The Owner shall exercise his right, as a tax-exempt entity, to recover sales tax in accordance with Article 1.37 of Section 00100, "Instructions to Bidders", and State Law with respect to, but not limited to, the following equipment (not a complete list):

Division No.	Potential Owner Direct Purchase (ODP) Items
3 - Concrete	Precast Concrete Structures
	Cast-in-Place Concrete
4 - Masonry	Masonry/Reinforced Unit Masonry
5 - Metals	Grating, Plates and Frames
6 - Wood and Plastics	Fiberglass Grating
7 - Thermal/Moisture Protection	Flashing and Sheet Metal
	Roofing System
8 - Door and Windows	Aluminum and wood doors and frames
	Aluminum windows
	Aluminum Overhead Coiling Doors
9 - Finishes	Suspended Tile Ceilings
11 - Equipment	High Service Pumping Systems
	Chemical Feed Systems
	Package Lift Station
12 - Furnishings	Wooden Laboratory Furniture Casework & Equipment
13 - Special Construction	Process Instrumentation and Control Systems
	Control Panels
	SCADA System improvements
	PLC's
14 - Conveying Systems	Overhead Hoist and Trolley System
15 - Mechanical	Piping, valves, appurtenances and accessories
	HVAC systems

Division No.	Potential Owner Direct Purchase (ODP) Items
16 - Electrical	Motors
	MCC's
	Panelboards
	Fiber Optic systems
	Lighting Systems
	Grounding Systems
	Lightning protection systems

3. ***The Contractor shall be fully responsible for all matters relating to the receipt, protection and risk of loss of Owner Direct Purchase (ODP) Items the same as if such items were purchased by the Contractor. Direct purchase of materials by the City in no way relieves the Contractor of responsibility regarding the compliance with specification requirements, coordination, protection, scheduling, installation or warranty.***
- a. At a minimum, the Contractor shall verify correct quantities, condition of the items received, compliance of the shipment with the purchase order, verify documentation, coordinate and expedite delivery, obtain and verify warranties required by the Contract Documents, inspect and accept or refuse each item at the time of delivery, unload, handle and store the accepted item(s).
 - b. As Owner Direct Purchase Items are delivered to the job-site, the ***Contractor shall visually inspect, receive all shipments, verify and reconcile supplier's shipping documents and invoice with the purchase order.***
 - 1) The Contractor shall assure that each delivery of Owner Direct Purchase Items is accomplished by documentation adequate to identify the Purchase Order against which the purchase was made.
 - 2) ***The Contractor shall forward approved invoices to the City's Representative for payment.***
 - c. If the Contractor discovers defective or non-conforming items he/she shall promptly notify the City of the defect or nonconformity and assist the City to obtain repair or replacement of the item.
 - 1) ***The Contractor shall not be relieved of its obligation to ensure that materials requested for purchase have been reviewed by the Engineer and are released for purchase complying with the shop drawing and submittal procedures.***

- 2) ***The Contractor shall warrant Owner Direct Purchase Items and provide indemnification to the City as germane to all other materials and equipment furnished by the Contractor.***
 - 3) Nothing in this Section shall alter or modify the Contractor obligations under the Contract relative to warranties and patent indemnification.
 - 4) ***The Contractor shall be liable for any interruption or delay in connection with Owner Direct Purchase Items.***
4. The Contractor shall maintain records of all Owner Direct Purchase Items incorporated into the Work. These records shall be available for inspection by the Owner and Engineer upon request.

R. Partial Pay Request

1. The installation of pipe and fittings includes backfilling, compaction, hydrostatic testing, fine grading, property restoration, clean-up and placing facilities into operation.
2. When measurements of the amount of Work constructed each month are made, for the purpose of partial payment, these items will be considered.
3. No less than five percent (5%) of the Contract Price shall be retained until the Record Drawings, Operational and Maintenance Manuals, and Shop Drawings are delivered and accepted by the Engineer.

S. Description of Pay Items

1. The description of Pay Items is presented in Part 2 of this specification section and is a brief summary of the Work to be accomplished for the Pay Items in the Bid Form and the way to measure for payment purposes.
2. Each Pay Item will include labor, installation, clean-up, testing, and placing into operation.
3. The summary is not intended to describe all items in detail, but to clarify the items on which the price is to be based.
4. The summary does not relieve the Contractor of his responsibility to supply all items complete, operational and fully functional.

T. Related Work Specified Elsewhere

Specification Section	Title
00680	Application and Certificate for Payment Form
00700	General Conditions
00800	Supplementary Conditions
00805	FDEP Supplementary Conditions
01030	Applications for Payment
01311	Construction Progress Schedules
01370	Schedule of Values
01510	Mobilization / Demobilization

2. DESCRIPTION OF PAYMENT ITEMS**2.01 Mobilization, Demobilization, Bonds, Insurance, Trailers, etc. (Bid Item No. 1)****A. Description**

1. The Work of this Measurement and Payment Item includes preparatory work and operations in mobilizing for beginning work on the Project, including, but not limited to, those operations necessary for the movement of personnel, equipment, supplies and incidentals to the Project site, construction photography, bonds, insurance, Contractor's site office/trailers, temporary facilities, obtaining of the necessary project permits, preparation for commencement of work onsite and upon completion of construction and miscellaneous general items necessary for completion of the project and final cleanup and demobilization as described on the Contract Drawings and in the Contract Documents.

B. Measurement

1. Unit of measure for this Bid Item shall be on a lump sum basis.

C. Basis of Payment

1. Payment for this item shall be split into two (2) applications. The first, seventy-five percent (75%) of the Bid Item, shall be paid in the first application for payment following the completion of the project mobilization. The second, twenty-five percent (25%), shall be held until the final application for payment.

2. ***Payment for mobilization or any part thereof, shall not exceed three percent (3%) of the total contract price.***

2.02 Survey, Layout and As-Built Information (Bid Item No. 2)

A. Description

1. The Work for this Measurement and Payment Item consists of furnishing all labor, equipment, and materials required to provide surveying, layout, and As-Built information, as required by the Contract Drawings and Contract Documents.

B. Measurement

1. Surveying, layout and As-Built information shall be paid for using the Contract Lump Sum Contract Amount.

C. Basis of Payment

1. Surveying, layout and As-Built information will be paid for at the contract lump sum price, for work completed to include all work items in the description. ***Fifty percent (50%), of the Bid amount for this item shall be paid at the time of the initial survey and layout.***
2. The remaining ***fifty percent (50%) shall be paid upon the receipt and acceptance of the Contractor's As-Builts*** for the completed project.

2.03 Preconstruction High-Definition (HD) Recording (Bid Item No. 3)

A. Description

1. The work for this Measurement and Payment Item consists of furnishing all labor, equipment, and materials required for a preconstruction High Definition (HD) recording of all construction areas, for both on and off-site construction, prior to commencement of construction activities, as required by the Contract Documents.

B. Measurement

1. The Preconstruction HD recording shall be paid for on a lump sum basis.

C. Basis of Payment

1. The Preconstruction HD Recording will be paid for at the Contract Lump Sum Price, for a completed and Engineer/Owner accepted HD recording (BD/DVD).

2.04 Lump Sum Price for Indemnification (Bid Item No. 4)

A. Description

1. The work for this pay item shall be for indemnification as specified in the General and/or Supplementary Conditions.

B. Measurement

1. The unit of measurement for this item shall be at the Lump Sum amount.

C. Basis of Payment

1. Payment will be based on the Contract Lump Sum Contract amount of **\$1,000**.

2.05 Drone Aerial Photography (Bid Item No. 5)

A. Description

1. The work for this Measurement and Payment Item consists of all labor, equipment, and materials required to conduct drone aerial photography of the Sanford Main WTP area where improvements are to be made, prior to construction, on a monthly basis during construction and after final project construction, as specified in the Contract Documents (Section 01380).

B. Measurement

1. The unit of measurement for this item shall be at the Lump Sum amount.

C. Basis of Payment

1. The Drone Aerial Photography will be paid for at the contract lump sum price, on a monthly basis, for the drone aerial photography. The "*pre-negotiated*" price for the work is \$5,000 (CPH, Inc.) and is included in the Total Base Bid Lump Sum Amount.

2.06 3D High Definition Laser Survey (Bid Item No. 6)

A. Description

1. The work for this Measurement and Payment Item consists of all labor, equipment, and materials required to conduct a 3D High-Definition Laser Survey of the Sanford Main WTP where improvements are proposed (figure in Section 01050), following completion of the proposed project improvements, and provide the Engineer and Owner with a hard-copy and digital version of the 3D high-definition laser survey.

B. Measurement

1. The unit of measurement for this item shall be at the Lump Sum amount.

C. Basis of Payment

1. The 3D High Definition Laser Survey will be paid for at the contract lump sum price, for a completed survey. The “*pre-negotiated*” price for the work is \$4,000 (CPH, Inc.) and is included in the Total Base Bid Lump Sum Amount.

2.07 Project Cash Allowance (Bid Item No. 7)

A. Description

1. The work for this Measurement and Payment Item consists of all labor, equipment, and materials required to acquire, deliver and install “*new*” treatment system operational and compliance monitoring equipment, computer hardware/software, the project building permit, building furnishings and other miscellaneous equipment, materials and ancillaries required for completion, implementation and optimization of the Sanford Main WTP improvements.

B. Measurement

1. Work under this pay item shall be for “*new*” treatment system operational and compliance monitoring equipment, computer hardware/software, printers, scanners, laboratory glassware/equipment, refrigerators, the project building permit, cleaning and maintenance and cleaning items, and other miscellaneous equipment, materials and ancillaries to be specified at a later date by the Engineer and Owner and purchased and installed by the Contractor.

C. Basis of Payment

1. Payment for this item shall be at the negotiated price for the miscellaneous equipment and materials to be specified by the Engineer and/or Owner at a later date. An allowance of \$130,000 is included in the Total Base Bid Lump Sum Amount. ***Any of the miscellaneous cash allowance funds not spent during the course of the project by the Owner/Engineer shall be deducted from the Contractor's final application for payment via a Project "Close-out" Change Order.***

2.08 Project Cash Allowance for FPL Service (Bid Item No. 8)

A. Description

1. The work for this Measurement and Payment Item consists of all FPL service installation costs in association with providing power to the new WTP improvements.

B. Measurement

1. The unit of measurement for this item shall be at the Lump Sum amount.

C. Basis of Payment

1. Payment shall be at the Contract Lump Sum price for the services completed or a percentage thereof. An allowance of \$35,000 is included in the Total Base Bid Lump Sum Amount. ***Any of the these cash allowance funds not spent for the FPL service installation during the course of the project shall be deducted from the Contractor's final application for payment via a Project "Close-out" Change Order.***

2.09 Main WTP Operations Building (Bid Item No. 9)

A. Description

1. The Work for this Measurement and Payment Item includes, but is not limited to, all earthwork, excavation, backfilling, compaction, grading, concrete and masonry work, construction of the Sanford Main WTP Operations Building (all rooms indicated on drawings), high service potable water pumping system (new pumps, piping, valving, fittings, flow meters, pressure sensing systems, associated equipment, appurtenances, testing), piping, fittings, valves, waterproofing systems, housekeeping pads, painting, HVAC systems, laboratory casework and fume hood,

acoustical ceilings, doors, finishes, installation of flooring systems, bathroom fixtures and ancillaries, and associated equipment, appurtenances and any miscellaneous items necessary for Project completion as shown on the Contract Drawings and described in the Contract Documents.

B. Measurement

1. The unit of measurement for this item shall be the Lump Sum amount for work actually installed, and accepted by the Owner.

C. Basis of Payment

1. Payment shall be at the Contract Lump Sum price for the work completed or a percentage thereof.

2.10 Operations Building Furnishings - Cash Allowance (Bid Item No. 10)

A. Description

1. The Work under this Measurement and Payment Item consists of, but is not limited to, the following:
 - a. Office Furnishings including, but not limited to, the following: desks, tables, credenzas, chairs, filing cabinets, book cases, blinds, high definition TV's/monitors, visual display boards, trash cans, floor mats, miscellaneous office supplies, etc.
 - b. Training Room Furnishings including, but not limited to, the following: computer compatible tables/desks, tables, chairs, cabinets, trash cans, filing cabinets, podium, blinds, computers, projector, screen, etc.
 - c. Breakroom Furnishings including, but not limited to, the following: refrigerators, microwave, kitchen appliances, blinds, water cooler, tables, chairs, trash cans, etc.
 - d. Miscellaneous furnishings throughout the building.
 - e. Delivery of the aforementioned materials/equipment to the Project Site.
 - f. Installation of the equipment, materials, etc., as required, when directed by the Engineer.

B. Measurement

1. Work under this pay item shall be for “new” Operations Building furnishings, as generically described above, and other miscellaneous equipment, materials and ancillaries to be specified at a later date by the Engineer and Owner and purchased by the Contractor.

C. Basis of Payment

1. Payment for this item shall be at the negotiated price for the miscellaneous furnishings, equipment and materials to be specified by the Engineer and/or Owner at a later date. An allowance of \$100,000.00 is included in the Total Base Bid Lump Sum Amount. ***Any of the miscellaneous cash allowance funds not spent during the course of the project by the Owner/Engineer shall be deducted from the Contractor’s final application for payment via a Project “Close-out” Change Order.***

2.11 Exterior and Interior Facility Security Systems (Bid Item No. 11)**A. Description**

1. The Work under this Measurement and Payment Item consists of, but is not limited to, installation of cameras, monitors, sensors, exterior and interior door entry systems and all miscellaneous items necessary for Project completion as shown on the Contract Drawings and described in the Contract Documents.

B. Measurement

1. The unit of measurement for this item will be Lump Sum for work completed and accepted.

C. Basis of Payment

1. Payment will be based on the Contract Lump Sum Value for work properly installed, tested and accepted or a percentage thereof.

2.12 Facility Wall and Architectural Fencing/Gate System (Bid Item No. 12)**A. Description**

1. The Work under this Measurement and Payment Item consists of, but is not limited to, concrete work, construction of the split-face CMU perimeter wall, installation of

the architectural aluminum fencing system and automatic gate systems, and all miscellaneous equipment and items necessary for Project completion as shown on the Contract Drawings and described in the Contract Documents.

B. Measurement

1. The unit of measurement for this item will be Lump Sum for work completed and accepted.

C. Basis of Payment

1. Payment will be based on the Contract Lump Sum Value for work properly installed, tested and accepted or a percentage thereof.

2.13 Site Work (Bid Item No. 13)

A. Description

1. The Work for this Measurement and Payment Item includes, but is not limited to, site piping, fittings, valves and associated appurtenances, trenching, excavation, earthwork cut and filling, backfilling, compaction, grading, sidewalks, driveways, paving, utility improvements, landscaping, sodding and miscellaneous items necessary for Project completion as shown on the Contract Drawings and described in the Contract Documents.

B. Measurement

1. The unit of measurement for this item will be Lump Sum for work completed and accepted.

C. Basis of Payment

1. Payment shall be at the Contract Lump Sum price for the work completed or a percentage thereof.

2.14 Site Demolition (Bid Item No. 14)

A. Description

1. The Work under this Measurement and Payment Item consists of, but is not limited to, demolition two buildings (the "existing" Main WTP Control/Operations Building

and the one-story masonry building) and all associated infrastructure and the legal disposal of all materials after the "new" Main WTP Operations Building is constructed and all systems and equipment have passed their demonstration tests and are operational as shown on the Contract Drawings and described in the Contract Documents.

B. Measurement

1. The unit of measurement for this item will be Lump Sum for work completed and accepted.

C. Basis of Payment

1. Payment will be based on the Contract Lump Sum Value for work properly installed, tested and accepted or a percentage thereof.

2.15 Electrical, Controls and Instrumentation Improvements (Bid Item No. 15)

A. Description

1. Work under this Measurement and Payment Item consists of, but is not limited to, project electrical, controls and instrumentation improvements, standby generator, power distribution and feeding, facility lighting, and other associated equipment/appurtenances associated with the improvements, necessary for Project completion as shown on the Contract Drawings and described in the Contract Documents.

B. Measurement

1. The unit of measurement for this item will be Lump Sum for work completed and accepted.

C. Basis of Payment

1. Payment will be based on the Contract Lump Sum Value for work properly installed, tested and accepted or a percentage thereof.

2.16 SCADA System Modifications (Bid Item No. 16)

A. Description

1. Work under this Measurement and Payment Item consists of, but is not limited to, modifications of the "existing" facility SCADA system and shall encompass all of the

equipment being supplied or relocated as part of this Project and shall be designed, supplied, connected and tested to ensure total integration, compatibility and functionality with the "existing" SCADA system at the Sanford Main WTP as identified on the Contract Drawings and as detailed in the Contract Documents.

B. Measurement

1. The unit of measurement for this item will be Lump Sum for work completed and accepted.

C. Basis of Payment

1. Payment will be based on the Contract Lump Sum Value for work properly installed, tested and accepted or a percentage thereof.

END OF SECTION

SECTION 01030

APPLICATIONS FOR PAYMENT

1. GENERAL

1.01 Description

A. Scope of Work

1. Submit Applications for Payment to the Engineer in accordance with the schedule established by the Conditions of the Contract and the Agreement between the Owner and the Contractor. The Contractor shall use the Application for Payment Form, included in Section 00680, "Application and Certificate for Payment Form", as the official payment request form.

B. Related Work Specified Elsewhere

Specification Section	Title
00500	Agreement
00662	Contractor's Partial Release of Lien Form
00663	Contractor's Final Release of Lien Form
00664	Subcontractor's/Suppliers Final Release of Lien Form
00805	FDEP Supplementary Conditions (Construction)
00807	Classification and Wage Determination (Davis Bacon Act)
00680	Application and Certificate for Payment Form
01025	Measurement and Payment
01311	Construction Progress Schedule
01370	Schedule of Values
01380	Construction Photographs
01700	Project Closeout
01720	Project Record Documents
01740	Warranties and Bonds
General and Supplementary Conditions: Progress Payments, Retainage and Final Payment	

C. Measurement and Payment - General Provisions

1. The Contractor shall receive and accept compensation provided for in the Bid and the Contract, in compliance with the Contract Documents, as full payment for furnishing all materials, labor, equipment, tools, appurtenances, accessories and incidentals, 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 the action of elements or from any unforeseen difficulties that may be encountered during the prosecution of the Work until Final Project Acceptance by the Owner.
2. The quotations for the Work are intended to establish a total price for completing the Work in its entirety.
3. ***Payment for all lump sum items shall be based on the percentage of completion of the particular item (actual work installed and accepted) until the work item is completed. Upon completion of the work item, one hundred percent (100%) of the lump sum price may be paid, less any retained amounts.***
4. ***For unit price items, the Contractor shall be paid for the actual amount of work installed and accepted during the period of construction.*** After the Work is completed and before final payment is made, the Owner's Representative shall make final measurements to determine the actual quantities of the various items of work installed and accepted as the basis of final payment for the unit priced item, ***less any retained amounts.***
5. ***Work for which there is not a Bid/Pay Item will be considered incidental to the Contract and no additional compensation will be allowed.***
6. Additions, deletions, modifications or changes to the Work, as defined in this Contract, will be performed by Change Order according to the General Conditions, as amended by the Supplementary Conditions, and will be paid for on the basis of the Cost of the Work.
7. ***Any items not shown or omitted from the Contract Documents that are required for a complete installation shall be furnished and installed by the Contractor at no additional cost to the Owner.***
8. ***No additional payment shall be made for well pointing or other methods of dewatering.***
9. ***Payment for repair and replacement of existing utilities will be included in the Lump Sum Bid Amount for the related new construction Bid item.***

10. The approved Contract Schedule of Values shall be the basis for making monthly progress payments.
11. Payments for Work “*in progress*” shall not constitute acceptance of the Work component, the Work item, or the Bid Item.
12. Prior to submitting any Application for Payment, the Contractor's superintendent or other authorized representative of the Contractor shall meet with the Engineer's Resident Project Representative (RPR) and determine the quantities of unit price and/or lump sum price work accomplished and/or completed during the period for which the Application for Payment is being submitted.
13. ***A “preliminary” monthly application for payment shall be submitted to the Engineer for review approximately five (5) days prior to the submittal for approval of the Contractor's monthly Application for Payment.***
14. Payment to the Contractor will be made for the actual work completed and accepted in accordance with the Contract Documents.
15. No payment shall be made for materials delivered and not installed, unless specifically agreed upon by the Engineer and Owner ***prior*** to delivery of such materials.
16. The Contractor shall take no advantage of any apparent error or omission in the Contract Drawings or Specifications, and the Engineer shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.
17. The Owner and Engineer reserve the right to alter the Contract Drawings, modify incidental work as may be necessary, and increase or decrease quantities of work to be performed to accord with such changes, including deduction or cancellation of any one or more of the Pay Items in the Schedule of Values. Changes in the Work shall not be considered as a waiver of any conditions of the Contract nor invalidate any provisions thereof.
18. Failure on the part of the Contractor to construct any Project Item to plan or authorized dimensions within the specification tolerances shall result in reconstruction to acceptable tolerances ***at no additional cost to the Owner; acceptance at no pay; or, acceptance at reduced final pay quantity, all at the discretion of the Engineer.***
19. ***Work shall not be considered complete (100%) until all testing has been satisfactorily completed and the item of work has demonstrated compliance with the Contract Drawings and Documents/Specifications.***

1.02 Format Required

- A. Submit applications for payment on the form provided in Section 00680, "Contractor's Application for Payment Form", with itemized data typed on 8½-inch x 11-inch white paper continuation sheets. Provide itemized data on continuation sheets of format, schedules, line items, and values specified on the Application and Certificate for Payment Form.
- B. The Contractor shall use the item descriptions and contract values included in the Schedule of Values, approved and accepted by the Engineer, as a basis for preparation of the Application for Payment Form.

1.03 Preparation of Application for Each Progress Payment

A. Application Form

- 1. Fill in the required information, including that for any Change Orders executed prior to date of submittal of application.
- 2. Fill in the percentage (%) complete for each "*lump sum*" activity item and dollar values to agree with respective percentages. Fill in quantities installed, using the correct set of units, for each "*unit price*" activity item and use the Contractor's unit prices to determine the dollar amount to be paid for said activity item.
- 3. Execute certification of the Application for Payment with the signature of a responsible officer of the Contractor in accordance with the Project Contract Documents.

B. Continuation Sheets

- 1. Fill in the total list of all scheduled component items of the Work, with item number and scheduled dollar value for each item.
- 2. Fill in the dollar value in each column for each scheduled line item when the Work has been performed or products stored. Round off the values to the nearest dollar, or as specified for the Schedule of Values.
- 3. List each Change Order executed, prior to the date of submission, at the end of the continuation sheets. List by Change Order Number, and description, as for an original component item of the Work.
- 4. To receive approval for payment on component material stored on the project site, the Contractor shall submit copies of the "original invoices" with the Application for

Payment. Any materials stored on-site that are included in the payment request must be installed prior to the next pay request submitted.

5. As provided for in the Application Payment Form, the Contractor shall certify, for each current Application for Payment, that all previous progress payments 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 the 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.
6. The Contractor shall attach to each Application for Payment like affidavits by all Subcontractors. The Contractor shall otherwise list the name and amount of any monies owed to subcontractors, suppliers, or equipment manufacturers, whose charges have been previously paid for by the Owner, on the appropriate area of the application form.
7. Applications for Payment, all associated documentation and certifications shall be submitted in accordance with Article 1.06 herein.

1.04 Substantiating Data for Progress Payments

- A. The Contractor shall submit suitable information, with a cover letter identifying the following:
 1. Project Name.
 2. Application for Payment number and date.
 3. A detailed list of enclosures.
 4. For stored products
 - a. Item number and identification as shown on the application.
 - b. A description of the specific material.
 - c. A copy of the material invoice showing the actual amount paid by the Contractor for the stored item.
- B. Submit one (1) copy of data and a cover letter for each copy of application.

- C. ***The Contractor is to maintain an updated set of drawings to be used as Record Drawings*** in accordance with Section 01720, "Project Record Documents". ***As a prerequisite for monthly progress payments, the Contractor is to exhibit the updated record drawings for review by the Owner and the Engineer.*** If the Project Record Documents are not up-to-date, the monthly progress payment will not be processed, by the Engineer, until the Contractor has updated, and the Engineer has approved, said documents.
- D. As a prerequisite for payment, ***each monthly application for payment shall incorporate, the corresponding "monthly progress status report" and updated construction schedule***, prepared in accordance with the requirements of Section 01311, "Construction Progress Schedules".
- E. As a prerequisite for payment, ***the Contractor shall submit a duly executed letter from it's Surety consenting to payment due and progress-to-date.***
- F. ***As a prerequisite for payment, the Contractor shall submit, with the application for payment, construction photographs in accordance with Section 01380, "Construction Photographs".*** If the construction photographs are not submitted with the monthly Application for Payment, the monthly progress payment will not be processed, by the Engineer, until the Contractor has submitted, and the Engineer has approved, said construction photographs.
- G. ***As a prerequisite for payment, the Contractor shall submit, with the application for payment, copies of the weekly certified payroll*** in compliance with the Davis Bacon Act and with Appendix C of the FDEP Supplementary Conditions (Section 00805). If the certified payroll is not submitted with the monthly Application for Payment, the monthly progress payment will not be processed, by the Engineer, until the Contractor has submitted, and the Engineer has approved, said construction photographs.

1.05 Preparation of Application for Final Payment

- A. Fill in the application form as specified for progress payments. Provide the information as required by Section 00700, "General Conditions" and Section 01700, "Project Closeout".
- B. Furnish evidence of completed operations and insurance in accordance with the General Conditions.
- C. Submit the Contractor's and Subcontractor/Supplier's Final Release of Lien Forms (Sections 00663 and 00664) and other close-out submittals as required by the General and Supplementary Conditions.

1.06 Submittal Procedure

- A. ***Submit Applications for Payment to the Engineer between the first (1st) and the tenth (10th) day after the end of each calendar month*** for which payment is requested as stipulated in the Agreement.
- B. Review the percentages complete (lump sum items) and/or unit quantities installed (unit price items), for each item of work, with the Engineer and resolve any conflicts or discrepancies.
- C. The Contractor shall ***submit three (3) copies of the Application for Payment, one electronic version of the entire Application for Payment in a PDF format on a CD/DVD/BD or flash drive***, plus any additional copies for the Contractor's needs. These completed forms shall provide the basis upon which payment will be made to the Contractor.
- D. Processing of the monthly Application for Payment will not proceed if the appropriate number of copies, the electronic version of the Application for Payment or any other required documentation, is not provided to the Engineer.
- E. When the Engineer finds the Application and Certificate for Payment Form is properly completed and correct, he will execute the Certificate for Payment and transmit the forms to the Owner, with a copy to the Contractor.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

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SECTION 01040

PROJECT COORDINATION

1. GENERAL

1.01 Work Included

- A. The Contractor shall furnish personnel and equipment that will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress that will insure the completion of the Work within the time stipulated in the Agreement.
- B. If at any time, such personnel appear to the Engineer to be inefficient, inappropriate or insufficient for securing the quality of work aforementioned, he may order the Contractor to increase the efficiency, change the character or increase the personnel and equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such an order shall in no way relieve the Contractor of his obligations to secure the quality of the Work and rate of progress.
- C. Several areas of construction under this Contract must be coordinated with the Engineer and Owner's Operating personnel and accomplished in a logical order to maintain the treatment level and capacity of the existing facility and to allow construction to be completed within the time allowed by the Contract Documents.
- D. ***During construction of the Project Work ("new" Operations Building and high service pumping and chemical feed systems, and modification of existing facilities) the "existing" WTP Control Building and potable water production systems must remain operable.*** Potable water production, disinfection, chemical storage and feed systems, ground storage tanks, high service pumping system and associated support facilities must remain in service at all times.
- E. ***When facilities are being upgraded or replaced, the new facilities shall be fully operational before the existing facilities are shutdown for modification, demolition, or decommissioning.***
- F. The Contractor shall provide a detailed construction schedule in accordance with Section 01311, "Construction Progress Schedules". The schedule shall incorporate the information in this section.

1.02 Private Land and other Public Properties

- A. The Contractor shall not enter or occupy private or public land outside of the Sanford Main WTP facility, except with written permission of the appropriate Owners. The Contractor shall provide the Owner with a copy of such written permission.

2. PRODUCTS - NOT USED

3. EXECUTION

3.01 Pipe Locations

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

3.02 Open Excavations

- A. **All open excavations shall be adequately safeguarded, on a daily basis,** by providing temporary barricades, caution signs, lights, and other means to prevent accidents to persons, and damage to property.
- B. **All open excavations shall comply with applicable OSHA Standards.** The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by workmen, the Owner and the Engineer.

3.03 Test Pits

- A. Test pits for the purpose of locating underground pipelines or structures in advance of the construction shall be excavated and backfilled by the Contractor. Test pits shall be backfilled and compacted immediately after their purpose has been satisfied and maintained in a manner satisfactory to the Engineer. **The costs for such test pits shall be borne by the Contractor.**

3.04 Care and Protection of Property

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto.
- B. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, **at his expense**, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the Engineer.

3.05 Cooperation within this Contract

- A. ***The Contractor shall, prior to interrupting a utility service (water, wastewater, reclaimed water, etc.) for the purpose of making tie-ins to the existing lines or for any other purposes, contact the Owner and Engineer and make arrangements for the interruption that will be satisfactory with the Owner and Engineer. "Written notification" shall be made at least seventy-two (72) hours prior to the interruption of the utility service. All tie-ins shall be made during "low-flow" periods.***
- B. ***The Contractor shall sequence and schedule the work in a manner to preclude delays and conflicts*** between the work of various trades and contractors. Each trade shall keep informed as to the work of other trades on the project and shall execute their work in a manner that will not interfere with the work of other trades.
- C. ***The Contractor shall be fully responsible for the coordination of his work*** and the work of his employees, subcontractors, and suppliers with the Owner, and regulatory agencies, and assure compliance with schedules.
- D. ***The Contractor shall verify that the utility requirements and characteristics of operating equipment are compatible with building utilities.*** Coordinate the Work of various sections, having interdependent responsibilities for installing, connecting to, and placing into service, such equipment.
- E. Coordinate space requirements, supports and installation of mechanical and electrical Work which are indicated diagrammatically on the Contract Drawings. Follow the routing shown for pipes, ducts and conduit, as closely as practicable; place runs parallel with lines of the building/structure. Use spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.
- F. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. ***Coordinate locations of fixtures and outlets with finish elements.***

G. General Scheduling Considerations

1. Coordinate scheduling, submittals, and Work of the various Sections of the specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
2. The Contractor shall take the following items into consideration when creating the construction schedule required by Section 01311, "Construction Progress Schedules":
 - a. ***The Contractor shall schedule the work so that the existing utilities can be maintained in operation at all times. The Contractor shall provide access to all existing facilities at all times during the construction period for operation and maintenance purposes.***
 - b. ***The Contractor shall ensure that vehicular and pedestrian traffic will be maintained at all times***, in accordance with Section 01550, "Maintenance of Traffic", during installation of the Project improvements. Roadways throughout the facility and access roads shall be kept free of obstructions to facilitate deliveries and operations and maintenance activities.
 - c. ***The Owner's existing SCADA system at the Sanford Main WTP shall remain operational at all times during construction and integration.***
 - d. ***The Contractor shall generate and submit to the Engineer, for review and approval, a schedule identifying all process "tie-ins" that are to be made within thirty (30) days of the Notice to Proceed.*** The "tie-in" schedule shall be detailed and provide, at a minimum, the following:
 - 1) Detailed description of the tie-in.
 - 2) Location of the tie-in.
 - 3) Length of time required to complete the tie-in.
 - e. ***One (1) week prior to any tie-in, the Contractor shall meet with the Engineer and Owner to discuss the work to be completed during the "tie-in" process.*** The Contractor, Engineer and Owner shall review the "detailed" written schedule of the events to take place during the tie-in. The schedule will be discussed in detail and changes to the schedule shall be made as required. All tie-ins shall be organized and constructed to minimize disruption of operations at the treatment facility. ***All ancillary work, equipment, etc. required to complete the tie-in shall be included in the Contractor Bid.***

- f. ***All raw wastewater, potable water, reclaimed water and chemical system tie-ins shall be performed during periods of low flow (10 p.m. to 5:30 a.m.).***
- g. Coordinate with the activities of all utility companies with equipment in the construction area and with the Contractor's and/or subcontractor's work.
- h. Coordination with other ongoing construction activities on the Project Site. See Section 01010, "Summary of Work", Article 1.09.

3.06 Cooperation with other Contracts - NOT USED

3.07 Diagrammatic Nature of Drawings

- A. Where layout of work is diagrammatic, such as pipelines, conduits, ductwork, etc., it shall be followed as closely as other work will permit. Changes from diagrams shall be made as required to conform to the construction requirements.
- B. Before running lines, carefully verify locations, depths and sizes and confirm that lines can be run as contemplated without interfering with other construction. Any deviation shall be referred to the Engineer for approval before lines are run. Minor changes in location of the equipment, fixtures, piping, etc., from those shown on the Contract Drawings, shall be made without extra charge if so directed by the Engineer before installation.
- C. Determine the locations and sizes of equipment, fixtures, conduit, ducts, openings, etc., in order that there will be no interference in the installation of the work or delay in the progress of other work. In the event that interferences develop, the Engineer's decision regarding relocation of work will be final.
- D. Any changes made necessary through failure to make proper arrangements to avoid interference ***shall not*** be considered as extras. Cooperate with those performing other work in preparation of interference drawings, to the extent that the location of piping, ductwork, etc., with respect to the installations of other trades shall be mutually agreed upon by those performing the work.

3.08 Provisions for Later Installation

- A. Where any work cannot be installed as the construction is progressing, provide for boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the

omitted work during later phases of construction. Arrange for chases, holes, and other openings in the masonry, concrete or other work and provide for subsequent closure after placing equipment.

- B. Arrangement for and closure of openings shall be subject to the approval of the Engineer and all costs therefor shall be included in the contract price for the work.

3.09 Protection of Construction and Equipment

- A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the Contractor at his own expense.
- B. ***The Contractor shall protect all structures and shall be protected in a manner approved by the Engineer.*** Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor at his own expense and to the satisfaction of the Engineer and Owner. If, in the final inspection of the work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required.
- C. The Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.
- D. ***The Contractor shall take all necessary precautions to prevent damage to any structure*** due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

3.10 Maintenance of Traffic

- A. Unless permission to close a street or road withing the treatment facility is received in writing from the proper authority (City, County, FDOT, etc.), all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Engineer.
- B. Detours around construction will be subject to the approval of the Owner and the Engineer. Where detours are permitted, the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured,

the Contractor shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the Owner. All maintenance of traffic plans required for construction shall be approved by the local governmental entity having jurisdiction.

- C. ***The Contractor shall take precautions to prevent injury to the public due to open trenches.*** Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The Contractor shall be fully responsible for damage or injuries whether or not police protection has been provided.

3.11 Miscellaneous

- A. The Contractor shall provide for the coordination of his Work with the required work of the Public Agencies and Utilities, which includes, but is not limited to, the following:
1. The City of Sanford Utilities/Public Works Department
 2. Florida Power and Light (FPL)
 3. AT&T
 4. Florida Public Utilities (FPU)
- B. Changes in the intended design of the Project as a result of improperly coordinated Construction Work will not be tolerated. Delays in the Work caused by rejections of installed materials due to improper coordination, and as otherwise specified, will not be considered valid justification for extensions of Contract Time.

END OF SECTION

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SECTION 01045

CUTTING AND PATCHING

1. GENERAL

1.01 Description

A. Scope of Work

1. ***The Contractor shall be responsible for all cutting, fitting, and patching, including attendant excavation and backfill,*** required to complete the Work, or to:
 - a. Make several parts fit together properly.
 - b. Uncover portions of the Work to provide for installation of ill-timed work.
 - c. Remove and replace defective work.
 - d. Remove and replace work not conforming to the requirements of the Contract Documents.
 - e. Remove samples of installed work as specified for testing.
 - f. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
2. The Contractor shall coordinate, in a satisfactory manner, with the Engineer and in accordance with the Contract Drawings and Specifications all work of this nature.
3. The work must be done by competent workmen skilled in the trade required by the restoration.

B. Related Requirements Described Elsewhere

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions

Specification Section	Title
00805	FDEP Supplementary Conditions
01010	Summary of Work
Division	Information
2	Sitework
3	Concrete
4	Masonry

1.02 Submittals

A. *Submit a written request to the Engineer within ten (10) calendar days prior to executing any cutting or alteration that affects:*

1. Work of the Owner or any separate Contractor.
2. Structural value or integrity of any element of the Project.
3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
4. Efficiency, operational life, maintenance or safety of operational systems.
5. Visual qualities of sight-exposed elements.

B. The written request shall include, but not be limited to, the following:

1. Identification of the Project.
2. Description of the Work.
3. The necessity for cutting, alteration or excavation.
4. Effect on work of the Owner or any separate Contractor, or on structural or weatherproof integrity of the Project.
5. Description of the proposed work
 - a. Scope of the cutting, patching, alteration or excavation.
 - b. Trades who will execute the work.
 - c. Products proposed to be used.
 - d. Extent of the refinishing to be done.

6. Alternatives to cutting and patching.
 7. Cost proposal, when applicable.
 8. Written permission of any separate Contractor whose work will be affected.
- C. ***Submit the written notice to the Engineer designating the date and the time that the Work will be uncovered and then completed.***

2. PRODUCTS

2.01 Materials

- A. Comply with the Contract Documents, specifications and standards for each specific product involved.

3. EXECUTION

3.01 Inspection

- A. Inspect existing conditions of the Project, including elements subject to damage or to movement during cutting and patching. Reference is made to the requirements of Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions", the pre-existing condition survey, Section 01380, "Construction Photographs", and Section 01390, "Preconstruction Video Recording".
- B. After uncovering the Work, inspect conditions affecting installations of products, or performance of the Work.
- C. Report unsatisfactory or questionable conditions to the Engineer in writing; do not proceed with the Work until the Engineer has provided further instructions.

3.02 Preparation

- A. Provide adequate temporary support as necessary to assure structural value or integrity of the affected portion(s) of the Work.

- B. Provide devices and methods to protect other portions of the Project from damage.
- C. Provide protection from elements for that portion of the Project that may be exposed by cutting and patching work, and maintain excavations free from water.

3.03 Performance

- A. Execute cutting and demolition by methods that will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.
- B. Execute excavating and backfilling by methods that will prevent settlement or damage to other work.
- C. Employ the original Installer or Fabricator to perform cutting and patching for:
 - 1. Weather-exposed or moisture resistant elements.
 - 2. Sight-exposed finished surfaces.
- D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.
- E. Restore work that has been cut or removed; install new products to provide completed Work in accordance with the requirements of the Contract Documents.
- F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- G. Refinish entire surfaces, as necessary, to provide an even finish to match adjacent finishes:
 - 1. For continuous surfaces, refinish to the nearest intersection.
 - 2. For an assembly, refinish the entire unit.

END OF SECTION

SECTION 01050

FIELD ENGINEERING

1. GENERAL

1.01 Description

A. Scope of Work

1. ***The Contractor shall provide and pay for all field engineering services for the Project***, including, but not limited to, the following:
 - a. ***Survey work*** required in execution of the Work and completion of the Project Record Documents.
 - b. ***Civil, structural, or other professional engineering services*** specified or required to execute the Contractor's construction methods.
 - c. The method of field staking for the construction of the Work shall be at the option of the Contractor. The Owner has provided the engineering survey necessary to establish reference points which in his judgement are necessary to enable the Contractor to proceed with his work.
 - d. 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.
 - e. 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.
 - f. ***The Contractor shall retain the services of a registered land surveyor licensed in the State of Florida*** to:
 - 1) Identify existing control points and property corner stakes indicated on the Contract Drawings, as required.

- 2) Verify all existing surface locations and all proposed building and structure corner locations, tank locations and equipment locations.
- 3) Maintain an accurate location of all buried piping and associated lines.
- 4) Maintain a survey during construction and for "Record Drawing" purposes.

B. Related Requirements Described Elsewhere

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
00805	FDEP Supplementary Conditions
01010	Summary of Work
01030	Applications for Payment
01720	Project Record Documents

1.02 Qualifications of the Surveyor or Engineer

- A. A qualified engineer or registered land surveyor, in the State of Florida, that shall be acceptable to the Owner and the Engineer.
- B. A registered professional engineer, if selected to provide services to the Contractor, shall be of the discipline required for the specific service on the Project, currently licensed in the State of Florida, and acceptable to the Owner and Engineer.
- C. The 3D high-definition final survey of the Sanford Main WTP, to be completed after the construction of all project improvements, shall be conducted by the "*current*" surveyor of record for the project and treatment facility, CPH, Inc., no equal.

1.03 Survey Reference Points

- A. Existing basic horizontal and vertical control points for the Project are those designated on the Contract Drawings.
- B. The Contractor shall locate and protect control points prior to starting site work, and preserve all permanent reference points during construction. The Contractor shall:

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

1.04 Project Survey Requirements

- A. ***The Contractor shall establish a minimum of two (2) permanent bench marks at the Project construction site***, referenced to data established by survey control points.
1. Record locations, with horizontal and vertical data, on the Project Record Documents.
 2. One of these should be on the east side of the project construction site; the other on the west side.
- B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:
1. All improvements (on-site, off-site, rights-of way, etc.)
 - a. Stakes for grading, fill, and topsoil replacement.
 - b. Utility piping slopes, invert elevations, fitting locations and elevations, manhole locations and elevations, etc.
 - c. Final site elevations.
 - d. Stormwater structures.
 - e. Locator balls, if used.
 2. Batter boards for structures.
 3. Building foundations, column locations, and floor elevations.
 4. Controlling lines and levels required for mechanical and electrical trades.
- C. On a monthly basis, verify layouts by the same methods.

- D. Establish all lines and grades prior to construction of line work for all force mains, potable water mains, wastewater/process mains, reclaimed water mains and transmission and distribution mains at 50-foot intervals and at defined breaks in grade.

1.05 Project Records

- A. Maintain a complete and accurate log of all control and survey work as it progresses.
- B. Update the Project Record Drawings, on a monthly basis, based on the work performed during the month ending with the Contractor's Application for Payment as a condition for approval of monthly progress payment requests.
- C. At the end of the project, submit a certified site survey, at scales to be approved by the Engineer (overall view at 1-inch = 40 feet; individual process diagrams at 1-inch equals 20 feet), on reproducible tracing sheets 22 inches by 34 inches, indicating the building corners and location of all structures and road intersections, horizontal and vertical location of all piping, valves, fittings existing utilities encountered, equipment and appurtenances, locator balls, etc. in accordance with the Engineer's instructions. The Contractor shall also submit the survey and other certified surveying record documents to the Engineer, in AutoCAD (latest version), on a CD/DVD/BD or flash drive.
- D. Project Records shall conform to Section 01720, "Project Record Documents".

1.06 Submittals

- A. Submit the name, address, telephone number and e-mail address of the registered surveyor and/or professional engineer to be used by the Contractor on the Project to the Engineer in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. On request of the Engineer, submit documentation to verify the accuracy of the field engineering work.
- C. ***Submit a certificate signed by the registered engineer or surveyor being used by the Contractor on the Project certifying that elevations and locations of improvements are in conformance with the Contract Documents, or if not in conformance, certify as to the variances from the Contract Documents.***
- D. ***At the end of the project, and prior to final payment, submit certified drawings*** (signed and sealed by the registered land surveyor) and a CD/DVD/BD or flash drive containing all certified drawings in AutoCAD (latest version) of the items listed below. These drawings shall be included with, and made part of, the Project Record Documents:

1. Certified site survey at 1-inch equals 40-foot scale or larger, but not greater than 1-inch equals 20-foot scale, on reproducible tracing sheet(s), that are 22-inch x 34-inch, indicating building corners, sidewalks, roadways, paved areas, existing utilities encountered and the location of all above ground structures within the facility or project site.
 2. **Certified drawings** showing the location, lines and grades of all lines 1-inch in diameter and larger, buried and exterior to buildings and other buried facilities (e.g., valves, fittings, tanks, vaults, etc.) installed as a result of the work. This shall be at the same scale as the Engineer's yard pipe drawing and submitted on reproducible paper.
 3. **Certified survey** at the same scale as the Engineer's line drawings (e.g., wastewater lines, force mains, potable water lines, reclaimed water lines, etc.) indicating lines, grades, elevations, and stationing at 50-foot intervals. Provide elevations of structure bottoms, pipe inverts, flow lines, rim elevations, etc. on all structures, manholes and vaults.
- E. Submit drawings showing locations of all structures, piping, valves, fittings, locator balls, etc., constructed. These drawings shall be included with the Project Record Documents.

1.07 3D High Definition Laser Survey: Post-Construction

- A. A 3D High-Definition Laser Survey of the Sanford Main WTP shall be completed after the construction of all Project improvements at the facility.
- B. **The 3D High-Definition Laser Survey shall be conducted by the "current" surveyor of record for the project and treatment facility, CPH, Inc., no equal.** The fee for the 3D High-Definition Laser Survey has been negotiated with the "Surveyor of Record" in the amount of \$4,000 and has been included in the Total Base Bid Lump Sum Amount.
- C. The 3D Surveyor shall conduct a topographic survey as per Rule Chapter 5J-17 of the Florida Administrative Code in compliance with the minimum technical standards of surveying and mapping of the State of Florida using a high-definition laser scanner.
- D. The 3D Surveyor shall:
 1. Provide a topographic information survey of the scope area.

2. Locate all existing visible ground structures, buildings, manholes, other infrastructure and visible utilities within the scope area (see figure below).
3. Provide a signed and sealed survey.



2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

SECTION 01060

REGULATORY REQUIREMENTS

1. GENERAL

1.01 Description

A. Work Specified Herein

1. Regulatory requirements.

B. Related Work Specified Elsewhere:

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
00805	FDEP Supplementary Conditions
01065	Permits and Fees

1.02 Requirements of Regulatory Agencies

- A. All piping installed within the right-of-way of any City, County, State, or Federal Highway or railroad shall be in accordance with a permit to construct issued by the controlling agency and obtained by the Owner. In no case shall an open trench be constructed within a railroad right-of-way unless otherwise indicated.
- B. Whenever the Contract Drawings and/or Specifications conflict with the requirements of the permit, then the requirements of the permit shall govern and the cost of abiding by the provisions of the permit shall be considered incidental to the Contract.

- C. All electrical apparatus and wiring pertaining to a piece of equipment or an appliance furnished and installed under this Contract shall comply with the National Electrical Code (NEC) and shall be listed by Underwriters Laboratories (UL) or bear the approval of a recognized Testing Laboratory approved by the Engineer.
- D. The Contractor shall follow all conditions and provisions of all applicable permits, applications, regulations, and approvals as a part of this project work.

END OF SECTION

SECTION 01065

PERMITS AND FEES

1. GENERAL

1.01 Description

- A. The work covered by this Section consists of furnishing all labor, materials, equipment and performing work required to comply with all conditions of the permits, where applicable, for this Project.
- B. ***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 Section 00700, "General Conditions"; Section 00800, "Supplementary Conditions"; and Section 00805, "FDEP Supplementary Conditions", a building permit from the City of Sanford Building Department; except as otherwise provided herein.
- C. The Contractor shall schedule all inspections and obtain all written approvals from all agencies required by the permits and licenses.
- D. ***If dewatering is required, the Contractor shall provide a Dewatering Plan to the Engineer that complies with the local water management district rules and regulations in a timely manner for review by the Engineer (14-day review period) and obtaining all required permits.*** If a permit is required for the dewatering operations, the Contractor shall be responsible for preparing, applying for, paying for, and obtaining said permit prior to construction activities.
- E. Permits regulating the construction of this Project are as follows:
 - 1. Florida Department of Environmental Protection: Public Water System (PWS) Construction Improvements for the Sanford Main WTP (PWS No. 3590205).
- F. FDEP Clearance
 - 1. The Contractor shall conform to the requirements of FDEP to obtain proper clearance of any completed Work prior to placing any portion of the Work into active public service.

G. Local Permits

1. All required City of Sanford local permits shall be applied for and obtained by the Contractor **prior to commencement of the Work**, and shall be in accordance with the approved site plan previously described.
 2. **The application fees for these local permits shall be paid by the Contractor after the amounts are determined.** The Contractor shall contact the City of Sanford for tree removal, land clearing and demolition requirements, if necessary, and contact the City of Sanford Building Department for a construction permit.
- H. ***It is the responsibility of the Contractor to ensure that all required permits are obtained before beginning construction activities associated with said permits.***
- I. The Contractor shall review and become familiar with **all** permits for the Project, complete all conditions, attachments, exhibits, and permit modifications.
- J. ***A copy of all permits for the Project shall be maintained by the Contractor at the Project sites***, and shall be available for review upon request.
- K. The Contractor shall be fully responsible to abide by all provisions and conditions of the permits. The Contractor is responsible for the selection, implementation and operation of all measures required by the permits, including the maintenance of said measures as necessary during construction. No additional compensation shall be allowed for any work associated with permit requirements.
- L. Violations of the permit conditions can potentially result in up to a maximum fine of \$25,000 levied against the Contractor per day, per violation. The costs and fines associated with permit violations shall be borne strictly by the Contractor and shall be incidental to the Contract.
- M. In addition, the Contractor shall be held responsible for any fines levied against the Owner as a result of these violations, as well as legal fees, engineering fees, administrative fees and restoration costs associated with these violations.

1.02 Submittals

- A. The Contractor shall be responsible to submit to the Engineer, for review, various permit condition material, as applicable, within fourteen (14) calendar days after the Notice to Proceed.
- B. ***The Contractor shall not submit permit condition information directly to an agency prior to the review and concurrence of the Engineer and Owner.***

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

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SECTION 01070

ABBREVIATIONS AND SYMBOLS

1. GENERAL

1.01 Standards and Abbreviations

A. Referenced Standards

1. 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 the Advertisement for Bids. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.
2. In case of a conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.

B. Abbreviations

1. In addition to the abbreviations listed in the General Conditions, the following is a list of abbreviations for standards and other terms referenced in the Contract Documents.
2. If an abbreviation is not explained below, it shall be as explained in ANSI Y1.1.

ABBREVIATION	TERM
A	Ampere or Area
AA	Aluminum Association
AAA	American Arbitration Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials

ABBREVIATION	TERM
AB	Anchor Bolt / Aggregate Base
ABA	American Bar Association
ABAN	Abandoned
ABC	Asphalt Base Course
ABMA	American Boiler Manufacturers Association
ABPA	Acoustical and Board Products Association
ABT	About
AC	Acre / Asphaltic Concrete / Alternating Current / Air Conditioning
ACCU	Air Cooled Condensing Unit
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
ACP	Asbestos-Cement Pipe
ACPA	American Concrete Pipe Association
ACU	Air Conditioning Unit
AD	Access Door
ADDL	Additional
AE	Architect - Engineer
AEIC	Association of Edison Illuminating Companies
AF	Air Filter / Ampere Frame
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
AHD	Ahead
AHU	Air Handling Unit
AI	The Asphalt Institute

ABBREVIATION	TERM
AIA	American Institute of Architects / American Insurance Association
AICS	Amperes Interrupting Capacity, Symmetrical
AIEE	American Institute of Electrical Engineers (now IEEE)
AIMA	Acoustical and Insulating Materials Association
AIR FIX	Compressed Air
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AL	Aluminum
ALIGN	Alignment
ALM	Alarm
ALTN	Alternate
AMB	Ambient
AMCA	Air Movement and Control Association
AMP	Ampere
ANCH	Anchor
ANG	Angle
ANSI	American National Standard Institute
APA	American Plywood Association
API	American Petroleum Institute
APPROX	Approximate
APWA	American Public Works Association
AR	Argon
ARCH	Architecture / Architectural
AR/CH ₂	Argon-Methane Mix
AREA	American Railway Engineering Association
ARI	American Conditioning and Refrigeration Institute

ABBREVIATION	TERM
ARV	Air Release Valve
ARVV	Air Release / Vacuum Valve
AS	Alum Solution
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
ASPE	American Society of Plumbing Engineers
ASPH	Asphalt
ASSCBC	American Standard Safety Code for Building Construction
ASSY	Assembly
ASTM	American Society for Testing and Methods
ATS	Automatic Transfer Switch
AVE	Avenue
AVG	Average
AWA	American Welding Association
AWG	American Wire Gauge
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preserver Institute
AWS	American Welding Society
AWWA	American Water Works Association
BaV	Ball Valve
BB	Back-to-Back
BC	Beginning of Curve / Back of Curve / Bolt Circle

ABBREVIATION	TERM
BCR	Begin Curb Return
BCS	Building Contractor Standards (Florida Statutes)
BEG	Begin
BETW	Between
BF	Blind Flange
BHMA	Builders Hardware Manufacturers Association
BHP	Brake Horsepower
BIA	Brick Institute of America (formerly SCPI)
BK	Back / Brake
BKR	Breaker
BL	Base Line
BLDG	Building
BLK	Block
BM	Benchmark / Beam
BNR	Biological Nutrient Removal
BO	Blowoff
BOCA	Building Officials Code Administration International, Inc.
BOD	Biochemical Oxygen Demand
BOT	Bottom
BP	Baseplate
BR	Bronze / Batch
BRG	Bearing
BT	Buried Telephone
BTN	Button
BTU	British Thermal Unit
BUR CBL	Buried Cable
BV	Butterfly Valve

ABBREVIATION	TERM
BVC	Begin Vertical Curve
BW	Block Wall
C	Conduit / Celsius
C ₂ H ₂	Acetylene
CAB	Crushed Aggregate Base
CAGI	Compressed Air and Gas Institute
CANTIL	Cantilevered
CAP	Capacity
CATV	Cable Television
CB	Catch Basin / Circuit Breaker
CC	Cooling Coil
C-C	Center-to-Center
CCB	Concrete Block
CCP	Concrete Cylinder Pipe
CCS	Central Control Station
CD	Cross Drain / Condensate Drain / Ceiling Diffuser
CDA	Copper Development Association
CEM	Cement
CF	Cubic Feet / Curb Face
CFH	Cubic Feet per Hour
CFM	Cubic Feet per Minute
CFS	Cubic Feet per Second
CG	Ceiling Grill / Compressed Gas
C & G	Curb & Gutter
CH	Chiller
CHG	Change
CHKD PL	Checkered Plate

ABBREVIATION	TERM
CI	Cast Iron
CIP	Cast Iron Pipe
CISP	Cast Iron Soil Pipe
CISPI	Cast Iron Soil Pipe Institute
CJ	Construction Joint
CL	Centerline / Class / Clearance
CLR	Clear
CMAA	Crane Manufacturers Association of America
CMC	Cement Mortar Lined or Coating
CML	Cement Mortar Lined or Lining
CMLCSP	Cement Mortar Lined and Coated Steel Pipe
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CMU	Concrete Masonry Unit
CO	Cleanout / Conduit Only
COL	Column
COMM	Communication
COMP	Composite
COMPL	Complete
CONC	Concrete
CONN	Connection
CONST	Construct or Construction
CONT	Continuous
CONTR	Contractor
COORD	Coordinate / Coordinated
COP	Copper
COR	Corner

ABBREVIATION	TERM
CPLG	Coupling
CPU	Central Processing Unit
CRES	Corrosion Resistant Steel
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard / Carbon Steel / Chlorine Solution
CSP	Corrugated Steel Pipe
CT	Center Top / Current Transformer
CTG	Coating
CTR	Center
CTV	Cable Television
CULV	Culvert
CV	Check Valve
CY	Cubic Yards
CYL	Cylinder
D	Degree of Curvature
DB	Direct Buried / Decibel
DBL	Double
DC	Direct Current
DEPT	Department
DET	Detail / Detour
DF	Diesel Fuel
DG	Decomposed Granite
DHI	Door and Hardware Institute
DI	Drop Inlet / Ductile Iron
DIA	Diameter
DIAG	Diagonal
DIM	Dimension

ABBREVIATION	TERM
DIMJ	Ductile Iron Mechanical Joint
DIP	Ductile Iron Pipe
DIPRA	Ductile Iron Pipe Research Association
DISCH	Discharge
DIST	Distance
DIV	Divide / Division
DMH	Drop Manhole
DN	Down
DO	Dissolved Oxygen
DOT Spec	Std Specification For Road and Bridge Construction, latest edition
DP	Differential Pressure
DPI	Differential Pressure Indicator
DPNL	Distribution Panel
DR	Drain / Door
DSL	Diesel
DWG	Drawing
DWY	Driveway
E	East
EA	Each
EC	End of Curve
ECC	Eccentric
ECR	End of Curb Return
ED	Equipment Drain / External Distance
EDA	Economic Development Association
EDUC	Eductor
EE	Each End
EEI	Edison Electric Institute

ABBREVIATION	TERM
EF	Each Face / Exhaust Fan
EFF	Effluent / Efficiency
EFL	Effluent
EG	Exhaust Grill
EGL	Energy Grade Line
EL	Elevation / Each Layer
E/L	Easement Line
ELEC	Electrical
ELEV or EL	Elevation
ELP	Elliptical
EMB	Embankment
ENC	Encasement
ENCL	Enclosure
ENG	Engine
ENGR	Engineer
EOP	Edge of Pavement
EOS	Equivalent Opening Size
EOTW	Edge of Traveled Way
EP	Explosion Proof / Edge of Pavement
EPA	Environmental Protection Agency
EQ	Equation
EQL	Equal
ESMT	Easement
EST	Estimate or Estimated
ETC	And so forth
ETM	Elapsed Time Meter
EVAP	Evaporator

ABBREVIATION	TERM
EVC	End Vertical Curve
EW	Each Way
EWC	Electric Water Cooler
EXC	Excavate or Excavation
EXP	Expansion
EXIST	Existing
EXP	Expansion
EXT	Extended / Exterior / Extension
F	Fahrenheit / Floor
FAA	Federal Aviation Administration
FAB	Fabricate
FBRBD	Fiberboard
FC	Foot-Candle
FCC	Federal Communications Commission / Filter Control Console
FCI	Fluid Control Institute
FCO	Floor Cleanout
FCV	Flow Control Valve
FD	Floor Drain
FDEP	Florida Department of Environmental Protection
FDN	Foundation
FDOT	Florida Department of Transportation
FDOT Index	FDOT Roadway and Traffic Design Standards, latest edition
FDOT Specification	FDOT Standard Specification for Road and Bridge Construction, Florida Department of Transportation, latest revision
FE	Filtered Effluent / Flanged End
Fed Spec	Federal Specification
FF	Finished Floor / Flat Faced
FG	Finished Grade

ABBREVIATION	TERM
FHY	Fire Hydrant
F & I	Furnish and Install
FIG	Figure
FIN	Final
FIT	Fitting
FL	Floor / Flow Line
FLEX	Flexible / Flexure
FLG	Flange
FLT	Float
FLUOR	Fluorescent
FM	Force Main (Wastewater) / Factory Mutual
FMH	Flexible Metal Hose
FNSH	Finish
FOC	Face of Concrete
FOS	Face of Stud
FPC	Flexible Pipe Coupling
FPM	Feet per Minute
FPS	Feet per Second
FPT	Female Pipe Thread
FS	Finished Surface / Floor Sink / Federal Standards / Florida Statutes
FSTNR	Fastener
FT	Feet or Foot
FTG	Footing
FUT	Future
FW	Finished Water
FWY	Freeway
G	Gas

ABBREVIATION	TERM
GA	Gauge
GAL	Gallon
GALV	Galvanized
GAS	Gasoline
GB	Grade Break
GDR	Guard Rail
GE	Grooved End
GEN	Generator
GENL	General
GFI	Ground Fault Interrupter
GM	Gas Main
GMT	Greenwich Mean Time
GND	Ground
GPD	Gallons per Day
GPM	Gallons per Minute
GR	Grade
GRTG	Grating
GS	Galvanized Steel
GSKT	Gasket
GSP	Galvanized Steel Pipe
GUT	Gutter
GV	Gate Valve
GWB	Gypsum Wall Board
GWBX	Gypsum Wall Board, Fire-Rated
GYP	Gypsum
H	Humidistat
H ₂	Hydrogen

ABBREVIATION	TERM
HARN	Harness
HB	Hose Bibb
HC	Heating Coil
HD	Heavy Duty
HDPE	High Density Polyethylene
He	Helium
HEPA	High Efficiency Particulate Air
HGL	Hydraulic Grade Line
HGT	Height
HID	High Intensity Discharge
HMI	Hoist Manufacturers Institute
HOA	Hand-Off-Automatic
HOR	Hand-Off-Remote
HORIZ	Horizontal
HP	Horsepower / High Pressure
HPAC	High Pressure Air - Copper
HPAG	High Pressure Air - Galvanized
HPS	High Pressure Sodium
HPT	High Point
HR	Hour / Handrail
HS	High Strength
HSBII	Hartford Steam Boiler Inspection and Insurance Co.
HTG	Heating
HTR	Heater
HV	Hose Valve
HVAC	Heating, Ventilating and Air Conditioning
HVY	Heavy

ABBREVIATION	TERM
HW	Headwall / Hot Water
HWL	High Water Level
HWY	Highway
HYDR	Hydraulic
HZ	Hertz (cycles per second)
I	Intersection Angle
ICBO	International Conference of Building Officials
ID	Inside Diameter or Identification
IE	Invert Elevation
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IFI	Industrial Fasteners Institute
IN	Inches
INCAND	Incandescent
INCL	Include
INF or INFL	Influent
INL	Inlet
INS	Insulating
INSTL	Install or Installation
INTR	Interior / Intersection
INV	Invert
IP	Iron Pipe
IPCEA	Insulated Power Cable Engineers Association
IPS	Iron Pipe Size
IPT	Iron Pipe Thread
IRI	Industrial Risk Insurers
IRR	Irrigation

ABBREVIATION	TERM
ISA	Instrumentation, Systems and Automation Society
J	Joist / Joule
JB	Junction Box
JCT	Junction
JN	Join
JT	Joint
KG	Kilogram
KM	Kilometer
KIPS	Thousands of Pounds
KV	Kilovolt
KVA	Kilovolt-Ampere
KW	Kilowatt
KWH	Kilowatt-Hour
KWHM	Kilowatt-Hour Meter
L	Length of Curve / Long / Left
LATL	Lateral
LAV	Lavatory
LB	Pound
LBR	Lumber
LCL	Local
LF	Linear Feet
LG	Long
LI	Level Indicator
LLO	Long Leg Outstanding
LOC	Location / Locate
LOS	Lockout Stop
LP	Light Pole

ABBREVIATION	TERM
LPT	Low Point
LR	Long Radius
L/R	Slenderness Ratio
LS	Lime Solution / Lift Station / Lump Sum
LT	Left / Light
LTG	Lighting
LWC	Lightweight Concrete
LWIC	Lightweight Insulating Concrete
LWL	Low Water Level
MA	Milliampere
MAG	Magnet / Magnetic
MANF	Manufacturer
MATL	Material
MAX	Maximum
MB	Machine Bolt / Megabyte / Millibar
MBH	Thousand BTU per Hour
MBR	Membrane Bioreactor
MC	Metal Channel
MCC	Motor Control Center
MCM	Thousand Circular Mils
MCP	Motor Circuit Protector
MD	Motorized Damper
MECH	Mechanical
MFR	Manufacturer
MG	Million Gallons
MGD	Million Gallons per Day
MH	Manhole

ABBREVIATION	TERM
MHI	Materials Handling Institute
MHZ	Megahertz
MI	Malleable Iron / Mile
MIL	Military Specifications
MIN	Minimum
MISC	Miscellaneous
MJ	Mechanical Joint
ML	Mixed Liquor
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
MMA	Monorail Manufacturers Association
MO	Motor Operator / Motor Operated / Masonry Opening
MOD	Modification
MON	Monument
MOT	Motor / Maintenance of Traffic
MPT	Male Pipe Thread
MSL	Mean Sea Level
MSS	Manufacturer's Standardization Society
MTD	Mounted
MUTCD	Manual of Uniform Traffic Control Devices
N	North / Neutral / Nitrogen
N ₂	Nitrogen
N ₂ O	Nitrous Oxide
NA	Not Applicable
NAAMM	National Association of Architectural Metal Manufacturers
NBFU	National Board of Fire Underwriters
NBHA	National Builders' Hardware Association

ABBREVIATION	TERM
NBS	National Bureau of Standards
N & C	Nail & Cap
NC	Normally Closed
NCPI	National Clay Pipe Institute
NCSA	National Crushed Stone Association
NCSPA	National Corrugated Steel Pipe Association
NE	Northeast
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NECA	National Electrical Contractors' Association
NEMA	National Electrical Manufacturers' Association
NF	Nanofiltration
NFC	National Fire Code
NFPA	National Fire Protection Association
NG	Natural Grade
NIC	Not In Contract
NIP	Nipple
NLA	National Lime Association
NO	Number / Normally Open
NOM	Nominal
NPC	National Plumbing Code
NPT	National Pipe Threads / National Pipe Taper
NPW	Non-potable Water
NRS	Non-Rising Stem
NSC	National Safety Council
NSF	National Sanitation Foundation
NTS	Not to Scale

ABBREVIATION	TERM
NW	Northwest
NWL	Normal Water Level
OA	Overall / Outside Air
OC	On Center / Overcurrent
OD	Outside Diameter
ODP	Open Dripproof / Owner Direct Purchase
OE	Or Equal
OF	Outside Face
OHE	Overhead Electric
OPER	Operator
OPNG	Opening
OPP	Opposite
ORIG	Original
OSA	Outside Air
OSHA	Occupational Safety and Health Administration
O TO O	Out to Out
OVFL	Overflow
OVHD	Overhead
P	Pole
PARA	Paragraph
PB	Push Button / Pull Box
PC	Point of Curvature / Programmable Controller
PCA	Portland Cement Association
PCC	Point of Compound Curvature / Portland Cement Concrete
PCI	Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
PE	Plain End / Polyethylene / Professional Engineer

ABBREVIATION	TERM
PEN	Penetration
PERF	Perforated
PF	Power Factor
PFMA	Power Fan Manufacturer's Association
PG	Pressure Gauge
PI	Point of Intersection
PJTN	Projection
PKWY	Parkway
PL	Plate / Property Line
PLATF	Platform
PLF	Pounds Per Lineal Foot
PNL	Panel
POB	Point of Beginning
POC	Point of Connection
POJ	Push-On Joint
PP	Power Pole / Polypropylene
PPB	Parts Per Billion
PPM	Parts Per Million
PR	Pair
PRC	Point of Reverse Curvature
PRESS	Pressure
PRL	Parallel
PROP	Proposed
PROV	Provisions
PRPSD	Proposed
PRVC	Point of Reverse Vertical Curve
PS	United States Products Standards or Polymer Solution

ABBREVIATION	TERM
PSI	Pounds per Square Inch
PSIA	Pounds per Square Inch - Absolute
PSIG	Pounds per Square Inch - Gauge
PSF	Pounds Per Square Foot
PT	Pressure Treated / Point of Tangency
PV	Plug Valve
PVC	Polyvinyl Chloride
PVMT	Pavement
PW	Potable Water
PWR	Power
Q	Flow Rate
QTY	Quantity
R	Right / Radius
RAD	Radius / Radial
RAF	Return Air Fan
RAG	Return Air Grille
RAS	Return Activated Sludge
RC	Reinforced Concrete
RCB	Reinforced Concrete Box
RCP	Reinforced Concrete Pipe
RCPA	Reinforced Concrete Pipe Arch
RD	Road
RDC	Reduce
RDCR	Reducer
RDWY	Roadway
RED	Reducer
REF	Reference

ABBREVIATION	TERM
REINF	Reinforce / Reinforced
RELOC	Relocated
REQ	Required / Requirement
REQD	Required
REUSE	Reuse Water
REV	Revise / Revision
RF	Raised Face
RH	Relative Humidity
RND	Round
RJ	Restrained Joint
RLG	Railing
RO	Reverse Osmosis
RPM	Revolutions per Minute
RR	Railroad
RST	Reinforced Steel
RT	Right
RTD	Resistance Temperature Detector
RW	Raw Water
R/W	Right-of-Way
RWM	Reclaimed Water Main
RWW	Raw Wastewater
S	South / Sewer / Slope in Feet Per Foot
SAE	Society of Automotive Engineers
SAN	Sanitary
SAR	Supply Air Register
SBC	Standard Building Code
SBCCI	Southern Building Code Congress International

ABBREVIATION	TERM
SC	Seal Coat
SCFM	Standard Cubic Feet per Minute
SCHED	Schedule
SCR	Silicon-Controlled Rectifier
SCRN	Screen
SCUM	Scum
SD	Storm Drain
SDG	Siding
SDI	Steel Deck Institute
SDWK	Sidewalk
SE	Southeast
SECT	Section
SEFF	Secondary Effluent
SF	Square Feet
SGL	Single
SH	Sheet / Shoring / Shielded
SIM	Similar
SJI	Steel Joists Institute
SJRWMD	St. Johns River Water management Project
SLP	Slope
SLV	Sleeve
SM	Sheet Metal
SMACNA	Sheet Metal and AC Contractor's National Association
sNdN	Simultaneous Nitrification/Denitrification
SOL	Solenoid
SOV	Solenoid-Operated Valve
SP	Space / Steel Pipe / Static Pressure / Spare

ABBREVIATION	TERM
SPCG	Spacing
SPEC	Specification
SPLC	Splice
SPRT	Support
SQ	Square
SQ FT	Square Foot
SR	Short Radius
SS	Stainless Steel
SSE	Substandard Effluent
SSI	Scaffolding and Shoring Institute
SSPC	Steel Structures Painting Council
SSPC	Structural Steel Painting Council
SST	Stainless Steel
ST	Street
STA	Station (100 ft)
STBY	Standby
STD	Standard
STK	Stake
STL	Steel
STN STL	Stainless Steel
STR	Straight
STR:	Structural
STRUCT	Structure
STS	Storm Sewer
STGR	Stringer
STWY	Stairway
SURF	Surface

ABBREVIATION	TERM
SW (S/W)	Southwest / Sidewalk
SWD	Side Water Depth
SWG	Swing
SY	Square Yard
SYMM	Symmetrical
SYS	System
T	Ton / Tangent Length of Curve / Telephone
TAN	Tangent
T/B	Top of Beam
TB	Top of Bank / Terminal Board
T & B	Top and Bottom
TBG	Tubing
TBM	Temporary Bench Mark
TC	Top of Curb
TD	Time Delay
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
TEFC	Totally Enclosed Fan Cooled
TEFF	Tertiary Effluent
TEL	Telephone
TEMP	Temperature / Temporary
TENV	Totally Enclosed Non-Ventilated
TH	Total Head
THB	Thrust Block
THD	Thread or Threaded
THH	Thrust Harness
THK	Thick

ABBREVIATION	TERM
TIR	Total Indicator Reading
TO	Turnout
T/O	Top of
TOC	Top of Concrete / Total Organic Carbon
TOF	Top of Floor
TOS	Top of Slab
TOT	Total
TP	Telephone Pole / Total Phosphorus
TRA	Tread
TRD	Tie Rod Assembly
TRANS	Transformer
TS	Tube Steel
TV	Television
TYP	Typical
UBC	Uniform Building Code
UD	Underdrain
UE	Underground Electric
UG	Underground
UH	Unit Heater
UL	Underwriter's Laboratories, Inc,
ULT	Ultimate
UNO	Unless Noted Otherwise
UPS	Uninterruptible Power Supply
UR	Urinal
USASI	United States of America Standards Institute
USGS	United States Geological Survey
UT	Underground Telephone

ABBREVIATION	TERM
UTC	Underground Telephone Cable
UTR	Up Through Roof
V	Vent / Valve / Volt
VAC	Vacuum / Volts - Alternating Current
VC	Vertical Curve
VCP	Vitrified Clay Pipe
VEL	Velocity
VERT	Vertical
VFD	Variable Frequency Drive
VOL	Volume
VPC	Vertical Point of Curve
VPI	Vertical Point of Intersection
VPT	Vertical Point of Tangency
VSS	Volatile Suspended Solids
VTR	Vent Through Roof
W	Water Line / West / Watt / Wide / Water
W/	With
WAS	Waste Activated Sludge
WC	Water Closet
WCO	Wall Cleanout
WG	Water Gauge
WH	Wall Hydrant
WL	Water Line
WLD	Welded
WM	Water Main / Water Meter
W/O	Without
WP	Waterproof/Working Point

ABBREVIATION	TERM
WRGWB	Water-Resistant Gypsum Wallboard
WSE	Water Surface Elevation
WSP	Water Stop
WT	Weight
WTR	Water
WWF	Welded Wire Fabric
WWM	Woven Wire Mesh
XFMR	Transformer
XFR	Transfer
YCO	Yard Cleanout
YD	Yard
YP	Yield Point
YR	Year
YS	Yield Strength

- C. Additional abbreviations and symbols are shown on the Contract Drawings. If an abbreviation or symbol is used that is not defined, inquire of the Engineer as to its meaning or intent.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

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SECTION 01075

REFERENCE SPECIFICATIONS

1. GENERAL

1.01 Description

A. Applicable Publications

1. Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes.
2. No requirements set forth herein or shown on the Contract Drawings shall be waived because of any provision of or omission from said standards or requirements.

B. Assignment of Specialists

1. In certain instances, a specification test requires (or implies) that specific work is to be assigned to specialist or expert entities who must be engaged for the performance of the Work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option.
2. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work. They are not intended to interfere with local union jurisdiction settlements and similar conventions.
3. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as an "expert" for the indicated construction processes or operations.
4. ***The final responsibility for fulfillment of the entire set of Contract requirements remains with the Contractor.***

1.02 Reference Specifications, Codes and Standards

- A. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall conform to or exceed the requirements of such referenced documents which are not in conflict with the requirements of these Specifications or applicable codes.
- B. References herein to "*Building Code*" shall mean the Florida Building Code (FBC). The latest edition of the code as approved and used by the local agency as of the date of award as adopted by the agency having jurisdiction shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.
- C. In case of conflict between codes, reference standards, Contract Drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or labor. The Contractor shall bid the most stringent requirements.
- D. Applicable Standard Specifications
 - 1. The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed.
- E. ***The Contractor shall ensure that the Work complies to all codes, standards and regulations as they apply to the Project whether or not specifically referenced elsewhere.***
- F. In the absence of specified agencies, associations, councils, etc., the Contractor shall conform to the requirements of the most widely recognized standards for each particular portion of the Work.

1.03 FDOT Standards and Requirements

- A. The Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, latest English Units edition ("Standard Specifications") and Roadway Traffic and Design Standards, latest English Units edition ("Design Standards") are referenced herein as source documents for applicable technical specifications and construction details to be used in the construction of this Project.
- B. Where the FDOT Standard Specifications use the reference "*Department*", replace "*Department*" with "*Owner*", except for when such reference is to Department Standards and evaluation criteria.

- C. The Design Standards are referenced herein as a source document for applicable construction items and details called for in the Contract Documents for which a specific plan detail is not provided. The Contractor shall construct the items called for in the Contract Documents in accordance with the "*Design Standards*" unless otherwise defined or detailed in the plans or as directed by the Owner, Engineer or authorized representative.
- D. In case of conflict, all technical specification sections provided within the Project Manual (Divisions 2-16) take precedence over FDOT specifications for a particular construction requirement.
- E. Copies of the Florida Department of Transportation Standard Specifications are on file with the Plans and other Contract Documents at the Engineer's office. Copies of the Florida Department of Transportation Standard Specifications may be purchased from FDOT for a nominal charge. Copies are also available on the Internet at "www.dot.state.fl.us/specificationsoffice".
- F. The Contractor shall inform the Owner and Engineer in writing of any specification which the Contractor feels is ambiguous or conflicting with other Contract Drawings and details prior to the construction of the associated item. The Engineer will determine which information is to be used for construction. The Contractor is responsible for the removal and replacement of any item improperly constructed resulting from a misinterpretation of the specifications, at no additional cost to the Owner.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

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SECTION 01120

SPECIAL PROJECT PROCEDURES

1. GENERAL

1.01 Scope of Work

- A. The Work included in this Project, as described in the General Requirements, is to be turned over to the Owner upon final completion. As such, this section describes the special project procedures that must be followed to meet the concerns and special needs of the Owner.
- B. The Contractor shall follow these procedures and no specific pay item is provided for this. The cost for the labor, equipment, and materials associated with meeting these requirements, including requirements of Federal, State, and local agencies with jurisdiction over the work, is considered incidental to the contract. Therefore, the Contractor shall bear any costs associated with them.
- C. Failure to comply with these provisions shall be adequate grounds to withhold payment requests and issue a stop work order at no cost to the Owner.

1.02 Workmanship, Material and Equipment

- A. When a particular product is specified or called for, it is intended and shall be understood that the proposal tendered by the Contractor included those products in his Bid. Should the Contractor desire equal to those specified, the Contractor shall furnish information as described in the General Conditions, Supplementary Conditions and the Bid Form. The alternate product or products proposed and submitted by the Contractor shall meet the requirements of the specifications and shall, in all respects, be equal to the products specified by name herein.
- B. The Contractor shall refer to and review the following specification sections with respect to materials and equipment specified: Section 00100, "Instructions to Bidders", Section 00300, "Bid Form", and the individual equipment sections.
- C. All materials and manufactured articles for incorporation into the Work shall be the new and unused standard products of recognized reputable Manufacturers.

1.03 Responsibility of the Contractor

- A. ***The Contractor shall be responsible for all of the Project Work*** determined by the Contract Drawings, Technical Specifications and Contract/Agreement from the date of the starting of the Work (Notice to Proceed) until Final Project Acceptance (Completion Certificate) by the Owner. The Contractor shall be responsible for removals, renewals and replacements due to action of the elements and all other causes except as otherwise provided in the Specifications.
- B. The Contractor shall keep the Contract under his own control and it shall be his responsibility to see that the Work is properly supervised and carried on faithfully and efficiently. ***The Contractor shall supervise the work personally or shall have a competent, English speaking superintendent or representative, who shall be on the site of the project at all working hours, and who shall be clothed with full authority by the Contractor to direct the performance of the work and make arrangement for all necessary materials, equipment and labor without delay.***
- C. Renewals or repairs necessitated because of defective materials or workmanship, or due to action of the elements or other natural causes, including fire and flood, prior to the acceptance as determined by the Completion Certificate, shall be done anew in accordance with the Contract and Specifications at the expense of the Contractor.

1.04 Services of the Manufacturer's Field Service Technician

- A. Bid prices for project equipment furnished under Divisions 5 through 16 shall include the cost of a competent field service technician of the manufacturers of all equipment to supervise the installation, adjustment and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance. The approved manufacturer's operation and maintenance data as specified in Section 01730, "Operation and Maintenance Data", shall be delivered to the Contractor prior to instructing the Owner's personnel. This supervision may be divided into two or more time periods as required by the installation program or as directed by the Engineer.
- B. After installation of the equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, ***the manufacturer's field service technician shall inspect, operate, test and adjust the equipment.*** The inspection shall include at least the following points where applicable:
 - 1. Soundness (without cracked or otherwise damaged parts).
 - 2. Completeness in all details, as specified and required;
 - 3. Correctness of setting, alignment and relative arrangement of various parts.

- C. ***Upon completion of this work, the manufacturer's field service technician shall submit, in triplicate, to the Engineer a complete, signed report of the results of his/her inspection, operation, adjustments and tests.*** The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified and suggestions for precautions to be taken to ensure proper maintenance.
- D. ***A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation and that the operating personnel have been suitably instructed*** in the operation, lubrication and care of the unit shall be submitted prior to the startup and performance demonstration hereinafter specified. The certificate shall indicate date and time that the instruction was given and names of operating personnel in attendance. This certification shall be submitted on the certification sheet, a sample of which is presented at the end of this Section.
- E. The Contractor is referred to the detailed specification sections, Section 01430, "Manufacturer's Services", Section 01600, "Materials and Equipment", and Section 01650, "Systems Start-Up and Demonstration", for additional requirements for furnishing the services of the manufacturer's field service technician.
- F. For equipment furnished under other Divisions, unless otherwise specified, furnish the services of accredited field services technicians of the manufacturer only when some evident malfunction or over-heating makes such services necessary in the opinion of the Engineer.

1.05 Operating and Maintenance Data

- A. Operating and maintenance data covering all equipment furnished under Divisions 5 through 16 shall be delivered directly to the Engineer: Benjamin M. Fries, Vice-President, CPH, Inc., 500 West Fulton Street, Sanford, FL 32771.
- B. Data shall be prepared and submitted in full conformance with Section 01300, "Shop Drawings, Submittals and Samples", and Section 01730, "Operation and Maintenance Data".
- C. Submissions of Project Operation and Maintenance Data shall be in accordance with Section 00980, "O & M Manual Submittal Form".
- D. Final approved copies of Operation and Maintenance data shall have been delivered to the Engineer prior to scheduling the instruction period with the Owner.

1.06 FDOT and Rights-of-Way

- A. The Contractor shall strictly adhere to the requirements of FDOT, the City of Sanford and Seminole County where construction work is in a right-of-way under the jurisdiction of the State of Florida, the City of Sanford or Seminole County and shall abide by applicable local ordinances and rules that govern work performed in right-of-ways under the City's/County's jurisdiction.
- B. The Contractor shall take care to avoid any unreasonable traffic conflicts due to the work in road rights-of-way, and shall provide appropriate detour equipment, barricades, flagmen, and safety equipment to protect the public and direct the smooth flow of traffic around work areas. The Contractor is referred to the General and Supplementary Conditions and Section 01040, "Project Coordination", for other traffic related requirements.

1.07 Notification of Work to Begin

- A. ***Before commencing work, the Contractor shall notify the Owner, in writing, at least ten (10) calendar days in advance of the date he proposes to commence such work.***
- B. The Contractor shall provide at his own cost all necessary temporary facilities for access to, and for protection of, all existing structures. The Owner's personnel must have ready access at all times to existing work areas.
- C. The Contractor is responsible for all damage to existing structures, equipment, and facilities caused by his construction operations, and must repair all such damage when and as ordered by the Owner.

1.08 Installation of Equipment

- A. Special care shall be taken to ensure proper alignment of all equipment with particular reference to mechanical equipment such as pumps, blowers and electric drives, etc. The units shall be carefully aligned on their foundations by qualified millwrights after their sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been approved by the manufacturer, the bedplates or wing feet of the equipment shall be securely bolted in place. The alignment of equipment shall be further checked after securing to the foundations and after confirmation of all alignments, the sole plates shall be finally grouted in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping, and under no circumstances, will "pipe springing" be allowed.

- B. All wedges, shims, filling pieces, keys, packing, red on white lead grout, or other materials necessary to properly align, level and secure apparatus in place shall be furnished by the Contractor. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the Contractor.

1.09 Sleeves and Openings

- A. The Contractor shall provide all openings, channels, chases, etc. and install anchor bolts and other items to be embedded in concrete, as required to complete the Work under this Contract, together with those required by subcontractors and shall do all cutting and patching, except cutting and patching of materials of a specified trade and as stated otherwise in the following Article.
- B. The Contractor shall coordinate with the subcontractors to provide all sleeves, inserts, hangers, anchor bolts, etc. of the proper size and material for the execution of the Work. Be responsible for any corrective cutting and refinishing required to make the necessary openings, chases, etc. In no case shall beams, lintels or other structural members be cut without the written approval of the Engineer.

1.10 Relocations

- A. ***The Contractor shall be responsible for the relocation of structures***, including but not limited to, light poles, signs, sign poles, fences, piping, conduits and drains that interfere with the positioning of the Work as set out on the Contract Drawings. The cost of all such relocations shall be included in the Bid for the Project and ***shall not result in any additional cost to the Owner.***

1.11 Obstructions

- A. The attention of the Contractor is drawn to the fact that during excavation at the Project site, the possibility exists of the Contractor encountering various water, chemical, electrical, or other lines not shown on the Contract Drawings.
- B. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines so as to avoid damage to the existing lines. Should damage occur to an existing line, the Contractor shall repair the line ***at no cost to the Owner.***

- C. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the close proximity of excavation, are temporarily stayed in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation by the Contractor.

1.12 Provisions for Control of Erosion

- A. Sufficient precautions in accordance with Section 01570, "Temporary Erosion and Sedimentation Control", shall be taken during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumen, calcium chloride, sodium hypochlorite or other polluting materials harmful to humans, fish, or other life, into the supplies and surface waters of the State.
- B. Control measures must be adequate to assure compliance with federal, state, and local regulations and permit conditions. Special precautions shall be taken in the use of construction equipment to prevent operations that promote erosion.
- C. Erosion and sedimentation control shall conform to the requirements of the Owner, Seminole County, St. Johns River Water Management District and the State of Florida.
- D. Submit background readings to the Engineer prior to the start of construction activities in any area.

1.13 Provisions for the Control of Dust

- A. Sufficient precautions shall be taken during construction to ***minimize the amount of dust created***.
- B. Wetting down the site may be required or as directed by the Engineer to prevent dust as a result of vehicular traffic.
- C. The Contractor shall be referred to the requirements in these specifications, particularly Section 01560, "Environmental Protection".

1.14 Architectural Coatings

- A. Maintain coordination among all Sections (windows, window walls, louvers, doors and frames, etc) requiring PVC and PVF coatings. All coatings shall match to the satisfaction of the Engineer with regard to color and texture. Items rejected by the Engineer shall promptly be removed from the job site.

1.15 "On-Site" Storage

- A. The Contractor's attention is directed to the special storage requirements and possible charges for "noncompliance" of "on-site" storage requirements for materials and equipment as specified in Section 01600, "Materials and Equipment".
- B. **All material delivered to the job site shall be properly protected from dirt, dust, dampness, UV, water and any other combination detrimental** to the life of the materials from the date of delivery to the time that the material is installed and the Owner assumes beneficial occupancy (Final Project Acceptance by the Owner).

1.16 Tropical Storm / Hurricane Preparedness Plan

- A. **Within fifteen (15) calendar days of the date of Notice to Proceed, the Contractor shall submit to the Engineer a Tropical Storm / Hurricane Preparedness Plan.** The Plan should outline the necessary measures which the Contractor proposes to perform, at no additional cost to the Owner, in the event of a tropical storm or hurricane warning. Such measures shall be in accordance with local and state requirements.
- B. In the event of inclement weather, the Contractor will, and will cause subcontractors to protect carefully the Work and materials against damage or injury from the weather.
- C. If, in the opinion of Engineer, any portion of Work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or subcontractors to so protect the Work, such Work and materials shall be removed and replaced at the expense of Contractor.

1.17 Valve Indices

- A. **The Contractor shall furnish and install tags for all valves, weir gates and sluice gates required on the Work.** Tags for buried valves shall be in accordance with Article 2.01 (G) of Section 09905, "Piping, Valve and Equipment Identification System".
- B. Submit to the Engineer for review, two (2) samples of each type of tag proposed and the manufacturer's standard color chart and letter styles. Tags shall have stamped or engraved on them the information shown on the Contract Drawings and the data described herein. **Submit to the Engineer for approval, within sixty (60) days from the Notice to Proceed, a valve schedule containing all valves required for his/her work.** The schedule shall contain a list of abbreviations used for each valve, the location, type, a number, words or abbreviations to identify the valve's function and the normal operating position.

- C. The valve schedule, abbreviations, words, identification, etc. shall be approved by the Engineer and Owner prior to submission for casting.
- D. The information contained in the valve schedules shall be coded on the tags in a system provided by the Owner.
- E. Above ground valve tags shall be furnished with **stainless steel (Type 316) wire** for attachment thereof. The tag shall not be attached to the handwheel or crank operators or any part of the valve which would inhibit operation of the valve.

1.18 Testing, Disinfection and Clearance

- A. It shall be the responsibility of the Contractor to perform all pressure tests, water main disinfection and preparation for subsequent bacteriological testing by the Contractor's designated laboratory (Owner approved). The Contractor shall review the Contract Documents for specific requirements for flushing, pressure tests and disinfection.
- B. Disinfection shall be performed in accordance with AWWA standards, FDEP and Florida Department of Health regulations and Section 15041, "Disinfection of Piping and Structures". Disinfection is required for both new potable water facilities installed, and existing potable water facilities which are modified.
- C. **The Contractor shall follow the potable water main clearance** procedure described in the Florida Department of Environmental Protection's regulations.
- D. **It shall be the responsibility of the Contractor to provide a "flushing plan" to the Owner and Engineer at the preconstruction conference.** This plan shall clearly indicate the volumes to be flushed and the disposal methodology for the flush water. Further, it shall be the responsibility of the Contractor to obtain any permits associated with the flushing activity.
- E. Testing shall be in accordance with Section 15044, "Pressure Testing of Piping".
- F. The Contractor shall be entirely responsible to coordinate and schedule the full diameter flushing activity and shall provide written notification to the Owner a minimum of forty-eight (48) hours prior to commencing the flushing activity. All temporary piping associated with the flushing shall be provided and installed by the Contractor.
- G. **Clean, disinfect and bacteriologically test and clear in accordance with applicable Florida Department of Health and FDEP regulations all water supply facilities affected by this Project** which shall come into contact with raw water, water being treated or treated water prior to placing the facility in operation. The above statement shall apply to both new water facilities installed and existing water facilities that are or may be modified.

- H. ***The cost of all disinfection work and bacteriological clearance tests shall be included in the Bid.***
- I. The Contractor shall employ a disinfection method approved by the Engineer and Owner and shall fully satisfy the Owner that adequate disinfection has been achieved prior to placing a potable water facilities on-line.
- J. ***Neither the Owner nor the Engineer shall be held responsible for delays to the Contractor awaiting a "Letter of Clearance" or "Release for Use" from the Florida Department of Environmental Protection (FDEP) to operate either the "new" facilities (water, wastewater and reclaimed water).***
- K. It shall be the responsibility of the Contractor to make provisions for the time to obtain these releases from FDEP when planning his construction progress schedule.

1.19 Connections to Existing Systems

- A. Perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing systems (potable water, wastewater and reclaimed water) all as shown on the Contract Drawings, or where directed by the Engineer.
- B. The cost for this Work and for the actual connection of the existing mains (potable water, wastewater and reclaimed water) shall be included in the Bid for the Project and shall not result in any additional cost to the Owner.

1.20 Utility Crossings

- A. It is intended that wherever existing utilities such as gas, potable water, wastewater, reclaimed water, storm drain, chemical, electrical or other service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Contract Drawings.
- B. However, when in the opinion of the Engineer, this procedure is not feasible, the Contractor may direct the use of fittings for a utility crossing as detailed on the Contract Drawings.

1.21 Watertightness

- A. Special precautions shall be taken in the curing of concrete to reduce concrete cracking as called for in Section 03300, "Cast-in-Place Concrete".

- B. The procedure and manner in which any leaks are repaired must meet the approval of the Engineer.

1.22 Utilities Infrastructure Maintenance and Protection

- A. Existing utilities are shown in their approximate locations. Locate and protect all utilities whether shown on Contract Drawings or not.
- B. The Contractor shall contact other utility companies at least seven (7) days before starting construction so maintenance personnel can locate and protect facilities, if required by the utility company.
- C. Throughout the entire duration of the construction process and within the construction project boundaries, it shall be the responsibility of the Contractor to maintain the location of all active Owner utility service lines and all utility lines that are pressurized (whether presently owned or to be owned in the future by the Owner) by identifying, by preserving, and by protecting all valves (with their associated boxes and lids) and manholes. These locations must remain visible and accessible to the Owner's personnel.
- D. Protection shall be provided in the form of a four (4) inch PVC conduit with a minimum burial of four (4) feet and a minimum above-ground exposure of four (4) feet. The entire circumference of the top two (2) feet of the pipe shall be color coded using blue paint to indicate potable water, green paint to indicate wastewater, and purple paint to indicate reclaimed water.
- E. Protection shall be installed by the Contractor after the Notice to Proceed but prior to any work (including preliminary clearing and grubbing) being performed within the construction project limits. ***Until the required protection is installed, the Contractor is strictly prohibited from performing any preliminary clearing or grubbing or excavating in areas that are adjacent to or include Owner's utilities.***
- F. Protection of utility lines that are to be removed and/or abandoned shall be removed only after the following conditions are met:
 - 1. The replacement line is in service and approved for operation by the Florida Department of Environmental Protection (FDEP) and the Engineer and accepted by the Owner.
 - 2. All service connections have been relocated from the utility line to be abandoned to the utility line that has been placed in active service, if any, with approvals from the Florida Department of Environmental Protection, the Engineer, and the Owner.
 - 3. The utility line to be taken out of service has been depressurized, if any.

- G. With respect to the utility lines that are to be the final utility lines in service at the completion of construction, the protection shall be removed by the Contractor only after the final site restoration (including final sodding and/or seeding and mulching of all disturbed areas) has been accepted by the Engineer.
- H. ***The Contractor shall be responsible for adjusting all manholes, valve boxes, lids, water meters, reclaimed water meters, and similar structures to match the final project finished grade***, regardless of whether other utility work is performed.
- I. ***The Contractor shall be responsible for the relocation of structures***, including but not limited to light and power poles, signs, sign poles, fences, piping, conduits (and wire), drains and other obstructions that interfere with the positioning of the work as set out in the Contract Drawings. The cost of all such relocations shall be included in the Contractor's Bid. The Contractor shall install any test pits required to identify potential points of interference.
- J. ***It shall be the responsibility of the Contractor to relocate or adjust all of the Owner's utilities in accordance with the approved plans***. Should a conflict arise between the relocated or existing utilities and the subsequent construction of the work as shown on the Contract Documents, it shall be the responsibility of the Contractor to relocate or adjust the utilities, providing the necessary piping, bends, tees, and fittings to resolve the conflict. Relocations of this nature shall be approved in advance of said work by both the Engineer and the Owner and shall be reflected on the "As-Built" drawings upon completion of the actual installation. The Contractor is to assume the cost of providing permanent or temporary utility work to resolve conflicts and is to bear all costs associated with the installation of various bends and fittings that are installed on new or existing water, wastewater and reclaimed water mains.
- K. ***It shall be the responsibility of the Contractor to provide all sheeting, bracing, shoring, and other forms of support when working adjacent to or directly on the Owner's utilities***. This provision applies to both existing and proposed utilities that are presently or are to be owned by the Owner.

1.23 Warranties

- A. ***All equipment supplied under this Project Contract shall be warranted by the Contractor and the equipment manufacturers for a period of two (2) years, unless longer periods are identified in individual specification sections. The Warranty period shall commence on the date of Final Project Acceptance by the Owner.***
- B. The Guarantee shall cover all necessary labor, equipment, materials, and replacement parts resulting from faulty or inadequate equipment design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by the manufacturer or the Contractor.

- C. The Contractor shall be responsible for obtaining certificates for equipment warranties for all major equipment specified under Division 11, "Equipment"; Division 13, "Special Construction"; Division 14, "Conveying Systems"; Division 15, "Mechanical"; and Division 16, "Electrical"; and which has at least a 1.0 hp motor or which lists for more than \$1,000.
- D. The Engineer reserves the right to request warranties for equipment not classified as major. The Contractor shall still warrant equipment not considered to be "major" in the Contractor's **two-year warranty period** even though certificates of warranty may not be required (commencing at the time of Final Project Acceptance by the Owner).
- E. The Owner shall incur no labor or equipment cost during the guarantee period.

1.24 Final Guarantee

- A. ***All work shall be guaranteed by the Contractor for a period of two (2) years, unless longer periods are specified in individual specification sections, commencing at the time of Final Project Acceptance of the work by the Owner.***
- B. If, within the guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Engineer, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, promptly upon receipt of notice from the Owner and without expense to the Owner, do the following.
 - 1. Place in satisfactory condition all guaranteed work and correct all defects therein.
 - 2. Make good all damage to the site, buildings, structures, equipment or contents thereof, which, in the opinion of the Engineer, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the contract.
 - 3. Make good any work or material, or the equipment and contents of any buildings or structures on the Project Site disturbed in fulfilling any such guarantee.
- C. If the Contractor, after notice, fails within ten (10) calendar days to proceed to comply with the terms of this guarantee, the Owner may have the defects corrected, and the Contractor and his/her surety shall be liable for all expense incurred, provided, however, that in case of an emergency where, in the opinion of the Owner, delay would cause loss or damage, repairs may be started without notice being given to the Contractor and the Contractor shall pay the cost thereof.
- D. All special guarantees or warranties applicable to specific parts of the work, as may be stipulated in the Contract Documents, or other papers forming a part of this Contract

shall be subject to the terms of this paragraph during the first year of life of each such guarantee. All special guarantees and manufacturers' warranties shall be assembled by the Contractor and delivered to the Engineer, along with a summary list thereof, as specified in Section 01740, "Warranties & Bonds", before the acceptance of the Work.

1.25 Archeological Finds

- A. Notwithstanding anything to the contrary herein, in the event any archeological artifacts within the Project are discovered during the course of the work, ***the Owner shall have and retain all right, title, and interest to such artifacts*** and shall have the further right, during the course of the Contract, to examine or cause to have examined, the site of the work for any such artifacts and to perform or have performed archeological excavations and all other related work to explore for, discover, recover and remove such artifacts from the site of the work.
- B. In the event the work or archeological examination and related work delays the Contractor's work, he/she shall be entitled to an extension of time to complete the work equal to the number of days he/she is thus delayed. Such delay shall be considered an excusable delay as defined in Section 00800, "Supplementary Conditions".

1.26 Electrical Devices and Voltage Ratings of Motors

- A. All motors, switches, controllers, panels, switchgear and other electrical devices shall be UL and/or CSA labeled and/or listed or shall be inspected and labeled in the field by an Owner approved certifying testing laboratory.
- B. Unless otherwise specified, motors in excess of $\frac{1}{3}$ -horsepower shall be nameplate rated for 460 Volt, 3 Phase, 60 Hz current. Motors of $\frac{1}{3}$ -horsepower or less shall be suitable for operation on 115 Volt, single phase, 60 Hz current.

1.27 Maintenance of Existing Utility Service and Existing Treatment Facility Operation

- A. Cooperate at all times with the Owner in order to maintain utility operations (water, wastewater, reclaimed water, stormwater, etc.) with the least amount of interference and interruption possible. Public health and safety considerations shall exceed all others and the Contractor's schedule, plan and work shall, at all times, be subject to alteration and revision if necessary for public health and safety considerations.
- B. ***Interruptions of the Owner's operations must be kept to a minimum of less than four (4) hours during low demand periods.*** However, no interruption of service to

- the Owner's customers will be allowed. The Contractor is to assume that water, wastewater and reclaimed water mains being replaced or temporarily bypassed are the only means of servicing existing customers and that no alternative water source or backfeed or wastewater collection system is available.
- C. ***It is the responsibility of the Contractor to schedule all shutdowns, at least seventy-two (72) hours in advance (Monday through Friday), in writing, with the Engineer and Owner. The Owner reserves the right to approve or disapprove said request.***
- D. Should the Contractor create an unscheduled interruption of utility service, then the Contractor shall be directly responsible for performing the necessary repairs in order to restore service. In addition, the Contractor shall be billed for subsequent repair work performed by the Owner, and shall be held liable for any claims related to the service interruption.
- E. If the requested "System Shut Down" is approved by the Owner, then it shall be the responsibility of the Contractor to notify all affected customers that will experience a disruption in service, if any. Notification shall indicate the date and time limits of the interruption and must be provided to affected customers, ***in writing, a minimum of forty-eight (48) hours in advance*** while simultaneously providing two (2) duplicate copies of all said notifications to the Engineer. In lieu of written notification, the Contractor may opt to install signage in the affected area indicating the same information stated above.
- F. ***The Owner reserves the right to require the Contractor to perform utility "tie-ins" during periods of "low flow" conditions in order to minimize service disruptions. "Tie-ins" of this nature are typically required to begin no sooner than 10 p.m. and be completed no later than 5:30 a.m. "Tie-ins" of this nature that are required by the Owner shall be performed by the Contractor at no additional cost to the Owner.***
- G. In no case will the Contractor be permitted to interfere with any existing service until all materials, supplies, equipment, tools and incidentals necessary to complete the Work are on the job site.
- H. The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing systems (potable water, wastewater and reclaimed water) all as shown on the Contract Drawings, or where directed by the Engineer.
- I. ***The cost for this Work and for the actual connection of the existing mains (potable water, wastewater and reclaimed water) shall be included in the Bid for the Project and shall not result in any additional cost to the Owner.***

- J. No interference with service shall be made until the Engineer approves the method and schedule for completing the work.

1.28 Equipment Data List

- A. Obtain, prepare and submit a complete, detailed listing of equipment and motor data for all electrical items furnished under this Contract. This listing shall be submitted on Equipment Data Sheets, a “*sample*” of which is at the end of this Section.
- B. Submit the Equipment Data List, at least thirty (30) calendar days prior to the start-up and performance demonstration hereinafter specified.
- C. Upon approval of the data sheets by the Engineer, the Contractor shall supply the appropriate number of each (number of items provided under the Contract), laminated in a heavy plastic with a non-metallic fastening system for attachment to each piece of equipment.

1.29 Protection Against Electrolysis

- A. Where dissimilar metals are used in conjunction with each other, ***suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resulting electrolysis.***
- B. The insulating material shall be bituminous impregnated felt, heavy bituminous coatings, non-metallic separators or washers, or other approved materials.

1.30 Damage on Account of High Water

- A. The Contractor shall be responsible for all damage done to his/her work by heavy rains or floods and he/she shall take all reasonable precautions to provide against damages by building such temporary dikes, channels, or shoring to carry off storm water as the nature of the work may require.

1.31 Tools

- A. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation and maintenance of any equipment shall be furnished with the respective equipment.

1.32 Grease, Oil, Fuel, Electrical Power and Testing Equipment

- A. ***All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment.*** Electric power and all equipment and tools required for testing of equipment shall be furnished by the Contractor, the cost of which shall be included in the prices quoted in the Bid Form.
- B. The Owner shall be furnished with a ***two (2) year supply of required lubricants*** including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under Divisions 11, "Equipment"; Division 13, "Special Construction"; Division 14, "Conveying Systems"; Division 15, "Mechanical"; and Division 16, "Electrical".

1.33 Emergency Phone Numbers and Accident Reports

- A. ***Emergency phone numbers (fire, medical, police) shall be posted in the Contractor's construction trailer.***
- B. Accidents shall be reported immediately to the Engineer, Owner and appropriate authorities by messenger or phone.
- C. All accidents shall be documented and a fully detailed written report submitted to the Engineer after each accident. The Contractor shall use the reporting form presented in Section 00852, "Construction Accident Report Form".

1.34 Construction Conditions and Subsurface Investigation

- A. The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) or agency(ies) having jurisdiction over the Work. Wherever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.
- B. The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his Bid, the nature and location of the Work, the conformation of the ground, the character and quality of the substrata, the types and quantity of materials to be encountered, the nature of the groundwater conditions, the character of equipment and facilities needed preliminary to and during 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. The prices established for the Work to be done will reflect all costs pertaining to the Work. Any claims for extras based on substrata, groundwater table, and other such conditions will not be allowed.

- C. From investigations, including surveys made at the site, it is assumed that physical conditions are approximately as indicated on the Contract Drawings, but the nature of the materials below the surface, the depth to satisfactory foundations, or the stability of beds or banks, are not guaranteed.
- D. Certain information regarding the reputed presence, size, character and location of existing underground structures, pipes and conduits has been shown on the Contract 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 Owner and Engineer are 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; and 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 Contract 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 Contract Drawings, or in case any pipe or other underground structure is encountered that is not shown on the Contract Drawings, as determined by the Owner and/or Engineer.
- E. Subsurface Investigation Data
 - 1. An independent geotechnical consultant, Terracon Consultants, Inc., conducted soils and subsurface investigations at the Sanford Main WTP. A copy of the complete soils and subsurface investigation in Specification Section 02000.

1.35 Public Nuisance

- A. The Contractor shall not create a public nuisance including, but not limited to, the following:
 - 1. Encroachment on adjacent lands.
 - 2. Flooding or pollution of adjacent lands.
 - 3. Excessive noise.
- B. **Sound levels measured by the Engineer shall not exceed 45 dBA from 7:00 p.m. to 7:00 a.m. or 50 dBA from 7:00 a.m. to 7:00 p.m.** This sound level shall be measured at the Owner's property line.
- C. **Levels at the equipment shall not exceed 50 dBA at any time.** Sound levels in excess of these values are sufficient cause to have the Work halted until equipment sound levels are in compliance with this Section.

- D. Work stoppage by the Engineer, Owner, or the local governmental agency for excessive noise shall not relieve the Contractor for any delays of other portions of the Contract including, but not limited to, completion dates and Bid amounts. The work stoppage shall not be grounds for any claims by the Contractor.
- E. **No extra charge may be made** for time lost due to work stoppage resulting from the creation of a public nuisance or for temporary or permanent sound attenuation systems.
- F. **No claim shall be made** by the Contractor for lost time due to work stoppage resulting from the creation of a public nuisance by the Contractor.
- G. Pollution control
 - 1. For pollution control, use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust and dirt rising and scattering in the air to the lowest level of air pollution practical for the conditions of work. Comply with the governing regulations.
 - 2. Take all necessary measures and means to provide dust, dirt, debris and paint abatement methods to prevent damage to surrounding residential properties, on-site structures and private property.
 - 3. Clean “on-site” structures and improvements of all dust, dirt and debris caused by construction operations as directed by the Engineer. Clean or repair all “off-site” residential and private property as directed by the Engineer. Return all areas to the conditions existing prior to the commencement of the Project Work.

1.36 Suspension of Work Due to Weather

- A. During inclement weather, all work which might be damaged or rendered inferior by such weather conditions shall be suspended. **The decisions of the Engineer as to suspensions shall be “final”.**
- B. During suspension of the work from any cause, the work shall be suitably covered and protected so as to preserve it from injury by the weather; and, all rubbish, debris and surplus materials shall be removed and legally disposed of.
- C. The Contractor is referred to the General Conditions, Supplementary Conditions, FDEP Supplementary Conditions and Article 1.16, “Tropical Storm/Hurricane Preparedness Plan”, herein, for additional requirements.
- D. A certain amount of “bad weather” days are to be expected for work in this Project location, especially due to rain or high winds.

1.37 Permits

- A. Upon issuance of the Notice of Award (NOA), the Contractor shall immediately apply for all applicable permits not previously obtained by the Owner to do the work from the appropriate governmental agency or agencies.
- B. No work shall commence until all applicable permits have been obtained and copies delivered to the Engineer.
- C. The costs for obtaining all permits shall be borne by the Contractor. Existing permits are identified in Section 01065, "Permits and Fees".

1.38 Pumping / Dewatering

- A. The Contractor, with his own equipment, shall do all pumping necessary to prevent flotation of any part of the structures during construction operations.
- B. ***The Contractor, with his own equipment, shall do all bypass pumping necessary to make tie-ins to structures, piping systems, etc.***
- C. The Contractor shall, for the duration of the Contract and with his own equipment, pump out water that may seep or leak into manholes and other appurtenances. All construction shall be kept dry at all times. The extent of pumping required shall be determined by the Engineer.
- D. If dewatering is needed, ***a Dewatering Plan must be prepared and certified by a Registered Professional Engineer in the State of Florida and be submitted and approved by the Engineer*** and the local water management district ***prior*** to commencement of work. The Contractor shall, for the duration of the Contract and with his own equipment, pump out water that may seep or leak into the excavations or structures. Any permitted dewatering and compliance with dewatering regulations shall be the responsibility of the Contractor.
- E. ***The Contractor shall not be allowed to pump water off-site or to area wetlands.***
- F. The Contractor shall meet all of the requirements specified in Section 02075, "Dewatering and Drainage".
- G. No additional payment shall be made for pumping or other difficulties encountered due to water.
- H. ***No additional payment shall be made for sheeting and shoring.***

1.39 Easement for Work on Private Property

- A. The Owner will secure easements for the construction of the lines across private property as shown on the Contract Drawings, if any. The Owner will not secure additional easement for additional working room. Bidders should base their Bids upon these conditions.
- B. Work performed in such easements shall be subject to the provisions of the easement agreement on file and open to inspection in the office of the Owner.
- C. In general, these easement agreements provide for restoring the property to the condition existing before construction began.
- D. Any damage to private property outside of easement shall be repaired or restored at the Contractor's expense.

1.40 Project Cleaning

- A. The Contractor shall execute cleaning, during the progress of the Work and at the completion of the Work, as required by the General and Supplementary Conditions, Section 01710, "Cleaning", Section 01800, "Miscellaneous Work and Cleanup", and as indicated herein.
- B. Control of blowing litter caused by any regrading by the Contractor shall be the responsibility of the Contractor.

1.41 Discrepancies in the Contract Documents

- A. ***In accordance with the Instructions to Bidders, it was the responsibility of the Contractor to alert the Owner, in writing, within forty-eight (48) hours of discovery of any apparent discrepancies in the Bid Documents prior to submission of Bids so that any required addendums can be issued to address these concerns.*** Given circumstances where it can be shown that a Contractor is aware of discrepancies in the Bid Documents and fails to formally alert the Owner in writing prior to the Bid Opening, the Contractor shall not be permitted additional compensation to comply with the Owner and Utility Design Engineer's intended requirements of the Bid Documents.
- B. Should the discrepancy in the Bid documents be discovered by the Contractor after the Bid Opening, it shall be the responsibility of the Contractor to alert the Engineer ***in writing within forty-eight (48) hours of the discovery*** of the discrepancy so that it can be addressed promptly to ***minimize*** impact on the project schedule. Failure of the Contractor to follow procedure shall forfeit any and all possibility for the Contractor to

- request additional time for the completion of construction. Further, failure of the Contractor to provide written notification of the discrepancy to the Engineer shall be regarded as an attempt by the Contractor to create an intentional delay in the construction and no additional compensation shall be allowed.
- C. Items of material, equipment, machinery and the like may be specified on the Contract Drawings and not in the Contract Specifications. Such items shall be provided by the Contractor in accordance with the specification on the Contract Drawings.

1.42 Claims for Property Damages and Citizen's Complaints

- A. In the event of any indirect or direct damage to public or private property caused in whole or in part by an act, omission or negligence on the part of the Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable, ***the Contractor shall at his own expense and cost promptly remedy and restore such property to a condition equal to or better than that existing before such damage was done.***
- B. The Contractor shall perform such restoration by underpinning, repairing, rebuilding, replanting, or otherwise restoring as may be required or directed by the Engineer or Owner, or shall make good such damage in a satisfactory and acceptable manner.
- C. In case of failure on the part of the Contractor to promptly restore such property or make good such damage, the Engineer or Owner may, upon five (5) calendar days written notice, proceed to repair, rebuild or otherwise restore such property as may be necessary and the cost thereof, or a sum sufficient in the judgement of the Engineer or Owner to reimburse the owners of the property so damaged, will be deducted from any monies due or to become due the Contractor under the Contract.
- D. The Contractor shall designate a responsible member of his organization at the site whose sole duty shall be the prevention and resolution of citizen complaints and the protection of material, equipment, and private property. This person shall be someone other than the Contractor's superintendent.

1.43 Jurisdictional Disputes

- A. It shall be the responsibility of the Contractor to pay all costs that may be required to perform any of the Work shown on the Contract Drawings or specified herein in order to avoid any work stoppages and delays due to jurisdictional disputes.

- B. The basis for subletting Work in question, if any, shall conform with precedent agreements and decisions on record with the Building and Construction Trades Department, AFL-CIO, dated June, 1973, including any amendments thereto.

1.44 Hauling and Construction Operations on Facility Property

- A. The Contractor shall conduct access, hauling, filling, and storage operations as specified herein and as shown on the Contract Drawings.
 - 1. **On-site borrow areas shall not be allowed.** All borrow material required shall be provided by the Contractor from off-site locations with all costs associated with the material being borne by the Contractor.
 - 2. On-site spoil areas will become the property of the Contractor and removed from the site and legally disposed of by the Contractor at no additional cost to the Owner.
- B. Construct all fill areas so that runoff will not flood improved areas.

1.45 Start-up and Acceptance of the Facilities and Related Systems

A. General Requirements

- 1. Successfully execute the step-by-step procedure of Start-Up and performance demonstration specified hereinafter.
- 2. The Start-Up and performance demonstration shall be successfully executed prior to substantial completion and acceptance by the Owner.
- 3. **All performance tests and inspections shall be scheduled, in writing, at least five (5) calendar days in advance or as otherwise specified with the Engineer and the Owner.** All performance tests and inspections shall be conducted during the work week of Monday through Friday, unless otherwise specified.

B. Preparation for Start-Up

- 1. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected. Preliminary run-ins of the various pumps, compressors, and other remaining equipment shall be made. All systems shall be purged as required. All sumps, tanks, basins, chambers, wet wells, and pipe lines

which are hydraulically checked shall be drained and returned to their original condition once the testing is complete.

2. All instruments and controls shall be calibrated through their full range. Any other adjustments required for proper operation of all instrumentation and control equipment shall be made.
3. Perform all other tasks needed for preparing and conditioning the treatment facilities for proper operation.
4. No testing or equipment operation shall take place until it has been verified by the Engineer that all specified safety equipment has been installed and is in good working order.
5. No testing or equipment operation shall take place until it has been verified by the Engineer that all lubricants, tools, maintenance equipment, spare parts, and approved equipment operation and maintenance manuals have been furnished as specified.

C. Start-up and Final Performance Demonstration

1. As soon after the satisfactory completion of the performance tests for the various system components, equipment, etc., make the appropriate connections and begin operation of the “new” facilities.
 - a. ***Demonstrate successful operation of the “new” facilities and systems as a prerequisite of Substantial Completion and acceptance.***
 - b. However, ***demonstration tests are presented in the Technical Sections of these specifications.***
2. In the event of failure to demonstrate satisfactory performance of the treatment facilities and systems on the first or any subsequent attempt, all necessary alterations, adjustments, repairs and replacements shall be made. When the facility is again ready for operation it shall be brought on line and a new test shall be started. This procedure shall be repeated as often as necessary until the facilities and systems have operated continuously to the satisfaction of the Owner and Engineer, for the specified duration.
3. The Contractor will furnish all operating personnel (other than vendor's or subcontractor's service personnel), electricity, chemicals, water, etc., needed to operate equipment during the final performance test period.

4. Until the performance tests are completed and the units and systems are accepted by the Owner as "*substantially complete*", the Contractor shall be fully responsible for the operation and maintenance of all new facilities and systems.
5. At no time during performance tests shall the Contractor allow the facilities and systems to be operated in a manner which subjects any equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.
6. Startup and the final performance demonstration test shall not begin until all new treatment facilities, systems and equipment have been tested as specified and are ready for operation.
7. ***The Owner shall receive spare parts, safety equipment, tools and maintenance equipment, lubricants, approved operation and maintenance data and the specified operation and maintenance instruction at least five (5) calendar days prior to startup.***
8. All valve tagging, as specified in the Contract Documents, shall also be complete prior to testing.

1.46 Delivery of Locator Ball Detector Devices

- A. The Contractor shall provide locator ball detector devices for all underground utilities, both new and relocated in accordance with Section 09905, "Piping, Valve and Equipment Identification System", Article 2.01(E).
- B. The Contractor shall be responsible for providing the Owner with water, wastewater and reclaimed water marker balls and an electronic marker locator and probe package as part of the construction contract.
- C. ***All electronic marker locators and probes shall be delivered by the Contractor to the Owner through the Engineer no later than thirty (30) days after the Notice to Proceed is issued.*** Failure to comply with this provision shall be adequate grounds for Engineer to withhold payment requests and issue a stop work order at no cost to the Owner.
- D. In addition, the Owner shall not perform any field utility locates for the Contractor nor allow any subsurface excavation in the vicinity of existing Owner utilities until the locator ball devices are provided to the Owner and are determined to be fully functional and acceptable.

1.47 Demolition, Salvage and Disposal

- A. The Contractor shall exercise the appropriate care necessary to remove and stockpile all existing utilities of the Owner (including, but not limited to, all piping, bends, valves, tees, fittings, hydrants, and appurtenances) in such a manner as to preserve the materials for future use.
- B. Salvaged materials, that the Owner wishes to keep, shall be removed and stock piled, hauled, unloaded and stored at the direction of the Owner in an orderly manner by the Contractor at a location to be provided by the Owner. Those that the Owner does not want, shall be removed from the Project Site and legally disposed of by the Contractor. The Contract shall be inclusive of all costs associated with the item description provided above.
- C. The Contractor shall contact the Owner to arrange for the delivery of any salvaged materials to the location designated by the Owner. The condition of the materials cannot be guaranteed as they shall be subject to the normal excavation and handling procedures used on the project.
- D. ***The Contractor shall be responsible for the removal and legal disposal of the materials associated with the demolition of the "existing" WTP Control Building and office building, all abandoned utilities of the Owner that are damaged and/or deemed unsalvageable by the Owner and all unsuitable materials from the development of the site and shall dispose of them in a legal manner. The cost associated with the legal disposal of the above referenced materials shall be included in the Contractor's Bid Price.***

1.48 City of Sanford Land Development Code

- A. The requirements of these specifications and the Engineer may or may not exceed the minimum technical requirements of City of Sanford Utilities as depicted in the *City of Sanford Land Development Code* including the "Water and Sewer Standards". In such instances, the more stringent requirement shall be observed. With respect to utilities, should a conflict exist within Bid documents (both the plans and technical specifications), the more stringent requirements shall be observed during the preparation of bids. Subsequently, there shall be no increase in the cost for the labor, equipment, and materials associated with this item.
- B. For utility items not specifically covered by these Bid documents, all construction shall be in accordance with the minimum technical standards as depicted in the latest copy of the *City of Sanford Land Development Code* which includes the "Water and Sewer Standards". In the absence of a Technical Specification, use the latest editions of the Florida Department of Transportation *Roadway Design Standards* and the Florida Department of Transportation *Manual of Road and Bridge Construction*.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

WARRANTY FOR EQUIPMENT ITEM

Location of Project	Sanford Main WTP Improvements
Owner	City of Sanford
Project No.	S06153.1
Equipment Item	
Section No. / Item No.	
Supplier	
Supplier's Address	
Suppliers Phone No.	
Supplier's Reference No.	

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

The undersigned agrees to repair, replace, or otherwise make good, any defect in workmanship or materials in the above described equipment which may develop within a ***period of two (2) years from the date of Final Project Acceptance by the Owner*** of the above named Project.

Two (2) years from the date of Substantial Completion: _____
(Insert date of Substantial Completion)

Company: _____

Company Address: _____

Phone / FAX: _____

By: _____

Title: _____

Signed: _____

Date: _____

EQUIPMENT DATA SHEET

Name	
Nomenclature	
Location	
Manufacturer	
Manufacturer's Local Representative	
Address	
Phone / FAX No.	

Equipment Data

Serial No.:	Model No.:
Size:	Lubricant:

If the equipment is a pump, complete the following:

Pump Capacity (gpm):	Material:
Pump TDH (ft):	Packing Gland:
Motor Speed (rpm):	Seal:
Impeller Diameter (in):	

Motor Data

Manufacturer:	
Serial No.:	Frame:
Model No.:	Type:
Volts:	Hertz:
Phase:	Amps:
Amps:	Horsepower (hp):
Motor Speed (rpm):	Rating:
Insulation Class:	Max. Ambient:
Service Factor:	Max. Temp. Rise:
Code Letter:	NEMA Design:
Shaft End Bearing No.:	Front Bearing No.:

EQUIPMENT DATA SHEET**Coupling Data**

Manufacturer:

Serial No.:

Model No.:

Type:

Driver or Reducer Data

Manufacturer:

Serial No.:

Model No.:

Horsepower (hp):

RPM In:

RPM Out:

Ratio:

Type:

Bearings:

Lubricant:

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

Owner	City of Sanford
Project Location	Sanford Main WTP Improvements
Contract No.	
CPH Project No.	S06153.1
Equipment Specification Section	
Equipment Description	

I _____, authorized representative of
(Print Name)

_____ hereby certify that
(Print Manufacturer's Name)

(Print equipment name and model with Serial No.)

installed for the subject Project has (have) been installed in a satisfactory manner, has (have) been satisfactorily tested, is (are) ready for operation, and the Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the unit(s) on _____,
at _____ (Date)
(Time)

Certified by: _____ Date: _____
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTION

I (we) the undersigned, authorized representatives of the City of Sanford, Florida and/or Facility Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and prepared to assume normal operational responsibility for the equipment.

NAME**DATE**

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SECTION 01200

PROJECT MEETINGS

1. GENERAL

1.01 Description

- A. The Contractor shall cooperate and coordinate with the Engineer to schedule and administer the preconstruction meeting, monthly progress meetings, coordination meetings and specifically called meetings throughout the progress of the Work.
- B. The Engineer shall schedule and administer a preconstruction meeting, periodic progress meetings, and specially called meetings throughout the progress of the work.
 - 1. Prepare agenda for meetings.
 - 2. Make physical arrangements for meetings.
 - 3. Preside at meetings.
- C. Representatives of the Contractor, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- D. ***The Contractor shall record all progress meetings in their entirety, and shall provide the Engineer with an audio copy of each such recording, having good quality and clarity, and an “electronic” version (Word or WordPerfect) of the manuscript of the minutes of each meeting. The “draft” minutes of each meeting shall be delivered to the Engineer, electronically (e-mail), no later than five (5) business days after the meeting.*** If the meeting minutes are not delivered within this time period, the current and all future applications for payment shall not be processed by the Engineer and Owner until the minutes are delivered. All delays in processing applications for payment, associated with the a delay in the delivery of meeting minutes, shall be borne solely by the Contractor.
- E. ***The Owner and Engineer shall review the “draft” minutes and shall provide comments to the Contractor, if any, within five (5) business days after receipt.*** The Contractor shall then make all corrections and changes to the “draft” minutes, based on the Engineer’s and Owner’s comments, and shall distribute “final” meeting minutes, in an ***“electronic” format***, within five (5) calendar days following receipt of the comments.

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

G. Related Work Specified Elsewhere

Specification Section	Title
01040	Project Coordination
01300	Shop Drawings, Submittals and Samples
01311	Construction Progress Schedules
01720	Project Record Documents

1.02 Preconstruction Meeting

- A. ***The Engineer will schedule a preconstruction meeting no later than fourteen (14) days after the date of the Notice to Proceed (NTP).*** The purpose of the meeting is to:

1. Designate responsible personnel and establish a working relationship.
2. Discuss matters of Project coordination and procedures for handling all construction related activities and to establish a construction schedule.

- B. This meeting shall be attended by the following:

1. Owner's representative.
2. Engineer and his professional consultants.
3. Resident project representative (RPR).
4. Contractor's Project Manager and superintendent.
5. Major subcontractors.
6. Representatives of major suppliers and manufacturers, as appropriate.
7. Government representatives, as appropriate.
8. Representative of the various utilities, as appropriate.
9. Others as requested by the Contractor, Owner, and Engineer.

C. Location

1. A central site, convenient for all parties designated by the Engineer.

D. The Engineer shall preside at the Preconstruction Meeting. The Contractor shall provide for keeping all project meeting minutes and distribution of the minutes to the Owner, Engineer, and others as identified in Article 1.01(D-E). 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 agenda for the Preconstruction Meeting would include, but is not limited to, the following:

1. Distribution and discussion of:

- a. List of major subcontractors and suppliers.
- b. Projected schedules.
- c. Schedule of Values (SOV).

2. Discussion of Owner Direct Purchase of Materials and Equipment (for tax savings purposes).

3. Critical work sequencing: Relationships and coordination with other contracts and/or work and continuing operation of the existing utilities.

4. Major equipment deliveries and priorities.

5. Project Coordination: Designation and responsible personnel.

6. Procedures and processing of:

- a. Field decisions, field orders and work directives.
- b. Proposal requests.
- c. Requests for Information (RFI)
- d. Submittals.
- e. Change Orders.
- f. Applications for Payment.

7. Submittals of Shop Drawings, Project Data and Samples.
8. Adequacy of distribution of Contract Documents
9. Procedures for maintaining project record documents.
10. Use of Premises
 - a. Office, work and storage areas.
 - b. Owner's requirements.
 - c. Access and Traffic Control.
11. Construction facilities, controls and construction aids.
12. Temporary utilities.
13. Housekeeping procedures.
14. Check of required Bond and Insurance certifications.
15. Completion Time for the Contract and Liquidated Damages.
16. Request for Extension of the Contract Time.
17. Procedures for monthly progress meetings, for all involved.
18. Security Procedures.
19. Procedures for making partial payments.
20. Guarantees on completed work.
21. Equipment to be used.
22. Project Layout and staking of Work.
23. Project Inspection.
24. Labor requirements.
25. Laboratory testing of material requirements.
26. Provisions for material stored on-site and monthly inventory of materials stored.

27. Requirements of other organizations such as utilities, railroads, highway departments, building departments.
 28. Rights-of-way and easements.
 29. Housekeeping procedures.
 30. Liquidated Damages.
 31. Posting of signs and installation of a Project Sign.
 32. Pay request submittal dates.
 33. Equal Opportunity Requirements.
 34. Safety and First Aid Procedures.
 35. Requirements of Special Conditions and Contract Forms.
 36. Process Safety Management Procedures.
 37. Contractor's Storage Area and Trailer Location(s).
- F. ***The Contractor shall furnish a list of emergency telephone numbers for the Project Manager, Superintendent and all supervisors and major Subcontractors.***

1.03 Progress Meetings

- A. The Engineer shall schedule regular progress 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 after the Notice to Proceed.***
- B. The Engineer or authorized representative shall hold called progress meetings as required by progress of the work.
- C. Location of the meetings
 1. The Contractor's construction trailer at the Project Site (See Section 01500, "Temporary Facilities").

D. Attendance

1. Engineer and his professional subconsultants as needed.
2. Resident Project Representative (RPR).
3. Contractor's Project Manager and Superintendent.
4. Owner's representatives.
5. Subcontractors (Active on the site and as appropriate to the agenda).
6. Suppliers and manufacturers, as appropriate to the agenda.
7. Others as appropriate to the Agenda.

E. The Engineer or authorized representative shall preside at the meetings. The Contractor shall be responsible for keeping all project meeting minutes and distribution of the minutes to the Owner, Engineer, RPR, and others as identified in Article 1.01(D - E). 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 is not limited to, the following:

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

9. Coordination of schedules.
10. Review the status of submittals and submittal schedules; 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 the construction schedule and on the completion date.
 - b. Effect on other contracts of the Project.
15. Critical/long lead times.
16. Other business.

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

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.
4. Latest contact with equipment manufacturers.
5. Specific actions taken to expedite material delivery.
6. Status of open deficiencies and what is being done to correct the same.

H. The Contractor shall provide a current submittal log at each progress meeting in accordance with Section 01300, "Shop Drawings, Submittals and Samples".

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01300

SHOP DRAWINGS, SUBMITTALS AND SAMPLES

1. GENERAL

1.01 Scope of Work

A. The Contractor shall submit to the Engineer for review and approval, such Shop Drawings, Test Reports, and Product Data on materials and equipment (hereinafter in this Section called Product Data), and material samples (hereinafter in this Section called Samples) as are required for the proper control of work, including but not limited to those Shop Drawings, Product Data, and Samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.

B. Shop Drawings

1. Shop Drawings are original drawings, prepared by the Contractor, a subcontractor, supplier, or distributor, which illustrate some portion of the work; showing fabrication, layout setting, or erection details. Refer to Article 1.04 herein.
2. Shop drawings shall be prepared by a qualified detailer and shall be identified by reference to sheet and detail numbers on the Contract Drawings. **Reproductions for submittal shall be "full-size" prints (22" x 34")** or other print acceptable to the Engineer. **Reduced size prints will not be reviewed or approved.**

C. Product Data

1. Product data are manufacturer's standard schematic drawings and manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data.
2. Standard drawings shall be modified to delete information which is not applicable to the project and supplemented to provide additional information applicable to the project.
3. Catalog sheets, brochures, etc., shall be clearly marked to identify pertinent materials, products, or models.

D. Samples are physical examples to illustrate materials, equipment, or workmanship and to establish standards by which work is to be evaluated.

- E. ***Within fourteen (14) calendar days after the Notice to Proceed, the Contractor shall submit to the Engineer a complete list of preliminary product data on items for which shop drawings 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 providing materials, equipment, etc., fully in accordance with the Contract Documents. This procedure is required to expedite final review of shop drawings.
- F. 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:
1. Submittal description and number assigned.
 2. Date shop drawings/product data/samples were submitted to the Engineer.
 3. Date shop drawings/product data/samples were returned to the Contractor.
 4. Status of submittal (Approved, Approved as Noted, Revise and Resubmit, etc.)
 5. Date of resubmittal and return (as applicable).
 6. Date material released (for fabrication).
 7. Projected date of fabrication.
 8. Projected date of delivery to the Project Site.
 9. Status of O&M Manual submittals.
 10. Specification Section and Contract Drawing sheet number.
- G. ***In addition to standard O&M Manuals, all manufacturers supplying equipment and products specified herein shall also submit their operation and maintenance manuals and data to the System Integrator for this Project on CD/DVD/BD's in Corel WordPerfect (latest version), Microsoft Word (latest version), or text, "txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats (integrators preference for the system shall be required). All O&M Manual files shall also be submitted electronically on CD/DVD/BD's to the Engineer in both PDF and JPEG formats, no exceptions.***

H. ***The System Integrator shall be responsible to configure and compile the O&M Manuals into “hypertext” window help files for use as computer “on-line” help screens for equipment operation and maintenance. The System Integrator shall return all hypertext files to the equipment and product manufacturer’s for review and approval prior to introducing them into the treatment facility SCADA System.***

I. Related Requirements Described Elsewhere

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
00805	FDEP Supplementary Conditions
00950	Shop Drawing Submittal Form
00980	O&M Manual Submittal Form
01311	Construction Progress Schedules
01600	Materials and Equipment
01720	Project Record Documents
01730	Operating and Maintenance Data
01740	Warranties and Bonds
Division	Information
0	Conditions of the Contract
11, 12, 13, 14, 15 and 16	Equipment

1.02 Contractor’s Responsibility

A. ***It is the responsibility of the Contractor, prior to submission to the Engineer, to thoroughly check all shop drawings, product data and samples for completeness and for compliance with the Contract Drawings.*** The Contractor shall verify all dimensions and field conditions and shall coordinate the shop drawings with the requirements for other related work. ***Each and every copy of the shop drawings and product data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be “rejected” and returned to the Contractor for conformance with this requirement.*** Shop drawings shall indicate any deviations in the submittal from the 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. The Contractor's responsibility for errors and omissions in submittals is not relieved by the Engineer's review of the submittals.
- C. **The Contractor shall notify the Engineer, in writing, at the time of submission, of deviations in submittals from the requirements of the Contract Documents** and is not relieved by the Engineer's review of submittals, unless the Engineer gives written acceptance of specific deviations.
- D. Determine and verify:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Catalog numbers and similar product data.
 - 4. Conformance with the Specifications.
- E. The Contractor shall furnish the Engineer a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning and ending of manufacture, testing, and installation of materials, supplies, and equipment. This schedule shall indicate those that are critical to the progress schedule.
- F. The Contractor shall not begin any of the work covered by a Shop Drawing, Product Data, or a Sample until the Engineer has returned to the Contractor an **"approved"** shop drawing submittal with his initials or signature.
- G. 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 checking and appropriate action from the time the Engineer receives them.
- H. All submittals shall be accompanied with a transmittal letter prepared in triplicate containing the following information:
 - 1. Date.
 - 2. Project Title and Number.
 - 3. Contractor's name and address.
 - 4. The number of each Shop Drawing, Project Data, and Sample submitted.
 - 5. Notification of Deviations from Contract Documents
 - a. The Contractor shall indicate in **"bold type"** at the top of the cover sheet of the submittal of shop drawing if there is a deviation from the Contract Drawings, Specifications, or referenced specifications or codes.

- b. **The Contractor shall also list any deviations from the Contract Drawings, Specifications, or referenced specifications or codes** and identify in “**blue**” ink prominently on the applicable Shop Drawings.
- 6. Submittal Log Number.
- 7. Specification Section Number and Contract Drawing Number(s).
- I. **No partial submittals will be reviewed.** Submittals not deemed complete will be stamped “Rejected” and returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items for:
 - 1. Systems.
 - 2. Processes.
 - 3. As indicated in specific specification sections.
- 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.
- K. **The Contractor shall submit four (4) copies of descriptive or product data information and Shop Drawings to the Engineer plus the number of copies which the Contractor requires returned. The Contractor shall also submit an electronic version of each “stamped and signed” submittal, in a PDF and JPEG format, to the Engineer on a BD/DVD/CD or flash drive. Failure to submit the electronic file will delay the review process at the Contractor’s expense.** The Engineer shall transmit copies to the Owner and any relevant subconsultant for a simultaneous review. The Engineer will incorporate all comments onto each set, stamp the submittals as required, and ship the sets to the parties indicated above with a “Shop Drawing Review” sheet of review comments for the Contractor to implement for resubmittal or to proceed with ordering equipment and materials. The Engineer will retain one (1) set of all submittals, one (1) set shall be retained by the Owner, one (1) set each shall be given to the RPR and any subconsultant, and one (1) set plus any additional copies will be returned to the Contractor.
- L. 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 the Engineer of the necessary shop drawings.
- M. 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 proposes to supply both as it pertains to his own work and any work affected under other parts, headings, or divisions of the Contract Drawings and Specifications.

- N. The Contractor ***shall not use Shop Drawings as a means of proposing alternate items*** to demonstrate compliance with the Contract Drawings and Specifications.
- O. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer, ***prior*** to ordering the materials or equipment.
- P. Each submittal shall bear a “***stamp of approval***” certifying that they have been checked and approved for submittal to the Engineer and that the Contractor has satisfied the Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal as illustrated in the figure below.
- Q. Submittals without the Contractor's initialed or signed certification “stamp of approval” and submittals which, in the Engineer's opinion, are incomplete, contain numerous errors or have not been properly checked, will be returned unchecked by the Engineer for resubmission. ***The Contractor shall mark his corrections in blue ink and the Engineer's comments shall be noted in red ink.***
- R. Submittals for each type of work shall be numbered consecutively, and the numbering system shall be retained throughout all revisions. Resubmittals shall utilize the same number with a modifying letter. For example, two different submittals for Section 15050 would initially be submitted as submittal number 15050-1 and 15050-2. Resubmittals would therefore be 15050-1A and 15050-2A.

Owner's Name:	City of Sanford, Florida		
Project Name:	Sanford Main WTP Improvements		
CPH Project Number:	S06153.1		
Shop Drawing No.:	_____		
Specification Section:	_____	Contract Drawing No.:	_____
With respect to this shop drawing or sample, I have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar product data with respect thereto and reviewed or coordinated this shop drawing or sample with other shop drawings and samples and with the requirements of the work, the Contract Documents and the existing Field Conditions. _____ No variation from contract documents _____ Variation from contract documents as shown			
Contractor's name:	_____		
Contractor's address:	_____		
By:	_____	Date:	_____
	Authorized Signature		

- S. Drawings and schedules shall be checked and coordinated with the work of all trades and sub-contractors involved, before they are submitted for review by the Engineer and **shall bear the Contractor's stamp of approval as evidence of such checking and coordination**. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.
- T. Submittals shall be clearly legible and note only the items to be reviewed. If a submittal lists several options or models, the Contractor shall specifically indicate what he proposes to furnish. If the item is not identified, the shop drawing will be "*rejected*".
- U. When the shop drawings have been completed to the satisfaction of 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.

1.03 Engineer's Review of Shop Drawings

- A. The Engineer's review of Shop Drawings, Product Data, and Samples as submitted by the Contractor will be to determine if the item(s) generally conforms to the information in the Contract Documents and is compatible with the design concept. The Engineer's review, and exceptions, if any, **will not** constitute an approval of means, methods, techniques, sequences, procedures of construction, safety precautions, dimensions, connections, quantities, and details of the material, equipment, device, or item shown.
- B. **The review and approval of a separate item will not constitute approval of the assembly in which the item functions.**
- C. **The Engineer's review of submittals shall not be construed as a complete check and shall not relieve the Contractor from responsibility for complete compliance with the Contract requirements.** The review of drawings and schedules will be general, and shall not be construed as:
 - 1. Permitting any departure from the Contract Documents.
 - 2. Relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.
 - 3. Approving departures from details furnished by the Engineer, except as otherwise provided herein.
- D. No corrections, changes, or deviations indicated on submittals reviewed by the Engineer or other supplementary reviewing agency shall be considered as a Change Order.

- E. According to the requirements of the particular local regulatory agency having jurisdiction or the requirements of the Owner or utility company, there may be required a review of the shop drawings by the local regulatory agency, or the Owner, or utility company in addition to the review by the Engineer. This supplementary review will be considered part of the normal processing and approval process and will be accomplished without additional compensation.
- F. If the drawings or schedules as submitted describe variations, per Article 1.02(M), and show a departure from the Contract Documents 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 Contract Time, the Engineer may return the reviewed drawings without noting an exception.
- G. When reviewed by the Engineer, each of the Shop Drawings will be identified as having received such review being so stamped and dated. Shop Drawings will be stamped with one of the following:

Stamp	Description
Approved	<i>The submittal is approved as submitted and in accordance with the Contract Documents.</i>
Approved as Noted	<i>The Contractor shall incorporate the Engineer's comments into the submittal before release to the manufacturer. The Contractor shall send a letter to the Engineer acknowledging the comments and their incorporation into the Shop Drawing.</i>
Revise and Resubmit	<i>The Contractor shall resubmit the shop drawing to the Engineer. The resubmittal shall incorporate the Engineer's comments highlighted on the shop drawing.</i>
Rejected	<i>The Contractor shall resubmit the shop drawing with materials or equipment meeting the specifications for review by the Engineer.</i>

- H. Resubmittals will be handled in the same manner as first submittals. On resubmittals 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.***
- I. Only the Engineer shall utilize the color "**red**" in marking Shop Drawing submittals.
- J. ***Shop drawing and submittal data shall be reviewed by the Engineer for each original submittal and the first resubmittal. Thereafter review time for subsequent resubmittals shall be charged to the Contractor and the Contractor shall reimburse the Engineer for services rendered by the Engineer as specified below:***

1. ***Reimbursements shall be based on a factor of five (5) times the Engineer's payroll cost plus reimbursable expenses at cost and shall be "paid in full", by the Contractor, PRIOR to the Engineer's release of the submittal back to the Contractor, regardless of whether the submittal is "approved" or "denied".***
 2. Failure to reimburse the Engineer for his time, with regard to the evaluation of additional submittals, will constitute a breach of the Project Contract/Agreement and all Work will be "*suspended*" until the Engineer is reimbursed and ***no additional time or Cost will be added to the Contract Time and Price.***
- K. Distribution of copies of "*acceptable*" submittals will be as mutually determined by the Contractor, Owner and Engineer on an individual item basis during or following the preconstruction conference.
- L. If the submittal is "*not satisfactory*", one (1) set of prints will be retained by the Engineer and the remaining transparencies and prints returned to the Contractor for appropriate action.

1.04 Shop Drawings

- A. When used in the Contract Documents, the term "shop drawing" shall be considered to mean the Contractor's plans for materials and equipment which become an integral part of the Project.
- B. ***Shop drawings shall be complete and detailed*** and shall consist of fabrication, erection and installation, layout, setting and schedule drawings, manufacturer's scale drawings, wiring and control diagrams, catalog cuts, catalogs, pamphlets, descriptive literature, mix design, performance and test data, and all other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment or systems, and the positions thereof conform to the Contract requirements. As used herein, the term "manufactured" applies to standard units usually mass-produced; and "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements.
- C. ***Shop drawings shall establish the actual detail of all manufactured or fabricated items***, indicate proper relation of adjoining work, amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure, and incorporate minor changes of design or construction to suit actual conditions. Shop drawings shall be drawn to scale and shall be completely dimensioned.

- D. If shop drawings cover more than one piece of equipment or components, the shop drawings shall show the entire assembly and the relationship and connections between all components.
- E. The Contractor shall coordinate the shop drawings from different manufacturer's and supplies so that all equipment and material will fit and work together.
- F. The Contract Drawings are "*diagrammatic*" and are intended to indicate the "*general arrangement*" of equipment, ducts, conduits, piping, and fixtures. 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 proposes to supply both as pertains to his own work and any work affected under other parts, headings, or divisions of drawings and specifications. ***Changes shall be reviewed in advance by the Engineer.***
- G. Manufacturer's data shall include all standard published information describing the products, systems, methods and performance. Include the manufacturer's name, address, telephone number, e-mail address and standards to which the products comply. Manufacturer's catalog sheets, brochures, diagrams, illustrations, and other standard descriptive data shall be clearly marked to identify pertinent materials, products, or models. ***Delete information which is not applicable to the Work by striking or cross-hatching.***
- H. ***Drawings and schedules shall be checked and coordinated with the Work of all trades involved, before they are submitted for review by the Engineer*** and shall bear the Contractor's "*stamp of approval*" as evidence of such checking and coordination. Drawings or schedules submitted without this "stamp of approval" shall be returned to the Contractor for resubmission.
- I. ***Each shop drawing shall be submitted with the shop drawing submittal form presented in Section 00950, "Shop Drawing Submittal Form".***
- J. Shop drawings, including manufacturer's literature, catalog cuts, or other printed material shall be entitled with the name of the project on each sheet and shall otherwise be identified by listing the particular Division, Section, Article, or reference of the work pertaining thereto. Differing items ***shall not*** be submitted on the same sheet.
- K. Product data on materials and equipment shall include, without limitation, materials and equipment lists, catalog data sheets, catalog cuts, performance curves, diagrams, verification of conformance with applicable standards or codes, materials of construction, and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish, and all other pertinent product data.

- L. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the manufacturer, equipment name, address, e-mail address and telephone number of the manufacturer and his representative and service company so that service and/or spare parts can be readily obtained.
- M. If drawings show variations from the 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.
- N. All manufacturers or equipment suppliers who propose to furnish equipment or products shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five (5) installations where identical equipment has been installed and has been in operation for a period of at least two (2) years unless specified otherwise in the Specification Section applicable.
- O. Shop drawings shall include specific information related to the installation proposed for this Project. Special shop drawings shall be submitted when necessary to show all details and requirements for anchorage, interface with other equipment, special fabricated products, and other information not shown on the standard manufacturer's submitted data.
- P. Certifications or test reports that may be required for submission in accordance with the technical specifications, shall contain the name (or signature), address, telephone number and e-mail address of the person(s) responsible for the certification or test who shall be authorized to make such certifications.
- Q. The Contractor shall utilize "**blue ink**" in marking shop drawing submittals. The Engineer shall utilize "**red ink**" in reviewing and marking shop drawing submittals.

1.05 Working Drawings

- A. When used in the Contract Documents, the term "Working Drawings" shall be considered to mean the Contractor's plan for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and falsework; for underpinning; installation drawings; and for such other work as may be required for construction but does not become an integral part of the Project.
- B. Copies of working drawings, as noted in Article 1.05(A) above, shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer, and shall be **submitted at least thirty (30) calendar days** (unless otherwise specified by

- the Engineer) ***in advance of their being required for the Work***. However, the Contractor shall require each manufacturer to provide complete installation instructions that include all information required to complete the installation of the equipment and which can be used as a guide for checking for conformance after installation.
- C. ***Working Drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida***, and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use.
- D. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the Engineer, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. ***All risks to new or existing work are assumed by the Contractor; the Owner and Engineer shall have no responsibility therefor.***

1.06 Samples

- A. The Contractor shall furnish, for the approval of the Engineer, samples required by the Contract Documents or requested by the Engineer to illustrate materials, equipment or workmanship and to establish standards by which the work is to be evaluated. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Work until approved by the Engineer.
- B. Samples shall be of sufficient size and quantity to clearly illustrate:
1. Functional characteristics of the product, with integrally related parts and attachment devices.
 2. Full range of color, texture, and pattern.
 3. A minimum of three (3) samples of each item shall be submitted.
- C. Each sample shall have a label indicating:
1. Name of Project.
 2. Name of Contractor and subcontractor.
 3. Material or equipment represented.
 4. Place of origin.

5. Name of producer/supplier and brand (if any).
 6. Location in the Project.
 7. Submittal, specification and Contract Drawing numbers.
- D. Samples of finished materials shall have additional marking that will identify them under the finished schedules.
- E. The Contractor shall prepare a transmittal letter and a description sheet for each shipment of samples. The description sheet shall contain the information required in Articles 1.06(B) and 1.06(C) above. He shall enclose a copy of the letter and description sheet with the shipment and send a copy of the letter and description sheet to the Engineer. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.
- F. Approved samples not destroyed in testing shall be sent to the Engineer or stored at the site of the Work. Approved samples of the hardware in good condition will be marked for identification and may be used in the Work. Materials and equipment incorporated in the Work shall match the approved samples. Samples which failed testing or were not approved will be returned to the Contractor, at his expense, if so requested at time of submission.

1.07 Schedule of Operations

- A. ***The Contractor shall submit a schedule of operations to the Engineer for approval within ten (10) calendar days after the Notice to Proceed (NTP) and prior to any construction operations.***
- B. Inform the Engineer of any changes in the schedule and allow ample time for the Owner to alter operations as required by the construction of the various components of the work.
- C. Approval of traffic control and schedules shall be obtained from the governmental entity having jurisdiction over the area of the Work.

1.08 Operation and Maintenance Manuals

- A. Submittal Requirements
1. The Contractor shall submit a “*preliminary draft*” and “*final*” O&M Manuals in accordance with Article 1.07, Section 01730, Operation and Maintenance Data”.

2. The form of Operation and Maintenance Manual submittals shall be in accordance with Article 1.03, Section 01730, Operation and Maintenance Data”.
 3. The content of the Operation and Maintenance Manuals shall be in accordance with Articles 1.03 - 1.06, Section 01730, “Operation and Maintenance Data”.
 4. Operation and Maintenance Manuals specified herein are in addition to any operation, maintenance, or installation instructions by the Contractor to install, test, and start-up equipment.
 5. Manuals shall be provided for each piece of equipment including individual components and subsystems of complete assemblies. The section of the manual on operation shall describe the function of each component and its relationship to the system of which it is a part. Where several models, options, or styles are described, the manual shall identify the items actually provided.
 6. Instruction of the Owner’s personnel shall be in accordance with Article 1.08, Section 01730, Operation and Maintenance Data”.
 7. ***In addition to standard O&M Manuals, all manufacturers supplying equipment and products specified herein shall also submit their operation and maintenance manuals and data to the System Integrator for this Project on CD/DVD/BD’s in Corel WordPerfect (latest version), Microsoft Word (latest version), or text, ".txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats (integrators preference for the system shall be required). All O&M Manual files shall also be submitted electronically on CD/DVD/BD’s to the Engineer in both PDF and JPEG formats, no exceptions.***
 8. ***The System Integrator shall be responsible to configure and compile the O&M Manuals into “hypertext” window help files for use as computer “on-line” help screens for equipment operation and maintenance. The System Integrator shall return all hypertext files to the equipment and product manufacturer’s for review and approval prior to introducing them into the SCADA System at the treatment facility.***
- B. The Contractor is directed to thoroughly review Section 01730, “Operation and Maintenance Data”, for additional detailed information with respect to O&M Manuals.
- C. ***Failure to meet the deadlines for submittal of the “preliminary” and “final” versions of the Operation and Maintenance Manuals shall be cause for the Project to be “shut down” until such time as the documents are provided, in the proper format, to the Engineer. Any lost construction time and Contractor associated construction costs shall be borne by the Contractor based on his failure to meet the above referenced deadlines.***

1.09 Project Record Documents

- A. Maintain at the project construction site for the Engineer , one (1) record copy of each of the following:
 - 1. Contract Drawings.
 - 2. Contract Specifications.
 - 3. Addenda.
 - 4. Change Orders and Other Modifications to the Contract.
 - 5. Engineer's Field Orders or Written Instructions.
 - 6. Approved Shop Drawings, Working Drawings and Samples.
 - 7. Field Test Records.
- B. ***The Contractor shall maintain a set of Record and As-Built documents*** in accordance with the General Conditions and the requirements herein.
- C. ***As the Project work progresses, the Contractor shall mark on a set of Contract Documents all changes from the Contract Documents*** using standard symbols listed in the legend.
- D. The Contractor is directed to thoroughly review Section 01720, "Project Record Documents", for additional detailed information with respect to Project Record Documents, Recording, and submittals.

1.10 Maintenance of Documents and Samples

- A. Store documents and samples in the Contractor's field office apart from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - 2. Provide a locked cabinet for secure storage space for storage of samples.
- B. File documents and samples in accordance with CSI format.
- C. Make documents and samples available at all times for inspection by the Engineer.

- D. Maintain documents in clean, dry, legible, condition and in good order. ***Do not use record documents for construction purposes.***
- E. As a prerequisite for monthly progress payments, the Contractor is to exhibit the currently updated "Project Record Documents" for review by the Engineer and Owner.

1.11 Marking Devices

- A. Provide "green" ballpoint pens for recording information on the Project Record Documents.
- B. The Contractor ***shall not*** use pencils or "red", "blue", or "black" colored pens to record information on the record documents.

1.12 Recording

- A. Label each document **"PROJECT RECORD"** in neat, large printed letters.
- B. Record information concurrently with construction progress.
- C. Contract Drawings
 - 1. The Contractor is directed to thoroughly review Section 01720, "Project Record Documents", for additional "detailed" information with respect to Project Record Documents, Recording, and submittals.
 - 2. Legibly mark to record actual construction:
 - a. Depths of various elements of foundation in relation to finish floor datum.
 - b. All underground piping with elevations, dimensions, pipe size, pipe material, class, etc.
 - c. All changes to piping location.
 - d. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - e. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
 - f. Field changes of dimension and detail.

- g. Changes made by Field Order or by Change Order.
- h. Details not on the “original” Contract Drawings.
- i. Equipment and piping relocations.
- j. Major architectural and structural changes.

D. Specifications Addenda

1. ***Legibly mark each Specification Section to record:***

- a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
- b. Manufacturer’s and local representatives name, address, e-mail address and telephone number.
- c. Changes made by Field Order or by Change Order.

E. Shop Drawings

- 1. After final review and approval, ***submit three (3) sets of record drawings*** for process equipment, structures, piping, appurtenances, electrical, and instrumentation systems.

1.13 Project Closeout

- A. At Project Closeout, deliver all Project Record Documents to the Engineer, in good condition and free from any extraneous notations.
- B. Accompany the Project Closeout submittal with transmittal letter in triplicate, containing:
 - 1. Date.
 - 2. Project Title and Number.
 - 3. Contractor's Name and Address.
 - 4. Title and Number of Each Record Document.
 - 5. Signature of Contractor or his Authorized Representative.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01311

CONSTRUCTION PROGRESS SCHEDULES

1. GENERAL

1.01 Scope of Work

- A. ***Within ten (10) calendar days after the Contract Award, the Contractor shall prepare and submit to the Engineer estimated construction progress schedules (11" x 17" sheets, minimum) demonstrating complete fulfillment of all Contract requirements utilizing a Critical Path Method (hereinafter referred to as CPM) in planning, coordinating, and performing the Work under this Contract (including all activities of subcontractors, equipment vendors, and suppliers).*** The principles and definition of CPM terms used herein shall be as set forth in the Associated General Contractors of America (AGC) publication, Construction Planning & Scheduling Manual, latest edition, but the provisions of this Specification shall govern the planning, coordinating, and performance of the Work.
- B. Development of the CPM construction schedule, the cost loading of the schedule, monthly payment requisitions and project status reporting requirements of the contract shall employ "computerized" CPM scheduling. The CPM construction schedule shall be cost loaded based on the schedule of values or unit bid prices or combination thereof.
- C. ***Submit a revised progress schedule to the Engineer on a monthly basis.*** No progress payments shall be approved until there is an approved construction progress schedule on hand.
- D. ***The schedule shall include sufficient time for final inspection and completion of punchlist items and all physical work prior to the contract completion date.***
- E. The construction schedule shall be in accordance with the requirements of Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", and Section 00805, "FDEP Supplementary Conditions" and shall be developed utilizing software specified and submitted for initial approval in accordance with the General and Supplementary Conditions.

F. Related Work Specified Elsewhere

Specification Section	Title
01010	Summary of Work
01030	Applications for Payment
01200	Project Meetings
01300	Shop Drawings, Submittals and Samples
01370	Schedule of Values
Division	Information
0	Conditions of the Contract

1.02 Qualifications

- A. ***A statement of computerized CPM capability shall be submitted in writing prior to the Award of the Contract*** and shall verify that either Contractor's organization has "in-house" capability to use the CPM technique or that Contractor will employ a CPM consultant who is so qualified.
- B. "In-house" capability shall be verified by description of construction projects that the Contractor or Contractor's consultant has successfully applied computerized CPM and shall include at least three (3) projects valued at least three-quarters the expected value of this Project.

1.03 Form of Schedules

- A. Prepare construction progress schedules in the form of a horizontal bar chart and as follows:
1. Provide a separate horizontal bar for each trade or operation within each structure or item.
 2. Horizontal Time Scale
 - a. Show starting and completion dates for each activity in terms of the number of days after Notice to Proceed. All completion dates shown shall be within the period specified for contract completion.

- b. See the General and Supplementary Conditions for stipulations for schedules submitted with earlier completion dates less than the specified completion time.
 - c. Identify the first work day of each month.
- 3. Scale, Spacing and Maximum Sheet Size
 - a. Sufficient to allow space for notations and future revisions.
 - b. Twenty-two (22) inches by thirty-four (34) inches.
- B. Format of Listings
 - 1. The chronological order of the start of each item of work for each structure/system.
- C. Identification of Listings
 - 1. By major specification section numbers as applicable and by structure.
- D. Construction Progress Schedules shall be computer generated using software equal to Primavera Project Planner for Windows by Primavera Systems, Inc., Bala Cynwyd, P.A., or approved equal.

1.04 Initial Schedule Submittals

- A. The Contractor shall **submit two (2) short-term schedule documents at the Preconstruction Conference** which shall serve as the Contractor's plan of operation for the initial sixty (60) day period of the contract time and to identify the manner in which the Contractor intends to complete all work within the contract time.
- B. The Contractor shall submit:
 - 1. **A sixty (60) day narrative plan of operation**, describing in detail how contract operations will be conducted.
 - 2. A project overview bar-chart type plan for all work as indicated below.
- C. Sixty (60) Day Narrative Plan of Operation
 - 1. During the initial sixty (60) days of the contract time, conduct contract operations in accordance with the sixty (60) day detail narrative and bar chart plan of operation.

2. The bar chart shall show the accomplishment of the Contractor's early activities (mobilization items, permits, submittals necessary for early material and equipment procurement, submittals necessary for long lead equipment procurement, CPM submittals, initial site work, and other submittals and activities required in the first sixty days).

D. Comprehensive Project Overview Bar Chart

1. ***The comprehensive overview bar chart shall indicate the major components of the Project Work and the sequence relations between major components and subdivisions of major components.*** The overview bar chart shall indicate the relationships and time frames in which the various components of the work will be substantially complete and placed into service in order to meet the project milestones.
2. ***Sufficient detail shall be included for the identification of subdivisions of major components*** into such activities as potholing, excavation, bedding and pipe installation, backfilling, surface restoration, tunneling, structures, relocations, improvements, and other important work identified in the overall project scope and Contract Documents.
3. Indicate planned durations and start dates for each work item subdivision. Plot each major component and subdivision component on time scale ***sheets not exceeding 22 inches by 34 inches in size.*** Do not use more than four (4) sheets to represent this overview information.

1.05 Content of Schedules

A. Construction Progress Schedule

1. Show the complete sequence of construction by activity and by structure/system.
2. Show the dates for the beginning and completion of each major element of construction in no more than a two (2) week increment scale. Specifically list, but do not limit the construction progress schedule to, the following:
 - a. Shop Drawing Schedule.
 - b. Installation of temporary facilities.
 - c. Site clearing.
 - d. Site utilities.

- e. Demolition.
- f. Excavation.
- g. Foundation work.
- h. Structural framing.
- i. Subcontractor work.
- j. Equipment installations.
- k. Finishings.
- l. Instrumentation.
- m. SCADA.
- n. Electrical.
- o. Painting.
- p. Operator training and receipt of operation and maintenance manuals.
- q. Equipment testing.
- r. Equipment and Process Start-up.
- s. Receipt of Spare Parts.
- t. Project Closeout.

- 3. ***Show the projected percentage of completion for each item, as of the first day of each month.***
- 4. ***Clearly show progress made on the construction schedule and actual "S" curves on a monthly basis.***
- 5. ***Show the projected dollar cash flow requirements for each month of construction and for each activity as indicated by the approved Schedule of Values and as specified in the General and Supplementary Conditions.***

- B. Submittals for construction progress schedules shall be in accordance with Section 01300, "Shop Drawings, Submittals and Samples". Indicate on the construction progress schedule the following:

1. The dates for the Contractor's submittals.
 2. The dates submittals will be required for Owner-furnished products, if applicable.
 3. The dates approved submittals will be required from the Engineer.
- C. ***A computer generated list of all long lead time items*** (equipment, materials, etc.).
- D. To the extent that the progress schedule or any revised progress schedule shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been approved by the Engineer. Failure to include any element of the Work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the Engineer's approval of the progress schedule.
- E. Scheduling Constraints
1. The Work within the Owner's treatment facility must be completed within the maximum number of calendar days, start to finish, as indicated in the Contract Agreement.
 2. Additionally, the Work must proceed on a continuous basis, without stoppages, except for nights and weekends. There shall be no lapses between phases of construction.
- F. Submit a preliminary Schedule of Values for the components that make up the Project, in accordance with Section 01370, "Schedule of Values".

1.06 Progress Revisions

- A. Indicate the progress of each activity to date of submission.
- B. Show changes occurring since the previous submission of schedule, including, but not limited to, the following:
1. Major changes in the scope.
 2. Activities modified since the previous submission.
 3. Revised projections of progress and completion.
 4. Other identifiable changes.

- C. Provide a narrative report as needed to define the following:
 - 1. Problem areas, anticipated delays, and the impact on the schedule.
 - 2. Corrective action recommended, and its effect.
 - 3. The effect of changes on schedules of other contractors.
- D. ***If the Work falls behind the critical path schedule by two (2) weeks or more, the Contractor shall prepare a recovery schedule.***

1.07 Submissions

A. Submittal Requirements

- 1. Submittals shall be in accordance with the requirements detailed within the specification section.
- 2. Logic network and/or time-phased bar chart, computer generated, with critical path(s) identified.
- 3. Computerized network analysis
 - a. Sort by early start.
 - b. Sort by float.
 - c. Sort by predecessor/successor.
- 4. Narrative description of the logic and reasoning of the schedule.

- B. The CPM construction schedules shall indicate dates for important activities, including, but not limited to, the following:
 - 1. A logical succession of work from start to finish. This logical succession, when accepted, is the Contractor's work plan and is only designated as early start to accommodate standard computerized systems.
 - 2. Detailed definition of each activity.

3. A logical flow of work crews/equipment (crews are to be defined by labor category and labor hours; equipment by type and hours).
 4. Shop drawings submittals and reviews.
 5. Decisions.
 6. Product procurement and delivery.
 7. Beginning and completion of each element of construction.
 8. Critical coordination dates.
 9. Submittal of record drawings and equipment manuals.
 10. Cleanup, final inspection, etc.
 11. Any project milestones or phases of work that affect important dates.
- C. Submit the construction schedules and provide the following:
1. Activity sorted by Early Start (ES) and organized by related elements.
 2. Activities sorted by Float (F) and organized by related elements.
 3. Activities sorted by predecessor/successor.
 4. Narrative description of the logic and reasoning of the schedule.
 5. Resource allocation by activity.
 6. A list of cost-loaded activities that identifies the specific cost amount for each activity in the CPM construction schedule.
- D. Show constraints between interrelated activities.
- E. The initial schedule shall include the following minimum data for each activity:
1. Activity numbers.
 2. Estimated duration.
 3. Activity description.

4. Early Start and Early Finish dates (calendar dated).
 5. Late Start and Late Finish dates (calendar dated).
 6. Status (whether "critical").
 7. Float.
 8. Cost of the activity.
 9. Other resources including equipment hours by type, labor by craft or crew, and materials by units.
- F. Where float time exists in activities, show the activities with early start/early finish times.
- G. The construction schedule shall include a title block with the project title, the Contractor's business name, the date of submittal or revision, and the signature of the Contractor's authorized representative attesting to his review and accuracy of the submittal.
- H. The duration indicated for each activity shall be in calendar days and shall represent the single best time considering the scope of the work and resources planned for the activity including time for inclement weather. Except for certain non-labor activities, such as curing concrete or delivering materials, activity durations shall not exceed fourteen (14) days, be less than one day, or exceed \$200,000 in value unless otherwise accepted by the Owner's Representative.
- I. Time of Submittals
1. ***Within ten (10) working days after the Notice to Proceed (NTP), the Contractor shall submit network diagrams describing the activities to be accomplished in the overall Project and their dependency (predecessor/successor) as well as a tabulated schedule as herein defined.***
 2. ***The total length of time indicated on the initial CPM schedule shall equal the exact number of days in the Contract Time*** as defined in the Agreement (Spec. Section 00500). The schedule produced and submitted shall also indicate calendar dates, including project starting and completion dates, based on the Contract Commencement and completion dates indicated in the Notice to Proceed.
 3. ***The Engineer will complete the review of the complete schedule within fifteen (15) working days after receipt.*** During the review process, the Engineer may meet with a representative of the Contractor to review the proposed plan and schedule to discuss any clarifications, that may be necessary.

- J. ***Within ten (10) working days after the conclusion of the Engineer's review period, the Contractor shall revise the network diagrams, as required, and resubmit the network diagrams and a tabulated schedule produced therefrom.*** The revised network diagrams and tabulated schedules shall be reviewed and accepted or rejected by the Engineer within fifteen (15) working days after receipt. The network diagrams and tabulated schedules, when accepted by the Engineer, shall constitute the project work schedules unless revised schedules are required due to substantial changes in the Work, a change in Contract Time or a recovery schedule is required and requested.

K. Acceptance

1. The finalized schedule will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates an orderly progression of the Project Work to completion in accordance with the contract documents and requirements, adequately defines the Contractor's work plan, provides a workable arrangement for processing the submittals in accordance with the project specification requirements, and properly allocates resources (labor, equipment and costs) to each activity (free of unbalances in resources).
2. Review of the Contractor's project schedule is for conformance to the requirements of the Contract Documents only. Review by the Engineer of the Contractor's project schedule does not relieve the Contractor of any of its responsibility whatsoever for the accuracy or feasibility of the project schedule, or of the Contractor's ability to meet the interim milestone date(s) and the contract completion date, nor does such review and acceptance imply or expressly warrant, acknowledge, or admit the reasonableness of the logic, durations, labor, or equipment loading of the Contractor's project schedule.
3. Such acceptance will neither impose on the Engineer responsibility for the progress or scheduling of the Work nor relieve the Contractor from full responsibility therefore.
4. The finalized schedules of shop drawing submittals will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates a workable arrangement for processing the submittals in accordance with the requirements.
5. The finalized Schedule of Values (lump sum price breakdown), as applicable, will be acceptable to the Engineer as to form and content when, in the opinion of the Engineer, it demonstrates a substantial basis for equitably distributing the Contract Price.
6. When the network diagrams and tabulated schedules have been accepted, the Contractor shall submit to the Engineer:

- a. Three (3) copies of the time-scaled network diagrams.
- b. Three (3) copies of a computerized tabulated schedules in which the activities have been sequenced by numbers.
- c. Three (3) copies of a computerized tabulated schedules in which the activities have been sequenced by early starting date.
- d. Three (3) copies of a computerized, tabulated schedules in which activities have been sequenced by total float.
- e. Three (3) copies sorted by predecessor/successor.

L. Revised Work Schedules / Schedule Revisions

- 1. The Contractor, if requested by the Engineer, shall provide revised work schedules if, at any time, the Engineer considers the completion date to be in jeopardy because of "activities behind schedule".
- 2. The revised work schedules shall include a new diagram and tabulated schedules conforming to the requirements of Article 1.10 herein, designed to show how the Contractor intends to accomplish the Work to meet the completion date. The form and method employed by the Contractor shall be the same as for the original work schedules.
- 3. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule.
- 4. No change may be made to the sequence, duration, or relationships of any activity without the approval of the Engineer.
- 5. ***No payment will be made if activities fall more than two (2) weeks behind schedule and a revised work schedule is not furnished.***
- 6. The Contractor shall revise or update the Project schedule upon the occurrence of any of the following:
 - a. When delay in completion of an activity or group of activities indicates an overrun of the contract time or control point requirement by ten (10) working days or ten percent (10%) of the remaining duration, whichever is less.
 - b. Delays in submittals, deliveries, or work stoppage are encountered which make replanning or rescheduling of the work necessary.

- c. The schedule does not represent the actual prosecution and progress of the Project as being performed in the field and progress for any activity is five (5) working days behind the current schedule.
 - d. The Contractor will be performing work at an earlier date than is shown on the schedule and the work will require additional inspection and/or testing personnel.
7. In the event of any change to the Contract, submit a time analysis of the effect on the Critical Path. If the Contractor maintains there is no impact, he shall submit a statement to that effect.
 8. The cost of revisions to the construction schedule, resulting from Owner-initiated contract changes, shall be included in the cost for the change in the work and shall be paid as part of the total cost of the change through the contract allowable percentages for changed work.
 9. ***The cost of revisions to the construction schedule not resulting from authorized changes in the work shall be the responsibility of the Contractor.***
 10. ***Submittal of an "updated" construction progress schedule shall be a condition for approval of the Contractor's monthly progress payment.***

1.08 Distribution

- A. Distribute copies of the revised construction progress schedules as follows:

Distribution	No. of Copies
Engineer	3
Contractor jobsite files	As required
Subcontractors	As required
Other concerned parties	As required

- B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

1.09 Change Orders

- A. Upon approval of a change order, the approved changes shall be reflected in the next scheduled, revision or update submittal of the construction progress schedules by the Contractor.

1.10 CPM Standards

- A. CPM, as required by this Section, shall be interpreted to be generally as outlined in the Associated General Contractor's (AGC) publication, Construction Planning & Scheduling Manual, latest edition.
- B. Work schedules shall include a graphic network and computerized, tabulated schedules as described below. To be acceptable the schedule must demonstrate the following:
 - 1. A logical succession of work from start to finish.
 - 2. Definition of each activity. Activities shall be identified by major specification section numbers, as applicable, and by major structure.
 - 3. A logical flow of work crews/equipment (crews are to be defined by manpower category and man-hours; equipment by type and hours).
 - 4. Show all work activities and interfaces including submittals as well as major material and equipment deliveries.
- C. Networks
 - 1. The CPM network or diagram, shall be in the form of a time-scaled diagram of the customary activity-on-type and may be divided into a number of separate pages with suitable notation relating the interface points among the pages. Notation on each activity line shall include a brief work description and a duration, as described herein.
 - 2. All construction activities and procurement shall be indicated in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity arrow shall be plotted so that the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. ***All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical path activities, and float for each non-critical activity. All non-critical path activities shall show estimated performances time and float time in scaled form.***

- D. The duration indicated for each activity shall be in calendar days and shall represent the single best time considering the scope of the work and resources planned for the activity including time for inclement weather. Except for certain non-labor activities, such as curing concrete or delivering materials, activity durations shall not exceed fourteen (14) days nor be less than one (1) day unless otherwise accepted by the Engineer.

E. Tabulated Schedules

1. The initial schedules shall include the following minimum data for each activity:
 - a. Activity Beginning and Ending Numbers (i-j numbers) (single activity numbers may be used).
 - b. Duration.
 - c. Activity Description.
 - d. Early Start Date (Calendar Dated).
 - e. Late Start Date (Calendar Dated).
 - f. Early Finish Date (Calendar Dated).
 - g. Late Finish Date (Calendar Dated).
 - h. Identified Critical Path(s).
 - i. Total Float (Note: No activity may show more than 20 days float).
 - j. Cost of Activity.
 - k. Equipment Hours, by type; manpower hours, by crew or trade.

F. Project Information

1. Each tabulation shall be prefaced with the following summary data:
 - a. Project Name.
 - b. Contractor.
 - c. Type of Tabulation (Initial or Updated).
 - d. Project Duration.

- e. Project Contract Completion Date.
- f. Effective or Starting Date of the Schedule.
- g. New Project Completion Date and Project Status (if an updated or revised schedule).
- h. Actual Start Date and Actual Finish Date (for all updated schedules).

G. Float Time

1. Definition

- a. Unless otherwise provided herein, float as referenced in these Contract Documents is "Total Float". **Total float is the period of time measured by the number of working days each non-critical path activity may be delayed before it, and its succeeding activities, become part of the "critical path".**
- b. If a "non-critical" path activity is delayed beyond its float period, that activity then becomes part of the critical path and controls the end date of the project. Thus, the delay of the "non-critical" path activity beyond its float period will cause delay to the project itself.

2. Float Ownership

- a. **Neither the Owner nor the Contractor owns the float time. The Project owns the float time.** As such, liability for delay of the Project completion date rests with the party actually causing delay to the project completion date.
- b. For example, if Party X uses some but not all of the float time and Party Y later uses the remainder of the float time as well as additional time beyond the float time, Party Y shall be liable for the costs associated with the time that represents a delay to the Project's completion date. Party X would not be responsible for any costs since it did not consume all of the float time and additional float time remained; therefore, the Project's completion date was unaffected.

1.11 Schedule Monitoring

- A. **At not less than monthly intervals or when specifically requested by Engineer, the Contractor shall submit to the Engineer a computer printout of updated schedules for those activities that remain to be completed.**

- B. The updated schedules shall be submitted with the application for payment as specified below.
- C. The updated schedules shall be submitted in the form, sequence, and number of copies requested for the initial schedule.

1.12 Progress Meetings

- A. ***For the monthly progress meeting, the Contractor shall submit a revised CPM schedule and three-week look-ahead schedule, showing all activities completed, in progress, uncompleted, or scheduled to be worked during the weeks.***
- B. ***The three-week look-ahead schedule shall include the current week plus the next two (2) weeks.***
- C. All activities shall be from the approved CPM and must be as shown on the CPM unless behind or ahead of schedule.
- D. ***Revised CPM schedules shall be submitted with each copy of that month's Application for Payment, three (3) copies minimum.***

1.13 Applications for Payment

- A. ***A revised CPM schedule shall be submitted with each copy of that month's application for payment.*** The following shall be submitted with each month's application for payment:
 - 1. Three (3) copies of the "revised" CPM Schedule.
 - 2. One (1) electronic version of the "revised" CPM Schedule in a PDF format.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

1. GENERAL

1.01 Description

A. Work Specified Herein

1. Submit to the Engineer a “*detailed*” Schedule of Values (SOV), allocated to the various lump sum and unit price portions of the Work, ***at the Preconstruction Conference***, and as otherwise specified or requested to be submitted earlier as evidence of the Apparent Low Bidder’s qualifications.
2. ***The Contractor shall support the values with data that will substantiate their correctness.*** The data shall include, but not be limited to, quantity of materials, all sub-elements of the activity, and their units of measure. The values should reflect the Contractor’s Bid Form detail sheets.
3. ***The Schedule of Values shall establish the actual value for each activity 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 Work Specified Elsewhere

Division	Information
0	Conditions of the Construction Contract

1.02 Form and Content of the Schedule of Values

- A. Generate the ***Schedule of Values on 8½” x 11” white paper in a computer generated format.*** The form of the Schedule of Values should parallel the form presented in Table 01370-1. The Contractor’s standard forms and computer printouts ***may*** be considered for approval by the Engineer upon the Contractor’s request.

- B. Identify the Schedule of Values (SOV) with the following:
1. Title of the Project and Location.
 2. Owner and Purchase Order No.
 3. Engineer and Project No.
 4. Name, address, phone number and e-mail address of the Contractor.
 5. Contract Designation.
 6. Date of Submission.
- C. ***The Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing item prices for progress payments during construction.***
- D. Identify each line item with the number and the title of the respective section of the Specifications.
- E. For each major item of the Work, list sub-values of major products or operations under the major item.
- F. 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 the following:
 - 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.
- G. Round off all figures to the nearest dollar.
- H. The sum of the costs of all items listed in the schedule shall equal the total Contract Price.
- I. For each item that has an installed value of more than \$1,000, provide a breakdown of costs to list major products or operations under each item.

- J. ***The ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through “cost loading” of the CPM schedule activities. The Contractor shall provide a sufficient detailed breakdown to meet this requirement.*** The Engineer shall be the sole judge of acceptable numbers, details, and the description of values established. If, in the opinion of the Engineer, a greater number of schedule of values items than proposed by the Contractor is necessary, the Contractor shall add the additional items so identified by the Engineer as a condition to processing the Contractor's monthly applications for payments.
- K. ***Following acceptance of the “detailed” Schedule of Values, the Contractor shall incorporate the values into the cost loading portion of the CPM schedule.*** The CPM activities and logic shall have been developed concurrent with development of the “detailed” Schedule of Values; however, it shall be necessary to adjust the “detailed” Schedule of Values to correlate to individual schedule activities. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM schedule activities, where interfacing these two documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the Schedule of Values. Schedule of Value items may need to be added to accommodate the detail of the CPM schedule activities. Where such instances arise, the Contractor shall propose changes to the Schedule of Values and to the CPM schedule activities to satisfy the CPM schedule “cost loading” requirements.
- L. The Contractor shall add additional Work items to Table 01370-1 to ensure the submission of a “detailed” Schedule of Values to the Engineer for review and approval. As a minimum, the Contractor shall provide a contract value for all of the items listed in for convenience in reviewing and approving pay applications.

1.03 Incorporation of the Schedule of Values into the CPM Schedule

- A. ***In conjunction with each submittal of the construction schedule, submit a cash flow projection indicating estimated earnings by month during the entire contract period and a Schedule of Values of the Work using the Schedule of Values described herein, including quantities and prices.*** The aggregate of these extended prices shall equal the contract price. Costs shall include all materials, labor, equipment, and appurtenant items necessary to accomplish the work in accordance with the contract documents. This schedule shall be satisfactory in form and substance to the Engineer and shall subdivide the work into the specified component parts. Upon review by the Engineer, the Contractor shall incorporate the Schedule into the form for Application for Payment. The Engineer and Owner reserve the right to delete (or add) items of work from the contract and the total contract amount shall be reduced (or increased) by the total amount shown in the Schedule of Values.

- B. ***Develop the Schedule of Values and incorporate it into the “cost-loading” function of the CPM schedule.*** Determine monthly progress payment amounts from the monthly progress updates of the CPM schedule activities. Develop the Schedule of Values independent, but simultaneous with, the development of the CPM schedule activities and logic.

C. Cross-Reference Listing

1. To assist in the correlation of the Schedule of Values and the CPM schedule, ***provide a cross-reference listing, furnished in two parts.*** The first part shall list each scheduled activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list the valued item with the respective scheduled activity or activities that make up the total cost indicated. In the case where a number of schedule items make up the total cost for a valued item (shown in the schedule of values), the total cost for each scheduled item should be indicated.
2. Update and submit these listings in conjunction with each CPM monthly submittal.
3. Incorporate executed Change Orders reflected in the CPM schedule into the Schedule of Values as a single unit identified by the Change Order number.

1.04 Schedule of Unit Material Values

- A. ***Submit a separate schedule of unit prices for materials to be stored on-site and for those materials incorporated into the Work for which progress payments will be requested.***
- B. The format shall be approved by the Engineer; however, it shall parallel that shown in Section 00845, “Materials Stored On-Site Form”.
- C. The unit values for the materials shall be broken down into the following:
1. Cost of the material, delivered and unloaded at the site, with taxes paid.
 2. Copies of the paid invoices for component material shall be included with the payment application in which the material first appears.
- D. Only materials unique to the Project may be billed when stored on-site. Materials of standard use such as conduit, wire, small-diameter pipe, steel, etc., shall not be accepted for payment.

- E. The installed value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

1.05 Review and Resubmittal

- A. The Contractor shall submit the Schedule of Values to the Engineer for approval.
- B. The Contractor and the Engineer shall meet and jointly review the Schedule of Values and make any adjustments in value allocations if, in the opinion of the Engineer, these are necessary to establish fair and reasonable allocation of values for the major work components. **Front-end loading will not be permitted.** The Engineer may require reallocation of major work components if, in the opinion of the Engineer, such reallocation is necessary. This review and any necessary revisions shall be completed within fifteen (15) days from the date of the notification of the required reallocation.
- C. After review by the Engineer, the Contractor shall revise and resubmit the Schedule of Values and the Schedule of Unit Material Values as required.
- D. Resubmit the revised schedules in the same manner.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

TABLE 01370-1**“SAMPLE” SCHEDULE OF VALUES**

CLASSIFICATION	ITEM	VALUE
General Requirements	1. Bonds, Insurance, Indemnification	\$
	2. Mobilization/Demobilization (Not to exceed 5% of the Total Contract Price)	\$
	3. Facilities/Process Start-up	\$
	4. Testing	\$
Site Work	1. Clearing and Grubbing	\$
	2. Excavation	\$
	3. Embankment	\$
	4. Final Grading	\$
	5. Siltation Systems	\$
	6. Stormwater Management System	\$
	7. Asphaltic Pavement or Concrete Pavement	\$
	8. Stabilized Subgrade (Pavement)	\$
	9. Sodding	\$
	10. Dewatering	\$
	11. Facility Entrance Sign	\$
	16. Sheeting and Shoring	\$
	17. Compaction	\$
	18. Geotechnical Testing	\$

TABLE 01370-1		
“SAMPLE” SCHEDULE OF VALUES		
CLASSIFICATION	ITEM	VALUE
Yard Piping, Valves and Fittings	1. Piping itemized per size and material	\$
	2. Valves itemized per size and type	\$
	3. Fittings itemized per size and type	\$
	4. Manholes and Precast Meter/Valve vaults	\$
Landscaping and Irrigation	1. Trees per type (6' - 8' height)	\$
	2. Trees per type (4' - 5' height)	\$
	3. Landscaping Accessories (Mulch, Pine Bark, Stone)	\$
	4. Plantings per type pot size	\$
	5. Irrigation Piping	\$
	6. Spray Heads and Rotors	\$
	7. Control Valves	\$
	8. Irrigation Controller	\$
Main WTP Operations Building	1. Excavation	\$
	2. Dewatering	\$
	3. Backfill and Compaction	\$
	4. Concrete Foundation	\$
	5. Split-Face CMU Walls	\$
	6. Slab on Grade	\$

TABLE 01370-1**“SAMPLE” SCHEDULE OF VALUES**

CLASSIFICATION	ITEM	VALUE
Main WTP Operations Building (Cont'd)	7. Interior Wall Systems	\$
	8. Insulation	\$
	9. Roofing System	\$
	10. Doors (Interior)	\$
	11. Doors (Exterior)	\$
	12. Overhead Coiling Doors	\$
	13. Grout	\$
	14. Piping, Valving and Fittings	\$
	15. High Service Pumps	\$
	16. Overhead Hoist and Crane System	\$
	16. Miscellaneous Metals	\$
	17. HVAC	\$
	18. MCC's	\$
	19. Conduit and Fittings	\$
	20. Lighting	\$
	21. Wire Terminations	\$
	22. Acoustical Ceiling Systems	\$
	23. Painting/Coatings	\$

TABLE 01370-1**“SAMPLE” SCHEDULE OF VALUES**

CLASSIFICATION	ITEM	VALUE
Main WTP Operations Building (Cont'd)	24. Laboratory Casework (Cabinets and Hood)	\$
	25. Laboratory Furniture	\$
	26. Laboratory Equipment	\$
	27. Laboratory Glassware	\$
	28. Lockers	\$
	29. ½-inch Drywall /Metal Stud Partition	\$
	30. Toilet Partitions	\$
	31. Restroom Equipment and Accessories	\$
	32. Wall Finishes	\$
	33. Floor Finishes by Type	\$
	34. Ceiling Finishes by Type	\$
	35. Plumbing Fixtures and Piping	\$
	36. Fire Suppression System	\$
	37. Electrical	\$
	38. Markerboards, Tackboards	\$
	39. Fire Alarm System	\$
	40. Panelboards	\$
	41. Tables, Chairs, File Cabinets, Computers, Projector (ceiling mounted), Equipment, Etc.	\$

TABLE 01370-1		
“SAMPLE” SCHEDULE OF VALUES		
CLASSIFICATION	ITEM	VALUE
Electrical, Instrumentation, SCADA and Control System	1. Digitally Based Monitoring and Control	\$
	2. Instrumentation	\$
	3. Conduit, Fittings and Wiring	\$
	4. Computer Systems and ancillary equipment	\$
	5. Electrical	\$
	6. Controls	\$
	7. Computers and ancillary equipment	\$
	8. SCADA System improvements	\$
	9. PLC, Remote I/O	\$
	10. Cabling	\$
	11. Fiber-Optics	\$
	12. Programming	\$
	13. Field Instruments	\$
	14. Field Panels	\$
	15. Testing	\$

This Sample Schedule of Values is by no way complete. It is presented for the Contractors convenience in developing a format for the submission of the Schedule of Values for the Contract Work to be conducted at the Sanford Main WTP. The Contractor's form, however, should parallel this sample and shall, as a minimum, provide a contract value for all Work items associated with the Project.

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

1. GENERAL

1.01 Description

A. Scope of Work

1. The Contractor shall provide professional quality construction record digital photographs prior to the start of work and periodically throughout the course of the Work as specified herein.

B. Related Requirements Described Elsewhere

Specification Section	Title
01010	Summary of Work
01720	Project Record Documents

1.02 Photography Required

- A. ***Digital Photographs taken in conformance with this Section shall be furnished to the Engineer, on a CD/DVD/BD or flash drive, with each Application for Payment, or every month if no application for payment is initiated in a month. Monthly Applications for Payment **will not be processed without submittal of the digital photographs outlined herein.*****
- B. Provide still photography of the general work area and any and all adjacent areas to be impacted by the construction activities, prior to commencing any work on any property. These photographs, in addition to the Preconstruction Video, will be used as a basis for settling any potential damage claims.
- C. Once work has begun, provide digital photographs at each of the major stages or events of construction related to the work performed and as directed by the Engineer or Resident Project Representative (RPR).

D. **High-Resolution digital photographs (> 10 MP) shall be provided as herein specified. No low-resolution (< 10 MP), poorly light, digital photographs, will be acceptable.**

E. Views and Quantities Required

1. A minimum of four (4) digital photographs, at 90° to one another, of each pre-existing condition of an area where work is to begin.
2. A minimum of four (4) digital photographs of each construction activity as directed by the RPR per week.
3. One (1) digital photograph each of six (6) views (minimum) of the overall project site on a weekly basis, as directed by the Representative Project Representative (RPR).
4. One (1) digital photograph, per side, of each structure on the Project Site where construction activities are present weekly.
5. Once per day, the Contractor shall take at least one (1) photograph of the same overall view (location and view to be determined by the Engineer) as previously photographed.

6. Drone Shots of the Treatment Facility

- a. Drone aerial photography shall be conducted at the Sanford Main WTP, prior to, during and after the construction work, as described below. The drone photography shall be provided by the CPH, Inc. as part of the Contract and shall be paid for by the Contractor, on a monthly basis, at the *pre-negotiated* price identified on the Bid Form.

b. Pre-Construction Drone Aerial Photography

- 1) Preliminary drone aerial photography of the Project Site prior to commencement of construction activities.
- 2) The Contractor shall provide **two (2) prints each of three (3) preliminary drone aerial views (16" x 20"), as selected by the Engineer, of the Project Site prior to commencement of construction activities.**

c. Monthly During Construction of the Project Improvements

- 1) Drone aerial photography of the Project Site every month for the duration of the project.
- 2) The Contractor shall provide **two (2) prints each of three (3) preliminary drone aerial views (16" x 20"), as selected by the Engineer, of the Project Site every month for the duration of construction activities.**

d. Post-construction Drone Aerial Photography

- 1) Post-construction drone aerial photography of the Project Site after the completion of construction activities and the new pumping, mechanical, chemical feed and electrical systems are operational and the final site work (sodding, landscaping, wall and fencing) has been completed.
- 2) The Contractor shall provide **six (6) prints of the selected final aerial drone photographs, enlarged and framed (1.5" wide, minimum, oak frame to be selected by the Engineer from samples provided by the Contractor) from the completed project set of drone aerial photographs (to be selected by the Engineer). Final print sizes shall be 18" x 24"** with the frames to match this sizing.

F. Digital Photography

1. The digital photographs shall be taken using a digital camera that has, at a minimum, the following characteristics:
 - a. 10.0 megapixel image sensor, minimum.
 - b. **Minimum** resolution: 1920 x 1080.
 - c. Precision digital zoom lens with high speed scan AutoFocus.
 - d. Flash capabilities.
2. The photographer shall take photographs of the views and quantities indicated above in Article 1.02(E)(1-5). The digital photographs shall be taken in the "high resolution" mode (> 10 MP). **No low resolution digital photographs (< 10 MP) will be allowed.**
3. The "high resolution" digital photographs shall be downloaded onto a CD/DVD/BD or flash drive each month, in accordance with Article 1.02(A), and shall be indexed, digitally labeled (photo ID name) and categorized in folders with distinctive names to be determined in the Preconstruction Conference. The monthly submittal will contain digital photographic CD/DVD/BD's or flash drives as required by Article 3.03(D).

1.03 Cost of Photography

- A. **The Contractor shall pay all costs for the specified digital photography.** The cost for the photography shall be included in the Contractor's Bid for this Project.

- B. The digital camera to be used by the Contractor ***shall be submitted for approval prior*** to construction activities to ensure that it meets the criteria identified herein.

2. PRODUCTS

2.01 Aerial Drone Photography Prints

A. Type of Print

1. Paper: Single weight, full color print paper.
2. Camera and Film: High Resolution, High Definition Camera
3. Finish: Smooth surface, glossy.

- B. Identify each print on the back, utilizing a printed label (bleed-proof), listing the following:

1. Name of the Project.
2. Project Location.
3. Description and orientation of the view.
4. Date and time of exposure.

C. Aerial Photographs

1. Each aerial drone photograph shall be scaled to picture the facility site within no less than eighty percent (80%) of the print total area.
2. ***Each selected enlarged final aerial print shall be provided mounted within an solid oak frame, with a non-glare glass front, behind a minimum 2-inch wide, two-tone, double beveled mat (color to be selected by the Engineer).***

2.02 Digital Camera

- A. As part of the Contract, the Contractor shall purchase one (1) “new” and “unused” digital camera, accessories and software/hardware, as specified herein, and turn them over to the Project Engineer, within ten (10) days after the Notice to Proceed.

B. **One (1) Olympus Tough TG-6 “waterproof”, “underwater” digital camera** shall be provided and shall have the following features:

1. Camera and Lens Color: Black
2. Megapixels (effective / total): 12.0 MP
3. Image Resolution (display): Up to 4,000 x 3,000
4. Maximum Aperture: f/ 2.0 - 4.9
5. Optical Zoom: 4 X
6. LCD Screen Size: 3.0-inch, Color LCD monitor
7. Image Stabilization: Yes
8. Video Resolution: 4k movie and full HD
9. Waterproof/Shockproof: Yes
10. Shutter Speeds: 1/2 - 1/2,000 seconds
11. Built-in Flash: Yes
12. Micro USB Port: USB 2.0 (Micro-B)
13. HDMI Output: HDMI Micro(Type D)
14. Built-in WiFi/GPS: Yes
15. Batteries: 1 rechargeable lithium ion battery pack
16. Camera Strap, USB Cable, Battery Charger
17. The following additional accessories shall be provided for each camera (can be purchased with camera as a deluxe accessory bundle on Amazon):
 - a. Two (2) camera replacement batteries (Olympus LI-92B Lithium Ion).
 - b. AC/DC rapid home and travel battery charger.
 - c. 3-piece multi-colored HD Filter Kit (UV, CPL, FLD).
 - d. Adapter ring for screw on filters.

- e. 0.43x wide angle HD macro lens attachment.
- f. 2.2x telephoto HD lens attachment.
- g. Water resistant carrying case for all bundle accessories.
- h. Flexible gripster tripod.
- i. Floating wrist strap.
- j. High speed memory card reader.
- k. Micro HDMI to HDMI Cable (A-D).
- l. Starter cleaning kit.

C. The following software/hardware shall be provided:

- 1. One (1) Western Digital - My Cloud Pro Series PR 4100 40 TB Network Attached Storage.
- 2. One (1) Tough TG-6 Digital camera case (designed/manufactured for the camera).
- 3. Two (2) Lexar Prof. 633X 1.0 TB SDXC UHS-I/ Memory Cards.

3. EXECUTION

3.01 Technique

A. Factual Presentation

B. Correct Exposure and Focus

- 1. High Resolution and sharpness.
- 2. Maximum depth-of-field.
- 3. Minimum Distortion.

3.02 Views Required

A. Photograph from locations, at the Project Site, to adequately illustrate the condition of construction and state of progress.

- B. Consult with the Engineer at each period of photography for instructions concerning the views required.

3.03 Delivery of Digital Photographs

- A. Deliver the herein described digital “*high resolution*” photographs, on CD/DVD/BD or flash drive, to the Engineer, ***with each Application for Payment or in the event of no Application for Payment, once per month.***
- B. ***All digital photographs shall be filed electronically in folders with appropriate titles for each of the pictures as approved by the Engineer in the Pre-construction Conference and the Monthly Progress Meetings.*** Digital photograph submissions not meeting the requirements of this specification section will be rejected and the monthly application for payment will not be processed until the proper photographs and format are provided to the Engineer.
- C. Distribute the digital construction photographs as follows:

Entity	No. of Sets of CD/DVD/BD's or Flash Drive
Owner	1
Engineer	1
Project Record File	One (1) set to be stored by the Contractor until the end of the Project that shall be delivered with the Project Record Documents.
Contractor	As required per Contractor

END OF SECTION

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SECTION 01390

PRECONSTRUCTION VIDEO RECORDING

1. GENERAL

1.01 Description

- A. Provide all material, equipment, transportation, labor and incidentals to prepare a continuous, "**high resolution**" digital HD video recording of all construction, roadway, utility and golf course areas around the treatment plant prior to the start of the Work.
- B. The Contractor shall engage the services of a competent, professional videographer to provide "**high quality**", digital HD recording, in color, of the construction areas.
- C. The purpose of this digital audio-video preconstruction survey is to serve as a record of pre-construction conditions and to establish a basis for defense against claims for damage to property owned by private or public entities, including the City of Sanford, Seminole County, Mayfair Golf Course, other utilities, businesses and residences, etc.
- D. All DVD's/BD's and written records shall become the property of the Engineer/Owner.
- E. Related work specified elsewhere

Specification Section	Title
00700 / 00800	General and Supplementary Conditions
01010	Summary of Work
01700	Project Closeout

- F. The "**high-resolution**" HD digital audio-video system and the procedures employed in its use shall be such as to produce a finished product that will be admissible as evidence in a legal or administrative proceeding involving the Project. The video portion of the recording shall produce bright, **high-resolution (1920 x 1280 minimum video resolution)** clear pictures with accurate colors and shall be free from distortion or any other form of picture imperfection. The audio portion of the recording shall clearly produce the commentary of the HD digital recording device operator and be free from distortion.

1.02 Videographer Qualifications

- A. The “*high resolution*” digital HD video documentation shall be performed by a responsible commercial firm, subcontracted by the Contractor, known to be skilled and regularly engaged in the business of “professional” pre-construction, color, “*high-quality*” digital audio/video documentation.
- B. ***The Engineer and Owner will approve the “high-quality” digital HD audio/video recording company providing the service.*** The recording company shall furnish such information as the Owner deems necessary to determine the ability of that company to perform the work in accordance with the contract specifications. ***Under no circumstances will the Contractor be allowed to do this HD filming.***
- C. The preconstruction “*high-quality*”, digital HD audio/video filming shall be of professional quality that will clearly log an accurate visual description of existing conditions. Any portion of the DVD/BD not acceptable for the determination of the existing conditions shall be re-filmed at no additional cost to the Owner.
- D. The videographer shall be prepared to serve as a consultant or witness for the Owner in any litigation, public hearing or other legal or administrative proceeding involving the Project.
- E. Include the names, addresses, e-mail addresses and telephone numbers of two (2) references where the videographer has performed color, “*high-resolution*”, digital HD audio/video filming on projects of a similar nature, including one (1) within the last six (6) months.

1.03 Submittals

- A. All submittals shall be in accordance with Section 01300, “Shop Drawings, Submittals and Samples”.
- B. The Contractor shall submit, at a minimum, the following:
 - 1. The qualifications and references of the videographer.
 - 2. A sample “*high-resolution*” HD digital audio/video color DVD/BD meeting the exact Contract requirements.
- C. It will be upon this sample DVD/BD that the job quality standards will be based and judged. This sample DVD/BD shall be submitted to the Engineer and Owner in sufficient time to allow the DVD/BD to be played back for viewing and audio results prior to beginning the actual video recording required by the Contract.

2. EQUIPMENT

2.01 General

- A. The total “*high-resolution*” digital HD audio/video recording system and the procedures employed in its use shall be such as to produce a finished product that will fulfill the technical requirements of the project.
- B. The “*high-resolution*” digital HD video portion of the recording shall produce bright, sharp (**1080p**), clear pictures with accurate colors and shall be free from distortion or any other form of picture imperfection.
- C. The audio portion of the recording shall produce the commentary of the HD digital recording device operator with proper volume, clarity, and be free from distortion.

2.02 HD Digital Recording Device

- A. The “high quality” HD digital recording device used in the recording system, shall have the ***minimum*** characteristics:
 - 1. Full HD capability
 - 2. Aspect Ratio: 16:9
 - 3. Video Format: MPEG-4
 - 4. “Minimum” Video Resolution: 1920 x 1280
 - 5. Maximum Frame Rate: 60 fps
 - 6. Video System: NTSC
 - 7. Sound System: Dolby Digital
 - 8. Optical/Digital Zoom: 10X / 200 X
- B. All digital media to be provided to the Owner and Engineer shall be “*high-resolution*” DVD/BD.

3. EXECUTION

3.01 Coverage

- A. The HD recordings shall contain coverage of all surface features located within the construction's zone of influence. The construction's "*zone of influence*" shall be defined as follows:
 - 1. Sanford Main WTP Project Site and adjacent Mayfair Golf Course (City-Owned).
 - 2. Area within the permanent and temporary easements or ROW, and areas adjacent to these areas that may be affected by routine construction operations.
 - 3. By the direction of the Engineer.
- B. The surface features within the construction's zone of influence shall include, but not be limited to, all roadways, pavements, curbs, driveways, sidewalks, culverts, headwalls, retaining walls, buildings, treatment structures, utilities (water, power, etc.), landscaping, trees, shrubbery, grassed areas, waterways, ponds, structures, tanks, fences, overhead projections, poles, signs, railroad tracks, etc.
- C. Panning, zoom-in and zoom-out rates shall be controlled to maintain a clear view of the Project.
- D. With respect to roadway construction or waterways, filmed coverage shall be limited to one side of the street or waterway at any one time and shall include all surface conditions located within the "*zone of influence*" of construction supported by appropriate audio description when dealing with work along roadways. When filming open areas, the entire region shall be videotaped in its entirety.

3.02 Audio Content

- A. The HD recording of each video shall be a simultaneous recorded audio recording. This audio recording, exclusively containing the commentary of the HD digital recording device operator, shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the feature being shown in the video portion of the recording.
- B. The audio recording also shall be free from any conversations between the HD digital recording device operator and any other production technicians that are not pertinent to the Project.

3.03 Recording Schedule

- A. The HD recording shall be performed **prior** to the placement of any construction materials or equipment on the proposed construction site.
- B. The Contractor shall coordinate the “*high resolution*”, digital HD video recording with the construction schedule so that those portions of the construction that will be completed first will be recorded first.
- C. The recording company shall deliver the “*high-resolution*”, digital HD video recordings to the Contractor upon their completion. The Contractor shall submit the “*high resolution*”, digital HD video recordings to the Engineer in accordance with Section 01300, “Shop Drawings, Submittals and Samples”.
- D. Upon delivery of the “*high resolution*”, digital HD video recordings to the Engineer, transfer of ownership of those DVD's/BD's shall be made to the Owner.

3.04 Visibility

- A. All HD recordings shall be performed during times of good visibility. No HD recording shall be conducted during periods of significant precipitation, mist, or fog.
- B. The HD recording shall only be done when sufficient sunlight is present to properly illuminate the subject, and to produce bright, sharp digital HD recordings of those subjects.
- C. No HD filming shall be performed when more than ten percent (10%) of the area to be taped contains debris or obstructions unless otherwise authorized by the Engineer.

3.05 Continuity of Coverage

- A. To increase the continuity of the coverage, the coverage shall consist of a single, continuous, unedited filming which begins at one end of a particular construction area.
- B. The coverage shall consist of an organized, interrelated sequence of HD recordings at various positions along that proposed construction area.
- C. The complete coverage of all building and structure surfaces is required per this contract to document their “*existing*” condition (due to project compaction operations).

3.06 HD Digital Recording Device Operation

A. HD Digital Recording Device Stability

1. The HD digital recording device shall be firmly mounted or held, such that transport of the recording device during the recording process will not cause an unsteady or jumpy picture.

B. HD Digital Recording Device Control

1. The HD digital recording device pan, tilt, zoom-in, and zoom-out rates shall be sufficiently controlled such that recorded objects will be clearly viewed during playback.
2. In addition, all other recording device and recording system controls (lens, focus, aperture, white balance, etc.) shall be properly controlled or adjusted to maximize picture quality.

3.07 Viewer Orientation Techniques

- A. The “*high resolution*”, digital HD video/audio recording shall maintain viewer orientation. To this end, overall establishing views and visual displays of all surface to determine their “existing” condition is critical to this component of the Project.
- B. In areas where the proposed construction location will not be readily apparent in the HD recording device viewer, highly visible yellow flags shall be placed, by the Contractor, in such a fashion as to clearly indicate the proposed centerline of construction.
- C. The horizontal location of the HD recordings shall be documented by linear measurement, utilizing a fifth “*wheel*” measuring device, relating the recording to the Project Stationing.

3.08 DVD/BD Identification and Security

- A. All DVD's/BD's shall be permanently labeled and shall be properly identified by DVD/BD number, Project Title and date(s) of the recording.
- B. To preclude the possibility of tampering or editing in any manner, all HD recordings must, by electronic means, display continuously and simultaneously generated transparent digital information to include the date and time of recording. The date information shall contain the month, day and year. The time information shall consist of hours, minutes and seconds, separated by colons (i.e., 13:24:10). This transparent information shall appear on the screen.

3.09 DVD/BD Logs

- A. Each DVD/BD shall have a log of that DVD's/BD's contents. The log shall describe the various segments of coverage contained on that DVD/BD in terms of the names of streets, waterways or easements, structures, coverage beginning and end, directions of coverage, and DVD/BD counter numbers when possible, and the date of the recording.

3.10 Contractor's Responsibilities

- A. All "*high resolution*", digital HD recordings shall be performed during regular business hours, unless otherwise specified by the Engineer. The Contractor shall enter and leave private property in a professional and orderly, workmanlike manner.
- B. The Contractor shall provide for an audio-visual presentation for review. The Engineer and Owner shall have the authority to reject all or any portion of the "*high resolution*", digital HD video recording not conforming to Specifications. ***Any coverage not acceptable to the Engineer and Owner shall be re-filmed at no additional charge.*** The Contractor shall reschedule unacceptable coverage within five (5) calendar days after being notified. Submit complete audio-visual DVD's/BD's to the Engineer no less than fifteen (15) calendar days before commencement of construction in areas to be filmed.

END OF SECTION

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SECTION 01400

QUALITY CONTROL

1. GENERAL

1.01 Description

- A. This Section discusses quality control and quality assurance measures required by the Contractor during execution of the construction activities associated with this Project.
- B. Related Work Specified Elsewhere:

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
00805	FDEP Supplementary Conditions
01040	Project Coordination
01075	Reference Specifications
01300	Shop Drawings, Submittals and Samples
01410	Testing and Testing Laboratory Services
01430	Manufacturer's Services
01600	Materials and Equipment
01650	Systems Start-Up and Demonstration
01710	Cleaning
Division	Information
6, 10 and 11	Equipment
12	Furnishings
15	Mechanical
13 and 16	Electrical, Controls and Instrumentation

1.02 Quality Control

- A. It is the Contractor's responsibility to perform all work to a degree and in a manner that satisfies and complies with the Project requirements. To fulfill this responsibility, **the Contractor is required to have an approved Quality Control Program (QCP)**, including testing, as part of his Contract work in accordance with the Contract Documents and to **submit details of his Program to the Engineer for review and approval prior to commencing any construction operations**. The submittal shall include detailed information on locations and number of all tests, etc., that will be necessary for compliance with the Contract Documents and the Project requirements.
- B. As part of the Contractor's Quality Control Program (QCP) included as part of his work under this Contract, **the Contractor shall employ and pay for an independent, approved testing laboratory to perform testing services outlined in these Contract Documents**. The Contractor shall meet all of the requirements outlined under Section 01410, "Testing and Testing Laboratory Services".
- C. The Contractor's Quality Control Program (QCP) shall include, but not be limited to, the following in addition to the type and frequency of tests as required by the individual technical specification sections:
1. Piping and structural excavation, bedding and backfill materials and density quality control testing.
 2. Determination of the compactive effort needed for compliance with the density requirements.
 3. Portland cement concrete and asphalt paving quality control testing including design mix review, materials, field slump and air content, and field and lab cured strength samples and testing.
 4. Removal and legal disposal of all trash from the project site.
- D. In addition to Quality Control Testing, the Contractor shall be responsible for required testing or approvals for any work (or any part thereof) if laws or regulations of any public body having jurisdiction specifically require testing, inspections or approval. The Contractor shall pay all costs in connection therewith and shall furnish the Engineer the required certificates of inspection, testing or approval. **The Contractor shall also be responsible for and shall pay all costs in connection with any inspection or testing** required in connection with Owner or Engineer acceptance of a supplier of materials or equipment proposed to be incorporated into the work.
- E. Any design or testing laboratory utilized by the Contractor shall be an independent laboratory acceptable to the Owner and the Engineer, **approved in writing**, and complying with the latest edition of the "Recommended Requirements for Independent

Laboratory Qualification", published by the American Council of Independent Laboratories.

- F. Testing laboratories, shall promptly notify the Engineer and the Contractor of irregularities or deficiencies of work which are observed during performance of services.
- G. Laboratories shall submit copies of all reports in accordance with Section 01410, "Testing and Testing Laboratory Services".

1.03 Quality Assurance

- A. **The Contractor shall monitor quality control** over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality.
- B. The Contractor shall comply with all manufacturer's instructions, including each step in sequence.
- C. Should the manufacturer's instructions conflict with the Contract Documents, the Contractor shall request clarification from the Manufacturer first, followed by the Engineer prior to proceeding.
- D. The Contractor shall comply with the specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship. The Work shall comply with all local, State and Federal Building Codes and regulations, and the Florida Building Code.
- E. The Contractor shall perform the Work with persons qualified to produce the required and specified quality.
- F. **The Contractor shall verify that field measurements are as indicated on shop drawings** or as instructed by the manufacturer.
- G. The Contractor shall secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- H. The Contractor shall comply with all of the quality assurance standards and criteria specified within the individual specification sections.

1.04 Tolerances

- A. The Contractor shall monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. The Contractor shall comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. The Contractor shall adjust products to their appropriate dimensions and positions before securing them in place.

1.05 Testing of Materials

- A. Unless otherwise specified in the Contract Documents, all materials shall be sampled and tested in accordance with the latest published standard methods of ASTM in effect at the time the Bids are received. If no ASTM Standards apply, applicable standard methods of the Federal Government or of other recognized agencies shall be used.
- B. ***Testing of materials shall be made by an authorized testing laboratory/manufacturer's representative, employed and paid for by the Contractor,*** unless otherwise provided.
- C. ***Testing of equipment shall be the responsibility of the Contractor or an authorized manufacturer's representative.*** All test results shall be furnished to the Engineer in writing in accordance with Section 01410, "Testing and Testing Laboratory Services".
- D. ***The Contractor shall provide facilities required to collect and forward samples.*** The Contractor shall furnish the required samples without charge.
- E. The Contractor shall not make use of or incorporate into the Work, the materials represented by the sample until tests have been made and the material found to be in accordance with the requirements of the Specifications.
- F. Materials to be tested and the applicable test procedure shall be as outlined in the individual sections of these Specifications or detailed by the Engineer.

1.06 References and Standards

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

- B. Conform to reference standards by date of issue, current on the date for receiving Bids, except where a specific date is established by code.
- C. Referenced Standards are identified in Section 01075, "Reference Specifications" and the individual specification sections. The Contractor shall obtain copies of and comply with all reference standards.
- D. Neither the contractual relationships, duties, or responsibilities of the parties in the Contract, nor those of the Engineer, shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.07 Source and Quality of Materials and Equipment

- A. The source of materials to be used shall be in accordance with the Contract Documents and as approved by the Engineer before delivery. The approval of the source of any material shall continue as long as the material conforms to the Specifications.
- B. ***All material not conforming to the requirements of the Specifications shall be considered as defective and shall be removed from the Project Site.*** If in place, faulty materials shall be removed by the Contractor, at his expense, and replaced with acceptable material. No defective materials which have been subsequently corrected shall be reused until approval has been given.
- C. Upon failure of the Contractor to comply immediately with any order of the Engineer to remove and replace defective material, the Owner shall have authority to remove and replace defective materials, and to deduct the cost of removal and replacement from any monies due or to become due to the Contractor. Failure to reject any defective materials or work at the time of installation shall in no way prevent later rejection when such defects are discovered, nor obligate the Owner to final acceptance.

1.08 Manufacturer's Field Services

- A. When specified in individual specification sections, material, product or equipment suppliers or manufacturer's may be required to provide qualified staff personnel to:
 - 1. Observe site conditions.
 - 2. Conditions of surfaces.
 - 3. Installation.

4. Quality of workmanship.
 5. Start-up of equipment.
 6. Testing, adjusting and balancing of equipment.
 7. Operation of equipment.
 8. Provide Operation and Maintenance training to the Owner's personnel.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to the manufacturer's written instructions.
- C. The Contractor shall refer to the individual specification sections for Contract required manufacturer's field services.
- D. The Contractor shall refer to Section 01300, "Shop Drawings, Submittals and Samples", Section 1430, "Manufacturer's Services", Section 01600, "Materials and Equipment", and Section 01650, "System's Start-Up and Demonstration".

1.09 Additional Testing

- A. In addition to soils laboratory and material testing, the Contractor shall perform other testing called for in the Contract Documents, including, but not limited to, piping, pressure, leakage, infiltration and exfiltration, as appropriate.

2. PRODUCTS - NOT USED

3. EXECUTION

3.01 Examination

- A. ***The Contractor shall verify that the site conditions and substrate surfaces are acceptable for subsequent work.*** Beginning new work means Contractor acceptance of existing conditions.

- B. The Contractor shall verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. The Contractor shall examine and verify specific conditions described in the individual specification sections.
- D. The Contractor shall verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 Preparation

- A. Clean substrate surfaces prior to applying the next material or substance.
- B. Clean all cracks or openings of substrate prior to applying the next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to apply any new material or substance in contact or bond.
- D. Refer to Section 01710, "Cleaning", and follow all contractual requirements and procedures.

END OF SECTION

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SECTION 01410

TESTING AND

TESTING LABORATORY SERVICES

1. GENERAL

1.01 Description

A. Scope of Work

1. *The Contractor will employ and pay for the services of an independent, qualified, state-certified 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. The Contractor shall cooperate with the laboratory to facilitate the execution of its required services.
3. The Contractor shall provide the Engineer with all test results herein ***within two (2) calendar days of receipt in an electronic format.***
4. Employment of any particular laboratory shall in no way relieve the Contractor's obligations to perform the Work of the Contract or cooperate with the selected laboratory, following the sampling methods and means required.

B. Related Requirements Described Elsewhere

1. General Conditions and Requirements of the Contract.
2. Respective Sections of the Specifications: Certification of products.
3. Each Specification Section listed: Laboratory test required, and standards for testing.
4. Testing laboratory inspection, sampling and testing is required for, but not limited to, the following:

Specification Section	Title
02200	Earthwork
02220	Excavation, Backfilling and Compacting
02500	Asphaltic Pavement
02610	Stabilized Sub-Base
03300	Cast-in-Place Concrete
15000	Mechanical - General Requirements

- C. The following schedule defines the responsibilities and extent of various tests required for the Project. The Contractor shall notify the Owner in advance of any new work so that arrangements can be made with the testing laboratory for the required sampling.

TEST	NOTES	PAID FOR BY
Soil Compaction	<u>Pipe Work</u> : Every 150 feet at each lift of compaction, minimum	Contractor
	<u>Beneath Structures</u> : Each 2,000 ft ² , each lift of compaction, minimum	
	<u>Strip/Column Foundation Work</u> : Every 100 feet at each lift of compaction, minimum	
Pressure	As specified in Section 15044, "Pressure Testing of Piping"	Contractor
Bacteriological	As required by the local and state agencies and as specified in Division 15	Contractor
LBR (Limerock Bearing Ratio)	Each 600 ft ² of pavement, minimum	Contractor
Concrete	<u>Slump Test</u> : Each delivery, minimum	Contractor
	<u>Compression Test</u> : Five (5) cylinders every 50 yd ³ , minimum	
	Additional tests per Section 03300, "Cast-in-Place Concrete".	
Leak Tests	As specified in Section 03800, "Leakage Testing of Hydraulic Structures".	Contractor
Electrical Tests	As specified in Division 16, "Electrical".	Contractor
Instrumentation Tests	As specified in Division 13, "Special Construction".	Contractor

D. Additional Tests

1. ***The Contractor shall pay for all tests*** to ensure that the applicable material specification is met.
2. If the first test samples do not meet the specification requirements, the Contractor shall take measures to conform the material and equipment to the Specifications.

1.02 Laboratory Duties: Limitations of Authority

- A. ***The Contractor shall submit, within fifteen (15) calendar days after the Notice to Proceed, the name of the testing laboratory that he is proposing to use on the Project.***
- B. The testing laboratory ***shall be “approved”*** by the Owner and Engineer prior to commencement of any Project Work.
- C. The testing laboratory shall cooperate with the Engineer and Contractor and provide qualified personnel promptly on notice to perform the required testing.
- D. The testing laboratory shall perform specified inspections, sampling and testing of materials and methods of construction to:
 1. Comply with specific standards, including, but not limited to, ASTM, other recognized authorities, and as specified.
 2. Determine and report on compliance with the requirements of Contract Documents.
- E. ***The testing laboratory shall immediately notify the Engineer and Contractor*** of any material or operations that do not meet the Project specifications.
- F. ***The testing laboratory shall promptly submit three (3) electronic copies of all reports or inspections and tests to the Engineer.*** Each report or inspection shall include, at a minimum, the following:
 1. Date issued.
 2. Project title and Engineer's Project No.
 3. Testing Laboratory's name, address, telephone, contact person and e-mail address.
 4. The name and signature of the inspector.

5. The date of inspection or sampling.
 6. A record of temperature and weather.
 7. Date of the test.
 8. Identification of the Product and Specification Section.
 9. Location in the project.
 10. The type of inspection or test.
 11. Observations regarding the compliance with the Contract Documents (or not).
- G. The testing laboratory may also be instructed to perform additional services as required by the Owner.
- H. The Engineer and Owner “*approved*”, independent, qualified, state-certified testing laboratory is not authorized to:
1. Release, revoke, alter, enlarge or give interpretations on the requirements of the Contract Documents.
 2. Approve or reject any portion of work.
 3. Perform any duties of the Contractor.

1.03 Contractor’s Responsibilities

- A. Cooperate with the Engineer’s representative and laboratory personnel. Provide access to the Work and the manufacturer’s operations.
- B. Provide to the laboratory the preliminary design mix proposed to be used for concrete, if to be placed, and other material 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 the Work to be tested.
2. To obtain and handle samples at the Project Site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.
5. For delivery of samples.

E. **Notify the Engineer “approved”, independent, qualified, state-certified testing laboratory a minimum of three (3) working days in advance of operations to allow for the laboratory assignment of personnel and scheduling of the required tests.**

Any Contractor “down-time” and expenses incurred by the Contractor due to his negligence or inability to have the testing laboratory perform tests when required shall not be compensated by the Owner.

F. **The Contractor shall employ and pay for the services of the same or a separate, equally qualified independent testing laboratory** to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the Engineer.

G. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, **the Contractor shall pay for the laboratory costs directly to the testing firm, at no additional expense to the Owner.**

H. 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 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 additional cost to the Owner.**

I. The Contractor shall assure that 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.

- J. 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.

1.04 Costs of Shop Tests and Substitute Equipment

- A. **Field testing of materials furnished under this Contract will be provided by the Contractor**, unless otherwise specified.
- B. **The cost of shop 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 Bid Price.
- C. 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 Project Site until the Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.
 - 3. **Three (3) copies** of the manufacturer's 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**.
- D. Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract, if allowed by the Contract Documents, 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 to verify equitable products are provided.**

1.05 Final Tests and Inspection

A. Final Demonstration 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 finishing Contractor shall assist in the final field tests as applicable.

B. Final Inspection

1. During such final inspections, the work shall be clean and functional.
2. In no case will the final pay 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.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

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SECTION 01430

MANUFACTURER'S SERVICES

1. GENERAL

1.01 Description

A. Work Specified Herein

1. Mechanical start-up services.
2. Process start-up services.
3. Training services.

B. Related Work Specified Elsewhere

Specification Section	Title
01600	Materials and Equipment
01650	Systems Start-Up and Demonstration
Division	Information
6, 10, 11, 12, 14 and 15	Equipment
13 and 16	Electrical, Controls and Instrumentation

1.02 Definitions

The following definitions shall apply wherever used herein and elsewhere in the Specifications:

A. Factory Serviceman:

A person trained by the manufacturer of the equipment and experienced in the installation, maintenance, start-up and operation of the specified equipment.

- B. Factory Process Specialist: *A person trained and experienced in adjusting and optimizing the operation of the specified equipment to assure proper operation of the equipment as a part of the system in which it is installed.*
- C. Factory Trained Specialist: *A person trained and experienced in the operation and maintenance of the specified equipment and capable of training the Owner's personnel in the operation and maintenance of the equipment and systems.*
- D. Eight-Hour Working Day: *A minimum of eight hours of on-site work, exclusive of travel time to and from the project location. Consecutive days include the five (5) working days in a week, exclusive of Saturday and Sunday.*

1.03 Submittals

- A. At the time of submittal of shop drawings and product data, ***the Contractor shall submit the names and qualifications of the manufacturer's personnel who will perform manufacturer's services*** as specified here and elsewhere. Failure to provide this information with the shop drawings will lead to "rejection" of that shop drawing submittal.

2. PRODUCTS - NOT USED

3. EXECUTION

3.01 General

- A. All manufacturers' services shall be performed in the presence of the Engineer and a representative of the Owner.
- B. The Contractor shall be responsible for scheduling and coordinating the manufacturer's site visits with the Owner and the Engineer. ***The Owner and the Engineer shall be given a minimum of ten (10) calendar days written notice prior to the site visit and shall be given a minimum of three (3) calendar days written notice of cancellation of a site visit.*** The time of written notification of the Owner and Engineer shall mean

- from the date of receipt of the notification by the Engineer and Owner, not the date that the Contractor issued the written notification. Any time delay, loss of work or increase in contract cost due to the Contractor not providing the required notification shall be incidental to the Contract.
- C. Mechanical start-up services shall be performed following complete installation of the equipment item or system.
 - D. Process start-up services shall be performed at the time the equipment item or system is required by the treatment process.
 - E. Initial training services shall be performed at the time of process start-up and Section 01730, "Operation and Maintenance Data".
 - F. ***Follow-up training and check-out services shall be performed at the times requested in writing by the Owner during the period of one (1) year after Final Project Acceptance by the Owner.***
 - G. The manufacturer's services specified herein are in addition to the guarantee requirements in Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", and Section 00805, "FDEP Supplementary Conditions".

3.02 Mechanical Start-Up Services

- A. Mechanical start-up services shall consist of checking the installed equipment electrically and mechanically to insure it has been installed correctly, wired correctly, properly lubricated, and is ready to operate.
- B. Mechanical start-up services shall be performed by a Factory Serviceman and shall consist of a minimum of the number of consecutive eight (8) hour working days specified in the individual equipment Specifications.
- C. ***The Contractor shall be responsible for arranging for or providing, at no additional cost to the Owner,*** all required equipment, supplies, and services, including power, water, wastewater, sludge, air, compressed gases, etc., and the availability of subcontractors and skilled tradesmen as necessary for mechanical start-up services.
- D. ***Mechanical start-up will not be considered complete until all installation and material difficulties have been corrected.*** Upon completion of the mechanical start-up services, ***the manufacturer shall submit to the Engineer a letter certifying that the equipment has been properly installed and is ready for process start-up. Process start-up will not be allowed without prior receipt of the above certification.***

- E. As part of the above certification letter, the manufacturer shall submit to the Contractor and the Engineer written interim operation and maintenance activities required to ensure that the equipment will remain in operating condition between the mechanical start-up service and process start-up. This information is in addition to information submitted to the Engineer for preparation of an operation and maintenance manual for the Owner. ***The Contractor shall be responsible for all interim operation and maintenance activities.***

3.03 Process Start-Up Services

- A. Process start-up services shall consist of start-up of the equipment at the time required by the treatment process and final adjustment, calibration, etc., required to optimize operation of the equipment. Process start-up shall also consist of the additional services specified in the individual equipment specifications.
- B. ***Process start-up services shall be performed by a Factory Process Specialist*** and shall consist of a minimum of the number of consecutive eight (8) hour working days specified in the individual equipment specifications.
- C. The Contractor shall be responsible for arranging for or providing, at no additional cost to the Owner, all required equipment, supplies, and services, including power, water, wastewater, air, compressed gases, etc., and the availability of subcontractors and skilled tradesmen as necessary for process start-up services.
- D. ***Upon completion of the process start-up services, the manufacturer shall submit to the Engineer a letter certifying that the equipment is operating properly.***

3.04 Training Services

- A. Training services shall consist of the following:
 - 1. Initial instruction of the Owner's personnel in the operation and maintenance of the equipment consisting of the number of ***consecutive eight (8) hour working days of "classroom" and "hands-on" training*** specified in the individual equipment specifications.
 - 2. ***Follow-up equipment check-out and instruction of the Owner's personnel during the first year of operation***, consisting of the number of trips and eight (8) hour working days of training specified in the individual equipment Specifications.

- B. Training shall be performed by a Factory Trained Specialist from the manufacturer. ***Training materials shall be supplied to the Owner at least seven (7) calendar days prior to the date of the training by the Factory Trained Specialist.***
- C. All training shall be performed at the Owner's facilities, unless otherwise specified.
- D. ***Each manufacturer's training service shall be filmed, in 1080p HD, by a professional filming firm, at no additional cost to the Owner,*** for the purpose of O&M training. Upon completion, three (3) copies of the tape (labeled and indexed) shall be submitted to the Engineer for distribution in accordance with the requirements and conditions of Section 01390, "Preconstruction Video Recording".

END OF SECTION

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SECTION 01500

TEMPORARY FACILITIES

1. GENERAL

1.01 Description

A. Scope of Work

1. Provide temporary facilities at the Project Site as specified in the General and Supplementary Conditions (Division 0), with the addition of the requirements set forth herein. The Contractor shall meet the requirements for all temporary facilities as specified in the General Conditions including, but not limited to, the following:
 - a. Temporary telephone and internet service.
 - b. Storage sheds.
 - c. Temporary water service.
 - d. Temporary lighting.
 - e. Temporary electrical service.
 - f. Temporary sanitary facilities.
 - g. Temporary fire protection.
 - h. Safety precautions.
 - i. Contractor's Field Office.
2. No temporary facilities of any type are to be provided by the Owner as part of the proposed project improvements identified within the Contract Documents.

- B. All construction temporary facilities and controls shall remain the property of the Contractor establishing them and shall be maintained in a safe and useful condition until removed from the Project.

1.02 Temporary Water

- A. The Contractor shall furnish and install temporary water service(s) for use throughout construction period, including, but not limited to, the following:
 - 1. Water for construction purposes (compaction, concrete, testing, dust control, etc.).
 - 2. Water for other purposes
 - a. Testing.
 - b. Temporary sanitary facilities.
 - c. Cleaning.
 - d. Potable water source (separate).
- B. Maintain adequate volume of water for all purposes.
- C. Water Source
 - 1. Supplier: Owner
 - 2. Potable water used shall be separately metered and protected with approved back flow prevention devices. **Potable water used will be billed to the Contractor at the Owner's current utility rates or a "constant" monthly fee can be negotiated between the Owner and Contractor.** Bills shall be paid promptly upon receipt of the bill. If the bill is not paid "on-time", the Project will be shut-down and all lost time, manpower and associated costs will be borne by the Contractor.
- D. The Contractor shall maintain strict supervision over the use of temporary services, including, but not limited to, the following:
 - 1. Enforce conformance with applicable codes and standards.
 - 2. Enforce sanitary practices.
 - 3. Prevent the waste of water.
 - 4. Prevent abuse of services.

E. Costs of Installation and Operation

1. The Contractor shall obtain and pay for all permits, and all fees and deposits required by governing authorities.
2. The Contractor shall pay all costs for water used by all trades, including costs of installation, maintenance, and removal of pipe, meters, and equipment.
3. Potable water used shall be separately metered and protected with an approved back flow prevention device(s). Potable water used shall be controlled.

F. Requirements of Regulatory Agencies

1. The Contractor shall obtain and pay for all permits, and all fees and deposits required by governing authorities.
2. Comply with the National Electric Code (NEC).
3. Comply with federal, state and local codes and regulations and with utility company requirements.
4. Comply with the County Health Department regulations.

1.03 Temporary Electricity

- A. The Contractor shall furnish and install temporary electric power service for all construction needs throughout the construction period including, but not limited to, the following:
1. Power centers for miscellaneous tools and equipment used in construction work.
 - a. Locate so that power is available at any desired point with no more than a 100-foot extension.
 - b. Provide a weatherproof distribution box with a minimum of four (4), 20 amp, 120 volt grounded outlets with GFCI protection.
 - c. Provide circuit breaker protection for each outlet.
 - d. Provide equipment grounding continuity for the entire system.
 - e. Users shall provide grounded, Underwriters Laboratories, Inc. (UL) approved extension cords from the power center to points of operations.

2. Power for construction equipment.
3. Power for testing and checking equipment.
4. Power for welding units and for other equipment having special power requirements.
5. Power for Contractors and Subcontractors.
6. Power for all field offices.

B. Capacity

1. Adequate electrical service for construction use by all trades at the Project Site during the entire construction period.
2. Notify the Power Company if unusually heavy loads such as welding, and other special power requirements, will be connected.
 - a. Provide special circuits for heavy load requirements.
 - b. Do not overload any circuit.

C. Power Source

1. Supplier: Florida Power and Light (FPL)
2. Provide minimum 120/240 volt, single phase, 60 hertz power service to the Project site. The use of portable generators is allowed, however, it is recommended to disconnect the temporary power from the power company metered power supply prior to using portable generators. If fuel powered generators are used, ConVault type fuel containment systems shall be utilized for fuel storage.

D. Maintain strict supervision of use of temporary services

1. Enforce conformance with applicable standards.
2. Enforce safe practices.
3. Prevent abuse of services.

E. Costs of Installation and Operation

1. ***The Contractor shall pay all costs of temporary electrical power used***, including costs of installation, meter, maintenance, and removal of temporary services from the point of connection.

F. Requirements of Regulatory Agencies

1. The Contractor shall obtain and pay for permits as required by all governing authorities.
2. Comply with applicable codes including, but not limited to, the following:
 - a. National Electrical Code (NEC).
 - b. National Electrical Safety Code (NESC).
 - c. National Fire Protection Association (NFPA).
 - d. Federal, state and local codes and utility company regulations.

1.04 Temporary Sanitary Facilities

- A. Furnish and install temporary sanitary facilities for use throughout the construction period. Existing facilities, private property facilities, school facilities and the Owner's facilities, if any, shall not be used. The temporary facilities herein, include, but are not limited to, the following:
1. Potable water for construction personnel
 - a. Portable containers to dispense drinking water. Provide cups for use by all employees at the Project Site.
 - b. Maintain the temperature between 45°F (7.5°C) and 55°F (13°C).
 2. Enclosed toilet facilities for construction personnel.
 3. General employee washing facilities.
 4. ***The Owner's facilities shall not be used by any construction personnel.***

B. Minimum number of fixtures

1. Toilets and Urinals

- a. For less than 20 employees: One (1) toilet.
- b. For 20 or more employees: One (1) toilet and one (1) urinal per 40 workers.

2. Washing Facilities

- a. Adequate for the number of employees and for the type of work requiring washing facilities.

C. Maintain strict supervision of use of facilities

- 1. Enforce conformance with applicable standards.
- 2. Maintain, service and clean facilities.
- 3. Enforce proper use of sanitary facilities.
- 4. ***Prohibit Contractor/subcontractor use of the Owner's facilities.***

D. Cost of Installation and Operation

- 1. Pay the costs of temporary sanitary facilities, including costs of installation, maintenance and removal.
- 2. Costs of Water: As specified in Article 1.02(C)(2) and 1.02(E)(2), herein.
- 3. Pay the service charges for the use of portable sanitary units.

E. Facility Locations

- 1. Within each project site at a location(s) approved by the Owner and Engineer.
- 2. Drinking Water: Convenient to work stations.
- 3. Toilet and washing facilities
 - a. Secluded from public observation.

b. Convenient for use of personnel in relation to work stations.

4. Obtain acceptance of facility locations from the Owner and Engineer .

F. Enclosure for Toilet Facilities

1. Weatherproof, sight-proof, sturdy temporary enclosures.

2. Insect-proof screening, adequate natural ventilation.

G. Requirements of Regulatory Agencies

1. Obtain and pay for all permits as required by governing authorities.

2. Comply with federal, state, and local codes.

1.05 Temporary Ventilation

A. The Contractor shall provide, operate and furnish power for temporary ventilation required for:

1. The proper installation and curing of materials.

2. Installation of materials and equipment in confined spaces.

3. The safety of the workmen.

1.06 Temporary Fuel Supply

A. The Contractor shall provide for all temporary fuel supply needs and specified herein and the General Conditions. A temporary fuel supply, for all types of fuel, shall be supplied as needed for running Contractor furnished tools and equipment

B. Temporary fuel supply tanks and equipment shall be of the double wall containment type with delivery systems that prevent accidental spillage of fuel.

C. Road capable vehicles or portable equipment that require fuel shall not be fueled "on-site".

- D. **Accidental spills shall be cleaned up immediately.** Any site impact containment of soils shall be remediated to the satisfaction of all governing agencies at the Contractor's cost.

1.07 Temporary Telephone

- A. The Contractor shall provide, for himself, at least one of the following:
 - 1. One (1) direct line telephone with a loud outside bell at the trailer(s); or
 - 2. Cellular phone service for the site superintendent/foreman.
- B. The Contractor shall have **high-speed internet** service at the field construction office.
- C. The Contractor shall pay for all telephone bills resulting from the use of services from the Contractor's Field Office(s) as part of the Contract. The bills to be paid shall include, but are not limited to, installation charges, monthly telephone service, all telephone calls (local and project-related long distance calls), monthly "high speed" internet service, throughout the entire construction period.

1.08 Temporary Pumping, Site Drainage, Erosion and Mud Control

- A. The Contractor shall refer to Section 01570, "Temporary Erosion and Sedimentation Control" for detailed erosion control requirements.
- B. The Contractor shall **keep the project site free from water at all times** to permit continuous access and to prevent damage to the Work.
- C. The Contractor shall comply with all of the requirement presented in Section 02075, "Dewatering and Drainage".
- D. Provide for the drainage of stormwater onto or off of the Project site in performance of the work. Drainage facilities shall be adequate to prevent damage to the work, project sites, and adjacent properties.
- E. Existing drainage channels and conduits shall be cleaned, enlarged or supplemented as permitted by drainage control agencies to carry all runoff attributable to Contractor's operations. Dikes shall be constructed to divert runoff from entering adjacent property (except in natural channels), to protect City's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided to prevent downstream flooding and waterway contamination.

- F. Install silt barriers, turbidity curtains and screens for capturing sediment/solids from erosion and liquids from temporary pumping and dewatering activities.
- G. ***Prevent erosion of soil on the Project Site and adjacent properties resulting from the Contractor's construction activities.*** Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection. Install silt barriers or screens for capturing sediments/solids from erosion and dewatering activities.
- H. Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast growing vegetation or other suitable ground cover shall be provided as necessary to control runoff.
- I. ***Perform dust and mud control operations to prevent construction operations*** at the Project construction site from producing dust and mud in amounts harmful to persons or causing a nuisance to persons living nearby or occupying buildings in the vicinity of the work. The Contractor shall use water or a dust preventative to control dust during throughout the construction period. Their supply and application shall be at the expense of the Contractor. The Contractor shall take all steps necessary to prevent the tracking of mud onto facility roadways, adjacent streets and highways.
- J. The Contractor shall be responsible for procuring and paying for all required permits associated with temporary pumping and site drainage.

1.09 Material Hoists and Cranes

- A. Provide material hoists required for normal use by all trades and employ skilled hoist operators. Provide all necessary guards, signals, safety devices, etc., required for safe hoist operation.
- B. The construction and operation of material hoists shall be in accordance with the applicable ANSI Standards, the "Manual Code of Accident Prevention in Construction" of the Associated General Contractors of America, OSHA, and of other Federal, State, and municipal codes or ordinances.
- C. The Contractor shall prohibit the use of hoists for transporting personnel. Hoists shall be located to avoid risk of damage to completed work.
- D. Special rigging and hoisting facilities shall be provided by each trade requiring their use.

- E. The Contractor shall employ a crane and certified operator, as necessary, from a local professional crane firm, to facilitate the Work in accordance with the Contract Documents.

1.10 Temporary Runways, Chutes, Scaffolding and Ladders

- A. Provide temporary ladders, chutes, ramps, and runways as required for performance and inspection of the Work. The above facilities shall be constructed and maintained in accordance with the applicable Federal, State, and Municipal regulations and codes.
- B. Furnish, erect, and maintain all scaffolding required for the Project Work. Scaffolding shall be constructed and maintained in accordance with applicable State and Federal laws and local ordinances. Scaffolding shall be promptly removed after serving its purpose.
- C. The structural strength and safety of scaffolding, runways, chutes, covers, railings, ladders, stairs, etc., and compliance with all laws and regulations shall be the sole responsibility of the Contractor.
- D. No materials shall be dropped from structures except through enclosed wooden or metal chutes which shall be provided and maintained as required for the performance of the work by the various trades.

1.11 Temporary Roadways and Parking Areas

- A. Construct temporary roadways and parking areas within the Project Site as required to provide proper access to the site for delivery of material and equipment of all trades.
- B. Construct temporary parking areas for the Contractor's Field Office(s), at the Project Site, in accordance with Article 2.06 of this Specification Section.
- C. At completion of the Project Work or when directed by the Engineer, surfacing and sub-base material used for the temporary road and parking areas shall be removed, unless otherwise approved by the Engineer, disposed of in a legal manner and the area restored to its natural condition as required by the Owner.

1.12 Project Signs

- A. As soon as practicable after Award of the Contract, the Contractor shall furnish and erect one (1) sign for the Project at the entrance of the project site, placed at a location to be determined by Engineer and Owner.

- B. The Project sign shall be erected before the Work is started and shall be suitably supported, braced, and maintained, and shall be removed upon completion of the project or when directed by the Engineer. The Project Sign shall meet the requirements presented in Section 01580, "Project Identification and Signs".
- C. ***The Contractor shall submit***, in accordance with Section 01300, "Shop Drawings, Submittals and Samples", and Section 01580, "Project Identification and Signs", an 11-inch x 17-inch AutoCAD drawing of the project sign ***to the Engineer for approval prior to final preparation of the sign and installation.***
- D. No other signs will be permitted.

1.13 Security

- A. The Contractor shall, at all times, be responsible for the security required in all project areas and shall provide all reasonable protection to prevent damage, injury or loss to employees on the Work and all other persons who may be affected thereby; all the work materials and equipment to be incorporated therein, whether in storage on or off the project site, under the care, custody or control of the Contractor or any subcontractors; and any other property under the care, custody or control of the Contractor or any subcontractors. The Contractor shall be responsible for such security and safety until final acceptance of the Work
- B. Full-time watchmen ***will not*** be specifically required as a part of the Contract, but the Contractor shall provide inspection of work area daily and shall take whatever measures are necessary to protect the safety of the public, workmen, and materials, and provide for the security of the site, both day and night.

1.14 Construction Solid Waste Disposal

- A. ***The Contractor shall provide at least one (1) roll-off container for construction debris for the duration of the construction contract.***

1.15 Fire Danger

- A. The Contractor shall minimize fire danger in the vicinity of and adjacent to the Project construction site. The Contractor shall provide labor and equipment to protect the surrounding private property from fire damage resulting from construction operations.

- B. All costs arising from fire or the prevention of fire shall be at the expense of the Contractor.

1.16 Construction Staking

- A. The Contractor shall provide all construction staking for the Work.

2. PRODUCTS

2.01 Materials

- A. Materials may be new or used, but must be adequate for the purpose required, sanitary and must not violate requirements of applicable codes.
- B. At the Contractor's option, patented specialty products may be used, in compliance with applicable codes.

2.02 Electricity

- A. Refer to Article 1.03 within this Specification Section.
- B. Comply with the requirements of Division 16, "Electrical".
- C. Provide the required facilities, including transformers, conductors, poles, conduits, raceways, breakers, fuses and switches.
- D. Provide the appropriate enclosures for the environment in which used, in compliance with NEMA standards.

2.03 Temporary Sanitary Facilities

- A. Refer to Article 1.04 within this Specification Section.
- B. Drinking Water Facilities (Portable Containers)
 - 1. Tightly closed, and equipped with dispensing tap.
 - 2. Clearly label contents.

3. Do not use for any other purposes.
4. Provide single-service disposable cups, with a sanitary container for unused cups, and waste receptacles for used cups.

C. Toilet Facilities

1. Portable Toilets shall be either: (1) chemical toilets; (2) recirculating toilets; or (3) combustion toilets.
2. Toilet Tissue: Provide at each toilet, on a suitable dispenser.

2.04 Contractor's Field Office(s) and Facilities

A. Specific Requirements

1. Provide either a separate building or a trailer of adequate floor space for the Contractor's use at the Project Site.
2. The trailer(s) shall be weather-tight, have a tight level floor at least eight (8) inches off the ground, shall be insulated, have suitable screened ventilation and a solid door. The Contractor shall provide temporary wooden steps and a landing with handrailing for ingress and egress to the office. The landing, steps and handrailing shall be constructed using new pressure treated lumber in accordance with local building codes and ordinances.
3. The office shall be provided with a weekly janitor service, heating equipment, water, approved fire extinguisher(s), electrical wiring, outlets and fixtures suitable to light the tables and desks adequately.
4. Toilet facilities are to be included with a holding tank to be pumped clean daily by the Contractor. Garbage shall be collected daily and clean-up of the trailer(s) shall be provided at least three (3) times per week.
5. Lighting and Temperature Control
 - a. Central heat and air-conditioning system capable of maintaining the trailer(s) between 65°F and 80°F with a heat strip and thermostat control (minimum 12,000 BTU (1-ton) rating).
 - b. The trailer(s) shall be provided with sufficient ceiling mounted lights per current lighting standards.

B. Furniture and Equipment

1. The office(s) shall have the following furniture and equipment:
 - a. Telephone: The Contractor shall provide one (1) direct line telephone with a loud outside bell at the trailer or cellular phone service for the site superintendent/foreman.
 - b. Internet: **High-speed internet access is required.**
 - c. Racks and file for Project Record Documents.
 - d. Other furniture and furnishings: Contractors' option.
- C. Within ten (10) days after issuance of the Notice to Proceed, submit a sketch showing the proposed number and locations; including storage sheds and trailers.
- D. The Contractor shall locate all temporary construction offices and storage trailers in locations approved by the Owner and the Engineer.

2.05 Engineer's Field Office

- A. An Engineer's field office trailer **will not** be required on this project. **An office space in the Contractor's Field office/trailer shall be provided for the Engineer resident project representative.**

2.06 Temporary Parking

- A. Provide a location, approved by the Engineer, for a gravel (12-inch minimum depth) or other suitable surface for the Contractor's employees, Engineer's representatives and visitor parking. Personal vehicles will be restricted from the work area.
- B. Provide gravel parking space at the Contractor's trailer(s) for a minimum of four (4) vehicles.

2.07 Security Lighting

- A. Provide for adequate pole-mounted flood lights for the parking area at the Contractor field office area. Maintain lighting on a photocell or timer.

2.08 Temporary Structures

A. Temporary Fences/Structures

1. If, during the course of the work, it is necessary to remove or disturb any needed fence or structure, or part thereof, the Contractor shall provide a suitable temporary fence or structure at his own expense.
2. The original fence or structure shall be replaced to at least its original condition, once the work is completed. The Project site shall remain secure at the perimeter at all times during the construction.

B. Temporary Controls/Power

1. If, during the course of the work, it is necessary to provide temporary means to control or power existing or new equipment until the final equipment is completed, the Contractor shall provide a suitable temporary equipment at his own expense.

C. Responsibility for Temporary Work

1. In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary 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.

3. EXECUTION

3.01 General

- A. Install the Work in a neat and orderly manner.
- B. Make structurally sound throughout.
- C. Maintain to provide continuous service.
- D. Modify and extend services as the Project Work progress requires.
- E. ***The Contractor's Field Office shall be delivered to the Project Site and made suitable for occupation (all facilities and services specified herein shall be fully operational) within ten (10) days after the Notice to Proceed.***

- F. ***The Contractor's Field Office shall be removed from the Project Site at Final Project Acceptance by the Owner*** and the area fully restored to its natural condition prior to construction and in a manner approved by the Engineer.

3.02 Temporary Water

A. Locate piping and outlets

1. Provide service convenient to work stations.
2. Avoid interference with:
 - a. Traffic and work areas.
 - b. Materials handling equipment.
 - c. Storage areas.

B. Do not run piping on the floor or on the ground.

C. When necessary to maintain pressure, provide temporary pumps, tanks, and compressors.

3.03 Temporary Electricity

A. Service and distribution may be overhead or underground.

B. Locate temporary electricity to avoid interference with the following:

1. Traffic, work and storage areas.
2. Cranes.
3. Material handling equipment

C. Do not run branch circuits on the floor or on the ground.

D. Wire all safety devices specified for final operation of the equipment.

E. Check the operation of all safety devices.

3.04 Temporary Sanitary Facilities

A. Portable Toilets

1. Erect toilets securely and anchor them to prevent dislocation or tipping over.
2. All sanitary waste shall be collected from the sanitary facilities a minimum of three (3) times per week by a licensed sanitary waste management contractor to prevent accumulation of wastes and creation of unsanitary conditions and odors.
3. Portable toilet shall be used unless wastewater and water service can be provided to site.

B. Washing Facilities

1. Provide faucets, drains and other washing facilities suitable for the type of work requiring washing.

3.05 Location of Construction Trailer(s)

- A. The Contractor shall locate the field office and construction trailer(s) where indicated on the Contract Drawings or as indicated by the Engineer and Owner.
- B. A “staging area” for delivered equipment stored outdoors, or for temporary storage trailers and sheds, shall be separated from the trailer area, as located on the Contract Drawings or as indicated by the Engineer and Owner.

3.06 Temporary Fuel Systems

- A. Install and maintain temporary diesel fuel tanks in a manner to avoid accidental spillage of fuel.
- B. Facilities shall be kept out of the path of normal vehicular traffic, including temporary fuel feed lines.

3.07 Removal of Temporary Materials and Equipment

- A. Completely remove all temporary materials, equipment, facilities, services and controls and legally dispose of them upon completion of construction.

- B. Clean, and repair damage caused by installation of the temporary facilities and restore the area to the specified, or original condition. All areas shall be solid sodded, after removal of temporary materials, equipment and construction trailer(s), in accordance with Section 02815, "Solid Sodding".

END OF SECTION

SECTION 01505

PEST CONTROL

1. GENERAL

1.01 Description

A. Scope of Work

1. The Work included in this Section consists of all labor, materials and equipment necessary to provide pest control treatment for the following “new” buildings:
 - a. Sanford Main WTP Operations Building.

B. Related Work Specified Elsewhere

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
00805	FDEP Supplementary Conditions

1.02 Submittals

- A. Submit the manufacturer's technical and application instructions in accordance with Section 01300, “Shop Drawings, Submittals and Samples”.
- B. Submit specific product warranty as specified herein.

1.03 Quality Assurance

- A. In addition to the requirements of these specifications. comply with the manufacturer's instructions and recommendations for work, including preparation of substrate application.

- B. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.
- C. Use only chemicals that bear a Federal registration number of the U.S. Environmental Protection Agency.

1.04 Specific Product Warranty

- A. ***Furnish a written warranty***, certifying that the applied insecticide treatment will prevent infestation of common household insects such as cockroaches, ants, and fleas.
- B. If insect activity is discovered during warranty period, re-treatment shall occur at no additional cost to the Owner.

2. PRODUCTS

2.01 Pest Control Solution

- A. Use an emulsible concentrated insecticide for dilution with water, specially formulated to prevent infestation by insects. Fuel oil will not be permitted as a diluent. Provide in a solution form for approval by the Engineer.
- B. Other solutions may be used as recommended by the Applicator if also acceptable to the Engineer and approved for the intended application and that meets all State and Federal Regulations.
- C. Use only insecticide treatment solutions that are not injurious to planting.

3. EXECUTION

3.01 Application

- A. Surface Preparation shall include, at a minimum, the removal of foreign matter that could decrease treatment effectiveness on areas to be treated.
- B. Application Rates
 - 1. Mix chemicals (from sealed containers) with water, at the job-site.

2. Apply the concentrate solution only at rates described by the manufacturer on the product label and in compliance with State of Florida laws.
- C. Post signs in areas of application to warn workers that insecticide treatment has been applied. Remove signs when areas are covered by other construction.
- D. Re-apply concentrate solution to areas disturbed by construction activities following application.
- E. The Applicator shall mix all treatment on-site and mixing shall be witnessed by the Owner's representative.
- F. ***The Applicator shall treat the buildings identified in Article 1.01(A)(1), at a frequency of once per month, starting when each building is "dried in" with windows, doors and roofing. The last two (2) treatments shall be applied at Substantial Completion and at thirty (30) days after Substantial Completion.***
- G. The Applicator shall treat all interior spaces of the buildings identified in Article 1.01(A)(1), including but not limited to, each side of the bottom of all interior walls, interior side of exterior walls, the bottom of vinyl bases, the perimeter of windows, the bottom of the exterior side of exterior walls, and any other areas openings on the exterior side of all buildings.

END OF SECTION

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SECTION 01510

MOBILIZATION / DEMOBILIZATION

1. GENERAL

1.01 Description

- A. Mobilization shall include the costs of obtaining all permits, insurance and bonds, moving onto the Project sites; all facets of construction for the Project, furnishing and erecting facilities, equipment, systems, temporary buildings, and other construction facilities; all facets of construction activities on the Project Site all as required for the proper performance and completion of the Work. Mobilization shall include, but not be limited to, the following principal items:
1. Move onto the site all Contractor's plant and equipment required for the first month's operations.
 2. Install temporary construction power, wiring, and lighting facilities.
 3. Establish a fire protection plan and safety program (shall meet all local, state and federal requirements).
 4. Secure a construction water supply.
 5. Provide field office trailer(s) for the Contractor as specified. ***The office/trailer shall be set-up and complete within ten (10) days after the Notice to Proceed.***
 6. Provide on-site sanitary facilities and potable water facilities as specified.
 7. Arrange for and erect the Contractor's work and storage yard and employee's parking facilities.
 8. Submit all required insurance certificates and bonds.
 9. Obtain all required permits.
 10. Post all OSHA, FDEP, EPA, Department of Labor, and all other required notices.

11. Have the Contractor's **English-speaking** superintendent at the job site "**full time**".
12. Submit a detailed construction CPM schedule acceptable to the Engineer as specified.
13. Submit a Schedule of Values (SOV) for the Work as specified.
14. Submit a schedule of submittals as specified.
15. **All employees shall:**
 - a. Pass a **Criminal Background Check** per Section 00425.
 - b. Have **state-issued identification badges** prior to coming "on-site".

1.02 Demobilization

- A. Demobilization is the timely and proper removal of all Contractor owned material, equipment or plant, from the job site and the proper restoration or completion of work necessary to bring the site into full compliance with the Contract Documents.

1.03 Payment for Mobilization/Demobilization

- A. The Contractor's attention is directed to the condition that **payment for mobilization/demobilization or any part thereof, shall not exceed three (3) percent of the Total Contract Price.**

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01530

CONSTRUCTION AIDS

1. GENERAL

1.01 Description

A. Scope of Work

1. Furnish, install and maintain required construction aids for completion of the work associated with the Project.
2. Remove all construction aids on completion of Work.

B. Related Work Specified Elsewhere

Specification Section	Title
01010	Summary of Work

- ##### **C. Comply with the applicable requirements specified in the Project Contract Documents.**

2. PRODUCTS

2.01 Materials

- ##### **A. Materials may be new or used, suitable for the intended purpose, but must not violate the requirements of applicable codes, standards, and regulations.**

2.02 Construction Aids

- ##### **A. Provide construction aids and equipment required by personnel and to facilitate execution of the Work: scaffolds, staging, ladders, stairs, ramps, runways, platforms,**

- railings, hoists, cranes, chutes and other such facilities and equipment such as temporary valves and fittings. Refer to respective specification sections for the particular requirements for each trade.
- B. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.
 - C. Maintain facilities and equipment in a “**first-class**” condition.

3. EXECUTION

3.01 Preparation

- A. Consult with the Engineer, review site conditions and factors which affect the construction procedures and construction aids, which may be affected by execution of the Work.

3.02 General

- A. Comply with applicable requirements specified in the Project Contract Documents.
- B. Relocate construction aids as required by the progress of construction, by storage of work requirements and to accommodate legitimate requirements of Owner and other contractors employed at the site.

3.03 Removal

- A. Completely remove temporary materials, equipment and services:
 - 1. When construction needs can be met by use of permanent construction.
 - 2. At completion of the Work.
- B. Clean and restore areas damaged by installation and by use of temporary facilities.
 - 1. Remove foundations and underground installations for construction aids.
 - 2. Grade and grass areas of the site affected by temporary installations to required elevations, slopes, ground cover and clean the area.

- C. Restore permanent facilities used for temporary purposes to the specified condition or in kind if not specified.

END OF SECTION

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SECTION 01550

MAINTENANCE OF TRAFFIC

1. GENERAL

1.01 Scope of Work

A. This Section covers procedures for developing and implementing traffic control and regulation measures and maintenance of traffic in and around the construction area to provide for safe and efficient protection and movement of vehicular and pedestrian traffic/through and adjacent to the construction site areas.

B. Related Work Specified Elsewhere

Specification Section	Title
01500	Temporary Facilities
02500	Asphaltic Pavement
Division	Information
2	Sitework

1.02 Terminology

A. The term "*Maintenance of Traffic*" as used herein, shall include all facilities, devices, traffic control personnel, and operations as are required for the safety and convenience of the public as well as for minimizing public nuisance.

1.03 References

A. Codes, Specifications and Standards

1. 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 the Advertisement for Bids. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.

2. Codes, specifications, and standards referred to by number or title shall form a part of this Specification to the extent required by the reference thereto. Latest revisions shall apply, unless other wise shown or specified.
3. In case of a conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.
4. The publications listed in Table 01550-1 form a part of the Specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

Table 01550-1: Referenced Publications	
	FDOT Manual State of Florida Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations
	FDOT Specifications Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Latest Edition
	FDOT Standards Florida Department of Transportation Roadway and Traffic Design Standards, Latest Edition
	Manual on Uniform Traffic Control Devices

1.04 Submittals

- A. All items associated with maintenance of traffic and this Project shall be submitted to the Engineer for approval in accordance with Section 01300, "Shop Drawings, Submittals and Samples, prior to construction.
- B. Before closing or restricting traffic flow through any thoroughfare or the internal roadway(s) within the treatment facility site, the Contractor shall give written notice to and, if necessary, obtain a permit or permits from the duly constituted public authority having jurisdiction over the thoroughfare. The Contractor shall also notify the applicable law enforcement, fire, and emergency services having jurisdiction in the area. Notice shall be given no less than seventy-two (72) hours in advance of the time when it may be necessary in the process of construction to close or restrict traffic to such thoroughfare, or as may be otherwise required by the governing authority.

- C. ***The Contractor shall prepare and submit a Maintenance of Traffic (MOT) Plan or Traffic Control Plan (TCP)*** . The MOT shall comply with County Code and Federal and State criteria, specifically MUTCD and FDOT 600 Series Indexes. Each MOT shall include, but not be limited to, the following:
1. Each MOT shall show the posted speed limits.
 2. The MOT for work outside the travel lanes can consist of the legible dimensioned sketch of field conditions, position and type of traffic control devices and a brief description of intended work, type of right of way encroachment, time and work duration.
 3. The MOT requiring a full or partial closure will provide full information as above, and dimensioned legible sketch of conditions and MOT. Based on the complexity of the project, the Engineer may require a Professional Engineer (P.E.) sign and seal plans. This requirement may be satisfied if the MOT is prepared by a company having trained and design certified personnel.
 4. The MOT for larger projects (i.e., subdivision entrance with deceleration lanes and overlay) will require that the plans be signed and sealed by a Professional Engineer (P.E.) The MOT shall detail individual phases.
 5. The TCP shall include the listing of all agencies (police, fire, emergency, utilities) and phone numbers to be contacted (72 hours) before and during MOT.
 6. During the construction of the Project, an MOT trained and certified person shall be present. The level of certification depends on type and complexity of the job (flagman, ATSSA Certified Worksite Traffic Supervisor, etc.).
 7. Any changes in the MOT shall be supervised by trained and responsible personnel (i.e., ATSSA Inspector). It includes active to non-active, day to night and phasing.
 8. The Contractor may choose to provide professional services from such firms as Bob's Barricades, Traffic Control Devices, Inc., Control Specialists, Inc., etc. The TCP and onsite MOT shall clearly display the names and emergency phone number of the MOT responsible person.

1.05 Site Conditions

- A. The Contractor shall plan construction operations such that existing local traffic access can be maintained and shall maintain during the construction such barricades, lights, flagmen, and other protective devices as appropriate, whether specified for the project or required by the local governing authority. Traffic control devices used for maintenance of traffic shall comply with the FDOT Manual.

- B. ***The Contractor shall conduct his work in such manner as not to unduly or unnecessarily restrict or impede normal traffic through the streets of the community or within the treatment facility site.*** Insofar as it is practicable, excavated material and spoil banks shall not be located in such manner as to obstruct traffic. The traveled way of all streets, roads, and alleys shall be kept clear and unobstructed insofar as is possible and shall not be used for the storage of construction materials, equipment, supplies, or excavated earth, except when and where necessary.
- C. If required by duly constituted public authority, the Contractor shall, at his own expense, construct bridges or other temporary crossing structures over trenches so as not to unduly restrict traffic. Such structures shall be of adequate proper construction and shall be maintained by the Contractor in such manner as not to constitute an undue traffic hazard. Private driveways shall not be closed except when and where necessary, and then only upon due advance notice to the Engineer and the Owner and for the shortest practicable period of time consistent with efficient and expeditious construction. The Contractor shall be liable for any damages to persons or property resulting from his work.
- D. The Contractor shall make provisions at cross streets for the free passage of vehicles and foot passengers, either by bridging or otherwise, and shall not obstruct the sidewalks, gutters, or streets, nor prevent in any manner the flow of water in the latter, but shall use all proper and necessary means to permit the free passage of surface water along the gutters. The Contractor shall immediately cart away all offensive matter, exercising such precaution as may be directed by the Owner. All material excavated shall be so disposed of as to inconvenience the public and adjacent tenants as little as possible and to prevent injury to trees, sidewalks) fences) and adjacent property of all kinds. The Contractor may be required to erect suitable barriers to prevent such inconvenience or injury.
- E. Unless otherwise required by the governing authority, maintenance of traffic in and around the construction zone shall conform to Section 102 of the FDOT Specifications, and 600 Series Roadway Design Standards drawings of the FDOT Standards, as applicable.

1.06 Qualifications

- A. Provide at least one (1) employee in the field (superintendent or foreman) who holds an IMSA (International Municipal Signal Association) Work Zone Traffic Control Safety Certification.
- B. This certified employee shall be on the job site when the traffic control measures are installed and when work is occurring within the zones.

2. PRODUCTS - NOT USED

3. EXECUTION

3.01 Site Preparation

- A. Contact property owners affected by the construction. Coordinate temporary driveway closures and sequencing. Maintain access for all property owners during construction.
- B. Remove existing pavement markings, as required, and remove or relocate existing signs as necessary to implement traffic control.
- C. Install signs, markings, barricades in accordance with approved traffic control plan.
- D. Implement lane closures in accordance with the “approved” traffic control plan.
- E. Perform work in a manner that will cause minimum interruptions to traffic.
- F. Place excavated material outside roadway clear zones, and away from pedestrian facilities.
- G. All trenches shall be backfilled each day prior to the completion of construction activities.
- H. Where special hazards exist, install traffic control through the use of lighted concrete barriers, barricades, or other such traffic control facilities as needed to ensure public safety.

3.02 Maintenance

- A. Inspect traffic control devices on a daily basis to ensure placement of barricades and function of lights is maintained throughout construction.
- B. Wet unstabilized areas as necessary to control dust.
- C. Adjust traffic control devices as required under emergency conditions.

END OF SECTION

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SECTION 01560

ENVIRONMENTAL PROTECTION

1. GENERAL

1.01 Description

A. Work Specified Herein

1. Environmental Protection References
2. Submittals
3. Environmental Protection Requirements
4. Quality Assurance
5. Natural Resources
6. Erosion and Sediment Control
7. Solid and Sanitary Wastes
8. Hazardous Wastes
9. Dust
10. Abrasive Blasting

B. Related Work Specified Elsewhere

Specification Section	Title
01000	Project Requirements
01300	Shop Drawings, Submittals and Samples
01570	Temporary Erosion and Sedimentation Control
Division	Information
2	Sitework

1.02 Scope of Work

- A. ***Furnish all labor, materials, and equipment to perform all work required for the prevention of environmental pollution in conformance with applicable laws and regulations***, during and as the result of construction operations under this Contract.

For the purpose of this Section, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents that adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.

- B. The control of environmental pollution requires consideration of air, water and land, and involves the management of noise and solid waste, as well as other pollutants.
- C. ***The Contractor shall schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the Work.*** Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching or other special surface treatments as are required to prevent silting and muddying streams, rivers, canals, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 01570, "Temporary Erosion and Sedimentation Control".
- D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.
- E. ***All phases of sedimentation and erosion control shall comply with and be subject to approval of the Florida Department of Environmental Protection (FDEP).*** The Contractor shall prepare sedimentation and erosion control drawings to minimize the impact of the construction activities and meet the requirements of the FDEP. These drawings and control methods must be submitted to the Engineer, and approved, prior to the beginning of Project construction activities. The Contractor shall be responsible for implementing the approved program and meeting all local, state and federal requirements.

1.03 References

- A. The publications listed in Table 01560-1 form a part of the Specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

TABLE 01560-1: REFERENCED PUBLICATIONS	
CODE	DESCRIPTION
29 CFR 1910.94 (SubPart G)	Occupational Health and Environmental Control
40 CFR 112	Oil Pollution Prevention
40 CFR 261	Identification and Listing of Hazardous Waste

TABLE 01560-1: REFERENCED PUBLICATIONS	
CODE	DESCRIPTION
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
40 CFR 403	General Pretreatment Regulations for Existing and New Sources of Pollution
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Tables and Hazardous Materials Communications Regulations
49 CFR 178	Shipping Container Specifications
PL 96-510	Comprehensive Environmental Response Compensation and Liability Act of 1980

1.04 Definitions

- A. Chemical Wastes: *Salts, acids, alkalies, herbicides, pesticides, and organic chemicals.*
- B. Debris: *Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.*
- C. Garbage: *Refuse and scraps resulting from consumption of food.*
- D. Hazardous Materials: *As defined in DOT regulation 49 CFR 171 and listed in 49 CFR 172.*
- E. Hazardous Substances: *As defined in EPA PL 96-510.*
- F. Hazardous Wastes: *Hazardous substances as defined in 40 CFR 261 or as defined by applicable state and local regulations.*
- G. Landscape Features: *Trees, plants, shrubs and ground covers.*
- H. Oily Wastes: *Petroleum products and bituminous materials.*

- I. Rubbish: *Combustible and noncombustible wastes including paper, boxes, glass, crockery, metal, lumber, cans and bones.*
- J. Sediment: *Soil and other debris that have eroded and have been transported by runoff water or wind.*
- K. Solid Wastes : *Rubbish, debris, and other discarded solid materials, except hazardous waste as defined in paragraph entitled, 'Hazardous Waste, resulting from industrial, commercial, and agricultural operations and from community activities.*
- L. Wastewater: *"Sewage" or waste characterized as domestic sanitary sewage.*

1.05 Submittals

- A. **Submit an Environmental Protection Plan (EPP) for the Project Site**, in accordance with Section 01300, "Shop Drawings, Submittals and Samples", of these Contract Documents.
- B. The Environmental Protection Plan (EPP) shall include at a minimum, but is not limited to, the following:
 - 1. Submit the proposed Environmental Protection Plan (EPP) including a preconstruction survey, to the Engineer ***within fifteen (15) days after the Notice to Proceed.***
 - 2. Identify the hazardous wastes expected to be generated and submit a management and disposal plan before commencing work.
 - 3. Submit a copy of a laboratory analysis of debris collected as a result from abrasive blasting operations before disposing of debris.
 - 4. Submit details of Dewatering and Drainage Plan in accordance with Section 02075, "Dewatering and Drainage".

1.06 Notifications

- A. The Engineer will notify the Contractor, in writing, of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor, in writing, through the Engineer, of any non-compliance with local, state or federal requirements. After receipt

- of such notice from the Engineer or from the regulatory agency through the Engineer, the Contractor shall immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose.
- B. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken.
 - C. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.
 - D. Failure to notify the Contractor of any non-compliance by the Engineer does not relieve the Contractor of the responsibility to comply with the foregoing provisions.

1.07 Quality Assurance

A. Environmental Protection Requirements

1. Provide and maintain, during the life of the contract, environmental protection as specified.
2. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice.
3. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project.
4. Comply with Federal, state and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances and noise pollution.

1.08 Implementation

- A. Prior to commencement of the Work, the Contractor shall meet with the Engineer to develop mutual understandings relative to compliance with these provisions and administration of the environmental pollution control program.
- B. Remove temporary environmental control features, when approved by the Engineer, and incorporate permanent control features into the Project at the earliest practicable time.

2. PRODUCTS - NOT USED

3. EXECUTION

3.01 Asbestos

- A. Materials containing asbestos should not be located on the Project site.
- B. Notify the Engineer immediately if asbestos materials are encountered.

3.02 Erosion Control

- A. Provide positive means of erosion control such as shallow ditches around construction activities to carry off surface water. The Contractor shall refer to Section 01570, "Temporary Erosion and Sedimentation Control".
- B. Erosion control measures, such as siltation basins, hay check dams, mulching, jute netting and other equivalent techniques, shall be used as appropriate.
- C. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas.
- D. At the completion of the work, ditches shall be backfilled and the ground surface restored to the original condition or as proposed on the Contract Drawings.

3.03 Protection of Streams and Surface Waters

- A. ***Take all precautions to prevent, or reduce to a minimum, any damage to any stream, drainage channel, canal or surface water*** from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near such natural resources.
- B. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the surface waters shall not be directly returned to the surface water. Divert such waters through a settling basin or filter before being directed into surface waters.

- C. **Do not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water or any storm sewer.** Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.
- D. Take all preventative measures to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the FDEP. **Submit two (2) copies of approved contingency plans to the Engineer for review and approval.**
- E. Water being flushed from structures or pipelines after disinfection, with a chlorine residual of 0.01 mg/L or greater, **shall be treated with a dechlorination solution**, in a method approved by the Engineer, prior to discharge.

3.04 Protection of Land Surfaces

- A. Restore land resources within the project boundaries and outside the limits of permanent work to a condition, after completion of construction, that will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas shown on the Contract Drawings or as identified by the Engineer and/or Owner.
- B. **Outside of areas requiring earthwork for the construction of the new facilities, do not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval.** No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. **The Contractor shall, in any event, be responsible for any damage resulting from such use.**
- C. **Before beginning operations near them, protect trees that may possibly be defaced**, bruised, injured, or otherwise damaged by the construction equipment, dumping or other operations, by placing barricades, constructed in accordance with local requirements or as indicated by the Engineer, around them. Monuments and markers shall be protected similarly.
- D. **Any trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored, as nearly as possible, to their original condition.** The Engineer will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of. **The cost of treating, healing, removing, disposal of and replacement of trees or other landscape features shall be incidental to the Contract.**

1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-inch in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted..
 2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Engineer, shall be immediately removed and replaced. **Costs shall be incidental to the Contract.**
- E. The locations of the Contractor's storage and other construction buildings, required temporarily in the performance of the Work, shall be cleared portions of the job site or areas to be cleared as shown on the Contract Drawings and approved by the Engineer and shall not be within wetlands or flood plains. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Contract Drawings showing storage facilities shall be submitted for approval of the Engineer.
- F. If the Contractor proposes to construct temporary roads or embankments and excavations for facility and/or work areas, he shall submit the following for approval at least ten (10) days prior to scheduled start of such temporary work:
1. A layout of all temporary roads, excavations, embankments and drainage to be constructed within the work area.
 2. Details of temporary road construction.
 3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
 4. A landscaping drawing showing the proposed restoration of the area. Indicate the proposed removal of any trees and shrubs outside the limits of existing clearing area. Indicate locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged. The drawing shall provide for the obliteration of construction scars as such and shall provide for a natural appearing final condition of the area. Modification of the Contractor's approved drawings shall be made only with the written approval of the Engineer. No unauthorized road construction, excavation or embankment construction including disposal areas will be permitted.
- G. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials,

or any other vestiges of construction as directed by the Engineer. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near natural conditions that will permit the growth of vegetation thereon. The disturbed areas shall be prepared and sodded as described in Section 02815, "Solid Sodding" or as approved by the Engineer.

- H. All debris and excess material will be disposed of outside wetland or flood plain areas in a legal and environmentally sound manner.

3.05 Protection of Air Quality

A. Burning

1. ***The use of burning at the Project Sites for the disposal of refuse is prohibited.***

B. Dust Control

1. The Contractor will be required to maintain all excavations, embankment, stockpiles, access roads, facility sites, waste areas, borrow areas and all other work areas within or without the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others.
- C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. ***The use of petroleum products is prohibited.*** The use of chlorides may be permitted with prior approval from the Engineer.
 - D. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor must have sufficient competent equipment on the job to accomplish this.
 - E. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Engineer.

3.06 Noise Control

- A. ***Make every effort to minimize noises caused by the construction operations.***

- B. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations.
- C. Noise levels shall not exceed those indicated in Section 01120, "Special Project Procedures".

3.07 Miscellaneous Provisions

- A. Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore the natural resources to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified by the Engineer/Owner.
- B. Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Take precautions to ensure that no oil or other hazardous material is released to the water or land or sanitary sewer system. Environmental requirements for the prevention of oil spills are contained in 40 CFR 112. For oil and hazardous substance spills which may be large enough to violate Federal, State or Local Regulations, verbally notify the Engineer and the Florida Department of Environmental Protection (FDEP) immediately. Immediately clean up spills of oil or hazardous substances which result from the Contractor's operations. The cost of the cleanup shall be borne entirely by the Contractor and shall be incidental to the Contract.
- C. Do not disturb fish and wildlife. Do not alter water flows or otherwise disturb the native habitat on or adjacent to the project, which is critical to the survival of fish and wildlife, except as indicated or specified.
- D. **Preserve, and verbally report immediately to the Engineer, items having possible historical or archaeological interest which are discovered in the course of work.** Protect monuments, markers, and works of art.
- E. Borrow pit areas, on the Owner's property, shall not be allowed.
- F. **Immediately finish the earthwork to its final grade, as indicated or specified.** Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.
- G. **Pick up solid wastes, and place in containers which are regularly emptied.** Prevent contamination of the site and other areas where handling and disposing wastes. On completion, leave the areas clean. **Control and dispose of all wastes in a legal manner.**

- H. ***The Contractor shall transport all wastes off the Project Site and dispose of them in a legal manner*** that complies with federal, state & local requirements at no additional cost to the Owner.
- I. Where the construction project is located in an area where garbage collection is accomplished on a scheduled basis, the Contractor shall place garbage in an appropriate container. In areas where there is no scheduled garbage collection, the Contractor shall transport the garbage to a pickup point or disposal area. The preparation, cooking, and disposing of food are strictly prohibited on the Project sites.
- J. ***Conduct the fueling and lubricating of equipment and motor vehicles to protect against spills and evaporation. Dispose of lubricants and excess oils in a legal manner.***
- K. As indicated previously, keep dust down at all times, including during non-working periods. Do not use dry power brooming, vacuuming, wet mopping, wet sweeping, or wet power brooming is acceptable. Air blowing will be permitted only cleaning non-particulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not shake bags of cement, concrete mortar, or plaster.
- L. Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris. Dispose of abrasive blasting debris.
- M. Perform work involving removal of blasting debris in accordance with 29 CFR 1910.94, SubPart G. Dispose of abrasive blasting debris containing lead in accordance with 40 CFR 262, 40 CFR 263, and 264. Collect dust, sand, paint, and other debris resulting from sandblasting operations and store in fifty-five (55) gallon drums with watertight lids. Take a representative sample of this material, and test for EP toxicity with respect to lead, chromium, and cadmium content. Perform sampling and testing in accordance with 40 CFR 261. Debris shall be transported only by a transporter licensed and permitted for transportation of toxic materials. Dispose of toxic debris in an EPA-approved and permitted facility.

3.08 Maintenance of Pollution Control Facilities During Construction

- A. Maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

END OF SECTION

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SECTION 01570

TEMPORARY EROSION AND SEDIMENTATION CONTROL

1. GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as required by Rules and Regulations and permit conditions.
2. Temporary erosion controls include, but are not limited to, grassing, mulching, setting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends 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 Owner and/or permit conditions.
3. 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 Engineer and Owner and/or permit conditions.
4. ***The Contractor is responsible for providing effective temporary erosion and sediment control measures during construction*** or until final controls become effective. The Contractor shall be responsible for removing and legally disposing of the erosion and sediment control measures installed as part of the Project.

B. Related Work Specified Elsewhere

Specification Section	Title
02220	Excavation, Backfilling and Compaction
02815	Solid Sodding

2. PRODUCTS

2.01 Erosion Control

- A. Sodding and grassing are specified in Section 02815, "Solid Sodding".
- B. Netting shall be fabricated of material acceptable to the Engineer and Owner.

2.02 Sedimentation Control

- A. Bales shall be clean, seed-free cereal hay type.
- B. Netting shall be fabricated of material acceptable to the Engineer and Owner.
- C. Filter stone shall be crushed stone which conforms to Florida Department of Transportation (FDOT) specifications.
- D. Concrete block shall be hollow, non-load bearing type.
- E. Concrete shall be exterior grade not less than one (1) inch thick.

3. EXECUTION

3.01 Erosion Control

- A. The minimum acceptable procedures for grassing are:
 - 1. Scarify slopes to a depth of not less than six (6) inches and remove large clods, rock, stumps, roots larger than ½-inch in diameter and debris.
 - 2. ***Sod within twenty-four (24) hours after the ground is scarified.***
 - 3. Roll and water grassed areas in a manner which will encourage the growth of grass. Resod areas which exhibit unsatisfactory growth. Backfill and resod eroded areas.

3.02 Sedimentation Control

- A. Install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings.

- B. Hay bales which deteriorate and filter stone which is dislodged shall be replaced.

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 State of Florida and/or the U.S. EPA, or the Engineer or Owner, the Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

3.04 Inspection and Maintenance

- A. ***During construction, the Contractor shall provide, at a minimum, weekly or within twenty-four (24) hours of any storm event of 0.25 inches or greater, an inspection of the temporary erosion and sedimentation controls.*** Inspection and maintenance practices shall be at a minimum as follows:
 - 1. No more than twenty-five percent (25%) of the Project Site shall be denuded at any point in time.
 - 2. All measures will be maintained in good working order; if a repair is necessary, it will be initiated within twenty-four (24) hours of report.
 - 3. Built up sediment will be removed from silt fences when it has reached one third ($\frac{1}{3}$) of the height of a fence.
 - 4. Silt fences will be inspected for:
 - a. Depth of sediment.
 - b. Tears.
 - c. To see if the fabric is securely attached to the fence posts.
 - d. To see that the fence posts are firmly in the ground.
 - 5. Temporary and permanent seeding and planting will be inspected for bare spots, washouts, and healthy growth.

6. ***A maintenance inspection report will be made after each inspection. A copy of the report shall be submitted to the Engineer and shall be kept with the stormwater pollution prevention plan.*** A copy of the report form to be completed by the inspector shall be included in the stormwater pollution prevention plan.
7. The site superintendent will select three (3) individuals who will be responsible for inspections, maintenance and repair activities, and filling out the inspection and maintenance report.
8. Personnel selected for inspection and maintenance practices necessary for keeping the erosion and sediment controls used onsite in good working order.
9. The site superintendent will select an individual who will be responsible for the recording of the dates when major grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initialized. These records will be kept with the stormwater pollution prevention plan.

END OF SECTION

SECTION 01580

PROJECT INFORMATION AND SIGNS

1. GENERAL

1.01 Description

A. Scope of Work

1. Furnish, install and maintain project signs at the Project construction site.
2. Remove the signs on completion of construction.
3. Install additional project signs that are designed, approved and fabricated by the Owner, at the location requested by the Owner.
4. Allow no other signs to be displayed.

B. Related Work Specified Elsewhere

Specification Section	Title
01010	Summary of Work
09900	Painting

1.02 Project Informational Signs

- A. One (1) painted sign with lettering, size, color and construction in accordance with the local, state and/or federal requirements at the treatment facility site.
- B. Erect the Project Site sign ***at a location of high public visibility as approved by the Engineer and the Owner prior to placement.***
- C. Sign Information

1. Information on each Project Sign shall contain, at a minimum, the following:

- a. Project name (Sanford Main WTP Improvements).
 - b. Treatment Facility Name (Sanford Main WTP).
 - c. Owner (City of Sanford) title and logo.
 - d. Design Engineer (CPH, Inc.) title and logo.
 - e. Contractor's title and logo.
 - f. Funding Agencies and logo, if any.
2. The size of the lettering for the Project Sign shall be as required by the Engineer and the Owner.
3. Project Sign Colors
 - a. All surfaces of the sign shall initially be painted with three (3) coats of white exterior grade paint.
 - b. The signage, lettering and logos will be painted with two (2) coats of exterior grade paint as follows:
 1. Logo: Colors to match logos of the Owner, Engineer, Contractor, etc.
 2. Lettering: Black Lettering
4. The Project Sign materials shall be as identified in Article 2.01(A-C) of this Specification Section.

1.03 Informational Signs

A. Painted signs with painted lettering, or standard products

1. Size of signs and lettering: As required by the Engineer and Owner, or as appropriate to usage - 4 foot x 8 foot (Submit shop drawings).
2. Color: As required by the Engineer and Owner, otherwise of uniform colors throughout Project.

B. ***Erect at a location, as approved the Owner and Engineer***, to provide the required information.

C. Information

1. Contractor's name and home office address.
2. A list of subcontractors and type of subcontract work.

1.04 Quality Assurance

- A. Sign Painter: Professional experience in the type of work required.
- B. Finishes, Painting: Adequate to resist weathering and fading for the scheduled construction period.

1.05 Submittals

- A. An 11-inch by 17-inch AutoCAD drawing of all Project Sign's (every type) shall be submitted to the Engineer for approval prior to final preparation of the Project signs.

2. PRODUCTS

2.01 Sign Materials

A. Structure and Framing

1. New wood or metal, in sound condition, structurally adequate and suitable for the specified finish.
2. The framing structure shall be designed to provide an even, uniform, smooth-surface without waves or buckles.

B. Sign Surfaces

1. Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

2. The sign thickness shall be as required by standards to span framing members, to provide an even, smooth-surface without waves or buckles.
- C. All hardware shall be galvanized.
- D. All paint to be used shall be exterior quality, waterproof paint as specified in Section 09900, "Painting".
- E. The Contractor shall submit shop drawing of all signs to the Engineer for approval, identifying all sign materials and layouts, prior to sign preparation.

3. EXECUTION

3.01 Project Information Signs

- A. Paint the exposed surface of supports, framing and surface material; one (1) coat of primer and one (1) coat of exterior paint.
- B. Paint all graphics in the size, styles, and colors selected by the Engineer.

3.02 Sign Maintenance

- A. Maintain signs and supports in a neat and clean condition.
- B. Repair any damage to the structures, framing or signs.

3.03 Sign Removal

- A. Remove signs, framing, supports and foundations at the completion of the Project.

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

1. GENERAL

1.01 Description

A. Scope of Work

1. In general, the material and equipment incorporated into the Work shall meet the requirements of the General Conditions as well as the following minimum requirements:
 - a. Conform to applicable specifications and standards.
 - b. Comply with size, make, type and quality specified, or as specifically approved in writing by the Engineer.
 - c. Manufactured and fabricated products
 - 1) Design, fabricate and assemble in accordance with the best engineering and shop practices.
 - 2) Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - 3) Any two (2) or more items of the same kind, type or classification, and being used for identical types of service, shall be manufactured by the same manufacturer.
 - 4) Products shall be suitable for service conditions intended supplied with all accessories, trim, finish, safety guards, and other devices needed.
 - 5) Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
 - 6) ***Only new, unused, and undamaged materials and equipment shall be incorporated into the Work.***

- d. Do not use material or equipment for any purpose other than that for which it is designed or specified.
- e. The proposed manufacturers, material suppliers, and dealers who are to furnish materials and equipment for this Project shall be listed on the Bid Form.
- f. Substitute equipment for items not listed in the Bid Form shall be subject to the procedures specified in the General and Supplementary Conditions and as specified herein **and must be approved by the Engineer.**
- g. 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 full responsibility under this Contract.

1.02 Approval and Samples of Materials and Equipment

- 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. **Within fifteen (15) days after the Notice to Proceed, 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. **Materials other than those designated within the Specifications or approved by the Engineer shall not be delivered to the Project Site.**
- D. **Facilities and labor for handling and inspection of all materials and equipment shall be furnished by Contractor.** If the Engineer requires, either prior to beginning or during progress of the work, the 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 the Contractor's expense. Except as otherwise noted, the Contractor will make arrangements for and pay for the tests.
- E. The 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 the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner or Engineer.

- F. To demonstrate the proficiency of workers or to facilitate the choice among several textures, types, finishes and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.
- G. 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 intent of these Specifications is to provide the Owner with a quality facility without discouraging competitive bidding. Substitutions may be submitted and will be evaluated as specified herein, within Division 0, "Bidding and Contract Requirements, and Division 1, "General Requirements".
- B. ***For products specifically listed in the Bid Form, the Contractor shall designate which manufacturer or supplier was used to form the basis of the bid by selecting one of the named manufacturers.*** No substitution shall be allowed after the Bid is awarded without significant benefit to the Owner being demonstrated, or in the case of product unavailability or other condition beyond the control of the Contractor. Requests for substitutions prior to the Bid must be made in the form of questions well in advance of the Bid date as indicated in the Instruction to Bidders. A formal submittal of product data similar to that referred to herein will be required.

1.04 Manufacturer's Instructions for Installation

- A. When Contract Documents require that installation of work shall comply with the manufacturer's printed instructions, obtain and distribute copies of such instructions to all parties involved in the installation, including three (3) copies to the Engineer. Maintain one (1) set of complete instructions at the job site during installation and until Project completion.
- B. ***Handle, install, connect, clean, condition and adjust products in strict accordance with the manufacturer's instructions and recommendations and in conformity with specified requirements.*** Should job conditions or specified requirements conflict with the manufacturer's instructions or recommendations, the Contractor shall consult with Engineer for further instructions. Do not proceed with work without clear instructions.
- C. Perform all work in accordance with the manufacturer's instructions and recommendations. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents.

1.05 Transportation and Handling

- A. Arrange deliveries of products in accordance with construction progress schedules. The Contractor shall coordinate to avoid conflict with work, conditions at the site, and avoid long term storage on-site
- B. ***Do not store materials on-site for more than thirty (30) days before installation.***
- C. Deliver materials to the Project 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 frame.
- D. Coordinate delivery to ensure the minimum holding time for items that are flammable, hazardous, easily damaged, sensitive to deterioration, or subject to theft.
- E. Ship and handle products in accordance with the manufacturer's recommendations, using means and methods that prevent damage, deterioration, and theft.
- F. ***Deliver products in an undamaged condition***, in the manufacturer's original containers or packaging, with identifying labels intact and legible, and instructions for handling, storage, unpacking, protecting, and installing readily available.
- G. Immediately on delivery, inspect shipments to assure compliance with the requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.
- H. Provide equipment and personnel to handle the products/equipment by methods to prevent soiling or damage to products or packaging. All materials shall be received by the Contractor and it shall be the Contractor's responsibility to provide the equipment to load, unload, and store all materials.
- I. Structural members and metal fabrications shall be handled to prevent overstress and damage of any kind. Any damaged or misformed members that can not be satisfactorily repaired at the site, without compromising the integrity of the item, shall be returned to the manufacturer for correction or replacement at no additional cost to the Owner.

1.06 Storage and Protection

- A. ***The Contractor shall furnish a covered, weather-protected storage structure*** providing a clean, dry, non-corrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this Project. Storage of equipment shall be in strict accordance

- with the "Instructions for Storage" of each equipment supplier and manufacturer including connection of heaters, placing of storage lubricants in equipment, etc. ***Corroded, damaged or deteriorated equipment and parts will not be accepted by the Engineer or Owner, at any time during the construction period, and shall be replaced before acceptance of the Project at no additional cost to the Owner.*** Improperly stored equipment and materials shall not be included in an application for payment.
- B. Store products in accordance with the manufacturer's instructions and recommendations, with seals and labels intact and legible.
 - C. ***Store products subject to damage by the elements in weather-tight enclosures***, off the floor, with adequate ventilation to prevent condensation. Maintain temperature and humidity with the ranges required by the manufacturer's instructions.
 - D. ***Store all products above the ground on blocks or skids*** and prevent soiling or staining. Cover products outside, which are subject to deterioration, with impervious sheet coverings and provide adequate ventilation to avoid heat buildup and/or condensation.
 - E. Miscellaneous metals, reinforcement bars, welded wire fabric, and masonry reinforcement materials shall be stored to prevent contact with the ground and from being damaged by its own weight or by other loads. Reinforcement which has become muddy shall be cleaned by the Contractor before use.
 - F. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
 - G. Store heavy materials or equipment with adequate support structures that maintain their integrity throughout the storage period.
 - H. ***Store cementitious materials in a weather-protected storage structure on an elevated floor away from damp surfaces.***
 - I. All materials and equipment to be incorporated in the Work shall be handled and stored by the 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.
 - J. ***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. Precast concrete beams shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking and spalling to a minimum.

- K. All materials, which, in the sole opinion of the 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 the Contractor shall receive no compensation for the damaged material or its removal.
- L. The Contractor shall not use and shall dispose of any materials that have been stored for longer than their maximum recommended shelf life or beyond their recommended shelf date.
- M. Arrange storage in a manner to provide easy access for inspection and inventory counting of stored materials or equipment. Make periodic inspections of stored products to assure that products are maintained under specified conditions, free from damage or deterioration, and verify the inventory.
- N. Protection After Installation
 - 1. **Provide substantial coverings as necessary to protect installed products** from damage from traffic and subsequent construction operations.
 - 2. Remove covering when no longer needed.
 - 3. Periodically rotate and oil moving parts as needed and recommended.
- O. The Contractor shall be responsible for all material, equipment and supplies sold and delivered to the Owner under this Contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.
- P. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven (7) days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the 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. Because of the long period allowed for construction, special attention shall be given to the storage and handling of equipment 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 major equipment or finish products be delivered to the site more than thirty (30) days prior to installation*** without written authorization from the Engineer.
 2. Materials shipped to the site, or temporarily stored off-site in approved locations, shall be stored in accordance with Article 1.06, herein.
 3. ***All equipment having moving parts such as gears, electric motors, etc., and/or instruments shall be stored in a temperature and humidity controlled building*** approved by the Engineer, until such time as the equipment is to be installed.
 4. All equipment shall be stored fully lubricated with oil, grease, etc., unless otherwise instructed by the manufacturer.
 5. The Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.
 6. ***Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding".*** Upon installation of the equipment, the Contractor shall start the equipment, at least half the load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
 7. ***Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and final acceptance of the Project.***
 8. ***Mechanical equipment to be used in the work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed and lubricated prior to testing and startup, at no additional cost to the Owner.***
 9. ***Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period.*** Such certifications by

the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. ***If such a certification is not given, the equipment shall be judged to be "defective". It shall be removed from the site and replaced with same at the Contractor's expense.***

10. ***The Contractor shall be responsible to protect the factory finish of equipment and materials from damage during construction operations and until Final Project Acceptance by the Owner.*** Satisfactorily restore any finishes that become stained or damaged to the acceptance of the Engineer and Owner.

1.08 Warranty

- A. For all major pieces of material, provide warranties, maintenance agreement, irrevocable letters of credit, and bonds as specified in Section 01740, "Warranties and Bonds".
- B. ***The manufacturer's warranty period shall be concurrent with the Contractor's for a minimum of two (2) years from the date of Final Project Acceptance by the Owner, or as specified in each specification section.***

1.09 Spare Parts and Special Tools

- A. 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 thermoplastic cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.
- B. Spare parts shall be furnished as specified in the individual technical specifications. ***The Contractor shall develop a complete list of spare parts for the Project, prior to turning over any spares to the Owner,*** that shall be used as the official check off sheet for spare parts verification. See Section 01700, "Project Closeout" for additional requirements for spare parts inventory.

- C. In addition, ***the Contractor shall furnish, to the Engineer, an inventory table listing all spare parts for the project***, prior to turning them over to the Owner, including, but not limited to, the following:
1. Name of the spare part.
 2. The equipment or system that the spare part is associated with.
 3. The SKU or stock number associated with each spare part.
 4. The name, address, telephone and fax numbers, and e-mail address of the supplier.
 5. The delivered cost of each item.
- D. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost.
- E. ***Each piece of equipment shall be provided with a permanent, corrosion-resistant nameplate***, securely fastened in place and clearly inscribed with the manufacturer's name, product name, year of manufacture, model and serial numbers, weight and principal rate data. Locate on an accessible but inconspicuous surface.
- F. Do not attach or imprint non-essential manufacturer's or product's trademarks or logos. Product labels or warning labels that are required should be located where required for observation after installation, as inconspicuously as allowable.

1.10 Grease, Oil and Fuel

- A. All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment. ***The Owner shall be furnished with a two (2) year's supply of the required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.***
- B. The lubricants shall be provided in containers or packages with identifying indelible labels, legible and intact, that indicate the type of lubricant and the equipment that it is to be used on.
- C. ***The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three (3) weeks of operation.***

1.11 Services of the Manufacturer's Representative

- A. ***The Contract prices for equipment shall include the cost of furnishing a competent and experienced representative who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test, certify and place into operation, the equipment in conformity with the Contract Documents.***
- B. After the equipment is placed into permanent operation by the Owner, ***the manufacturer's representative shall make all adjustments and tests required by the Engineer, and these Contract Documents, 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.
- C. The Contractor shall review and conform to all of the requirements of Section 01430, "Manufacturer's Services".

1.12 Equipment Selection and Serviceability

- A. Locate and install all equipment so that it may be serviced. Demonstrate, during the shop drawing review process, that there is room to remove all parts, shafts, bearings, filters, pumps and motors and similar equipment.
- B. Equipment that is too large or poorly located to permit servicing shall be replaced or repositioned at no additional cost to the Owner.
- C. Where piping, control diagrams or sequencing differ from the recommended piping arrangements of the equipment manufacturer, and will directly affect the equipment performance, the manufacturer's recommendations shall be submitted in writing to the Engineer for review prior to purchasing the equipment involved. Obtain such recommendations from the manufacturers in order to effect correct and perfect operation of the equipment at the capacities and temperatures indicated.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01650

SYSTEM'S START-UP AND DEMONSTRATION

1. GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Demonstrate to the Owner and Engineer that the Work functions as a complete and operable system under normal and emergency operating conditions.

B. Related Work Described Elsewhere

Specification Section	Title
00865	Check-Out Form
00866	Certification of Completed Demonstration Form
01311	Construction Progress Schedules
Division	Information
0	Miscellaneous Forms
11	Equipment
13	Special Construction - PICS
15	Mechanical
16	Electrical

1.02 Applicable Codes

- A. All work shall be acceptable to the State Health Authority, Florida Department of Environmental Protection (FDEP) and the U.S. EPA. If any requirements of this Section

are in conflict with the requirements of the State Health Authority, Florida Department of Environmental Protection (FDEP), or the U.S. EPA, those of the Authority shall govern.

1.03 Qualifications

- A. All work performed shall be under the direction of an experienced supervisor.
- B. All equipment used shall be in proper working condition, meet the requirements of the manufacturer/supplier and shall be adequate for the specified work.

1.04 Requirements

- A. Equipment testing and facility start-up is requisite to satisfactory completion of the Contract and, therefore, shall be completed within the required Contract Time for Substantial Completion.
- B. ***The Contractor shall furnish all personnel, power, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, and services required for conducting the tests.***
- C. ***The Contractor shall provide all water or purchase water from the Owner, if available, required for testing of equipment, process subsystems, and facility start-up.*** The Contractor shall notify the Owner of the amount of water required for the test at the time the testing is scheduled. If the Owner is providing the water to the Contractor, the Owner reserves the right to limit the amount of water or set the time of day and dates of the deliveries of water to the Contractor if deliveries of such water unduly affects Owner 's system operation and to maintain customer service. The Contractor shall provide a ten (10) calendar day, written notice to the Engineer, for the scheduling of the process water for testing purposes. If the Owner is unable to deliver the water for process startup, a time extension may be provided. This extension shall be equal to the time the process startup was delayed.

1.05 Start-Up Guidelines

- A. The Contractor shall startup and test all equipment, subsystems, and the complete facility under the guidelines listed below. The startup and testing shall be performed in the following segments:

1. Individual Equipment Units

- a. ***The startup and testing of the individual equipment units shall not commence until all flushing and pressure testing of pipelines, hydraulic structures, and equipment is complete and the Engineer and Owner have accepted the results.*** All potable water lines shall be disinfected and pressure tested prior to acceptance by the Engineer and Owner.
- b. The sequence shall be determined by the Contractor and approved by the Engineer and Owner.
- c. The description and requirements for startup and testing of individual equipment units are located under the equipment's individual specification section.

2. Process Subsystems

- a. ***The startup and testing of the process subsystems shall not commence until the startup and testing of the individual equipment units is complete and the manufacturer has determined the unit(s) to be "ready" for operation.***
- b. The sequence shall be determined by Contractor and approved by the Engineer and Owner.
- c. The description of startup and testing of process subsystems is located under the system's specification section or herein as noted.

3. High Service Pumping System Startup

- a. ***The startup of the high service potable water pumping shall not commence until the startup and testing of the process subsystems are complete and approved by the Engineer.***
- b. This segment shall demonstrate operation of the high service pumping system, chemical feed system and all associated subsystems for a specified length of time and provide evidence of satisfactory potable water quality, pumping flow rates and system hydraulic pressures.

4. Performance Testing

- a. Performance testing of the water treatment plant improvements shall not commence until the startup of the facility is complete and facility's potable water can be introduced to the potable water distribution system with the permission

of regulatory agencies having jurisdiction. ***The Contractor is referred to Division 11 for testing requirements.***

- b. This segment shall demonstrate that the water treatment plant improvements shall function properly and reliably and that all systems shall function to meet the specified standards, defined in the individual specification sections, over the stated period of time.

2. PRODUCTS

2.01 Testing

- A. ***The Contractor shall provide all necessary equipment, appurtenances and instrumentation required for proper completion of the testing.*** The quality, flow rates and pressures of the potable water being pumped into the distribution system shall be approved by the Engineer and FDEP Clearance, per the permit, is required.

2.02 Start-Up Plan (SUP)

- A. ***Submit for approval by the Engineer, two (2) copies*** of a detailed Start-Up Plan (SUP) for each system associated with the Sanford Main WTP improvements outlining the schedule and sequence of all tests and start-up activities, including, but not limited to, submittal of the following:
 - 1. Checkout forms.
 - 2. Demonstration test procedures, start-up, demonstration and testing.
 - 3. Certification of completed demonstration and training.
- B. ***Start-up and commissioning of the Sanford Main WTP improvements may not begin until the Start-Up Plan (SUP) is approved by the Engineer and Owner and a clearance is received from FDEP.***
- C. Provide adequate chemicals, fuel and materials to perform start-up services. ***After completion and acceptance of the performance testing, all bulk chemical tanks and the generator bulk fuel tank shall be completely filled (at the Contractor's cost).***

3. EXECUTION

3.01 Component Test and Check-out

A. Start-up Certification

1. Prior to system start-up, successfully complete all the testing required of the individual components of the Work. **Submit three (3) copies of Check-out Form's** (Section 00865) **for each individual component or piece of equipment**, signed by the Contractor or the subcontractor and the manufacturer's representative.
 2. **All copies of the Operation and Maintenance Manuals must be provided before start-up may begin and in accordance with Section 01730, "Operation and Maintenance Data"**. These forms shall be completed and submitted before "Instruction in Operation" to the Owner and his personnel or a request for initiating any final inspections.
 3. Insert one (1) copy of this form into the applicable section of each Operation and Maintenance Manual.
- B. Demonstrate to the Engineer and the Owner's representative(s), that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their own controls as designated and specified.
- C. Coordinate start-up activities with the Owner and with the Engineer prior to commencing system start-up. Utilize the Owner's/Engineers's standard start-up request form given in the Special Conditions of the General Requirements or one provided by the Engineer.
- D. Initiate O&M Training in accordance with Section 01730, "Operation and Maintenance Data", prior to Start-Up. Training shall include the use of the facility Operation and Maintenance Manuals, handouts and any instructions received from the Engineer or Owner.

3.02 Start-Up

- A. **Confirm that all equipment is properly energized, that the valves and ancillary infrastructure/equipment are set to their "normal" operating condition and that the flow path through the Work is unobstructed.**
- B. **Confirm that all process subsystems have been tested and are ready for operation.**

- C. Receive all letters of clearance from the appropriate regulatory agencies and provide proof of such clearance to the Owner.
- D. **Receive approval from the Engineer and Owner to begin start-up** of any equipment after notification is given through the standard start-up request form.
- E. **Slowly initiate the operation of the process streams.**
- F. Initiate start-up and training in accordance with and with the use of the facility Operation and Maintenance Manuals and any instructions received from the Engineer or Owner in accordance with Section 01730, "Operation and Maintenance Data".
- G. **Observe the component operation and make adjustments as necessary** to optimize the performance of the Work.
- H. Coordinate with the Engineer and Owner for any adjustments desired or operational problems requiring debugging. Make adjustments as necessary to provide a complete and functional system.

3.03 Start-Up Demonstration and Testing

- A. After all Work components have been constructed, field tested, and started up in accordance with the individual specification sections and manufacturer requirements, and after all Check-Out Forms have been completed and submitted, perform the Start-Up and Demonstration Testing in the presence of the Engineer, Owner and Owner's representatives. The demonstration period shall be held upon completion of all systems at a starting date to be agreed upon, in writing, by the Engineer and Owner. **Prior to beginning the start-up demonstration testing, the Contractor shall submit a detailed schedule of operational circumstances for approval by the Engineer.** The schedule of operational circumstances shall describe, in detail, the proposed test procedures for each piece of equipment. Provide similar test procedure forms for each piece of equipment or section of the Work to include all particular aspects and features of that equipment or section of the Work and as specified in the Specifications.
- B. The Start-Up and Demonstration Testing will be conducted for thirty (30) consecutive days. The Work must operate successfully during the thirty (30) day testing period in the manner intended and produce a potable water quality acceptable to the FDEP and pump water at the proper flow rates and system pressures. **If the Work does not operate successfully, or if the start-up is interrupted due to other contracts, the problems will be corrected and the test will start over from day one.** The party causing the interruption will be subject to the assessment of actual damages due to delay. During the start-up tests, instruct des Pipe Work: Every 150 feet at each lift of

compaction, minimum ignited facility operating personnel in the function and operation of the Work.

- C. During the start-up demonstration period, operate the Work, instruct designated facility operating personnel in the function and operation of the Work and all associated equipment and systems, and cause various operational circumstances to occur. As a minimum, these circumstances shall include average, maximum and peak daily flows, random equipment or process failures, tank overflows, surcharges, interlocks and bypasses. Demonstrate the essential features of the equipment and its relationship to other equipment. The approved schedule of operational circumstances and Demonstration Test Procedures Forms will be used as the agenda during the Start-Up Demonstration Testing period for all equipment and sections of the Work. Coordination of the Demonstration Test schedule will be accomplished through the Engineer.
 - 1. ***Coordination of the Demonstration Test schedule shall be accomplished through the Engineer.***
- D. The Demonstration Test procedures shall follow the sample test procedures form provided in Section 00870, "Demonstration Test Procedures". Provide similar test forms for each section of the Work to cover all aspects and features specified.
- E. Acceptability of the Work's performance will be based on the Work performing as specified under these actual and simulated operating conditions, to ensure that potable water, wastewater, reclaimed water, and other utilities are functioning as intended and as defined in the Contract Documents. ***The intent of the start-up demonstration and testing 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 final acceptance.***
- F. ***Demonstrate the essential features of the "entire" High Service Pumping and Chemical Feed Systems, as a whole system, as it applies to the Work, including the mechanical equipment, piping, structures, finishes, controls, instrumentation, PICS and SCADA systems, power distribution and lighting systems.*** 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 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.
- G. Demonstrate the essential features of all the mechanical systems, for both Demonstration Tests, including, but not limited to, the following as they apply to the Work:

1. High Service Pumping System.
 2. Chemical Storage and Feed Systems.
 3. Flow metering systems.
 4. Pressure systems.
 5. Emergency Standby Generator, Fuel System and Transfer Switch.
 6. Process Control Instrumentation.
 7. Controls and Instrumentation.
 8. Mechanical Systems.
 9. Electrical Systems.
 10. Computer and SCADA Systems.
 11. Building Systems.
 12. Laboratory Equipment.
 13. Facility telephone, audio-visual systems, internet systems, security systems, etc.
 14. Heating, Ventilating and Air Conditioning Systems and Controls
 - a. Air conditioning /heating systems.
 - b. Ventilating systems.
- G. Demonstrate the essential features of all electrical systems including, but not limited to, the following as they apply to the Work:
1. Electrical systems controls and equipment
 - a. Electrical power equipment.
 - b. Motor control centers (MCC).
 - c. Motor control devices.

d. Relays.

e. Special transformers.

f. Starting devices.

2. Lighting fixtures

a. Exit and safety fixtures.

b. Indoor fixtures.

c. Outdoor fixtures.

d. Floodlighting.

3. Panelboards

a. Distribution panels.

b. Lighting panels.

c. Main panels and power panels.

d. Switchboards.

4. Wiring devices

a. Face plates.

b. Low-voltage controls.

c. Convenience and special purpose outlets.

d. Regular and time switches.

H. Upon successful completion of the Start-up and Demonstration Tests, the Owner's personnel shall receive the specified training for each system. ***Training of the***

Owner's personnel will not be considered valid unless it takes place using a system that has successfully passed the Start-up, Demonstration and Testing.

- I. Upon completion of all Demonstration Testing, the Contractor shall **submit three (3) copies of the Certificate of Completed Demonstration Form** to the Engineer, for each item of equipment or system in the Work, signed by the Contractor, Subcontractor, Engineer, and the Owner. Insert one (1) copy of this form in the applicable section of each Operation and Maintenance Manual. A sample Certificate of Completed Demonstration Form is presented in Section 00866.

END OF SECTION

SECTION 01700

PROJECT CLOSEOUT

1. GENERAL

1.01 Description

A. Scope of Work

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

B. Related Requirements Described Elsewhere

Specification Section	Title
00848	Certificate of Substantial Completion
00880	Certificate of Final Inspection
00883	Certificate of the Engineer
01650	Systems Start-up and Demonstration
01710	Cleaning
01720	Project Record Documents
01730	Operation and Maintenance Data
01740	Warranties and Bonds
01800	Miscellaneous Work and Cleanup

1.02 Substantial Completion

- A. The Work at the Sanford Main WTP will not be declared "*substantially complete*", and the Contractor may not request an inspection for a "Certification of Substantial Completion" inspection unless the following submittals and Work are completed:

1. ***All Operation and Maintenance Manuals have been submitted and “approved”*** to the requirements of Section 01730, “Operation and Maintenance Data”.
2. ***All equipment has been “checked-out”*** by the equipment manufacturer and Certificates of Manufacturer's Check-Out have been submitted as required by Specification Section 01650, “Systems Start-Up and Demonstration”.
3. ***All start-up and demonstration testing has been completed*** and Certificates of Completed Demonstration have been submitted in accordance with the requirements of Section 01650, “System's Start-Up and Demonstration”.
4. ***Project Record Documents are complete and have been submitted and reviewed*** in accordance with the requirements of Section 01720, “Project Record Documents”.
5. ***All tools, spare parts, extra stocks of material and similar physical items have been delivered*** to the Owner and all spare parts delivery sheets have been certified by the Contractor, Engineer and Owner.
6. ***The entire Project Site has been thoroughly cleaned*** in accordance with the Section 01800, “Miscellaneous Work and Cleanup”.
7. ***All training of the Owner's personnel has been completed and the high-quality HD recordings have been submitted*** in accordance with the Contract Documents.
8. ***All areas to be used and occupied are safe, operable in “automatic” and complete.***
9. ***All building occupancy certificates have been issued*** by the appropriate building permitting agency.
10. ***All temporary facilities and services have been removed from the Project Site*** along with construction tools, mock-ups, and similar elements.
11. ***All painting, finishes, fencing, cleanup, final grading, sodding, grassing, sidewalk construction and paving have been completed and are ready for inspection.***
12. ***All marred, exposed surfaces have been touched-up*** and otherwise repaired and/or restored.
13. ***All deficiencies noted on inspection reports or non-conformances are corrected*** or the correction plan approved.
14. ***Punchlist items that remain***, as identified by the Engineer and Owner, shall be ***completed within thirty (30) consecutive calendar days.***

- B. Work cannot be considered to be “*Substantially Complete*” until ***all regulatory agency letters of clearance*** for placing systems into service are received by the Owner.
- C. When the conditions of Article 1.02(A) are met, the Contractor shall submit the following to the Engineer:
 - 1. A written notice that he considers the Work at the Sanford Main WTP, or portion thereof, is substantially complete, and requests an inspection.
 - 2. A punchlist of items to be completed or corrected (uncompleted work which is not related to the safe, effective, efficient use of the Projects may be allowed on the punchlist with the Engineer's approval) and explanations thereof.
- D. Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the status of Project Completion.
- E. Should the Engineer determine that the Work is not “*substantially complete*”:
 - 1. The Engineer will promptly notify the Contractor, in writing, giving the reasons therefore.
 - 2. The Contractor shall remedy the deficiencies in the Work and send another written notice of substantial completion to the Engineer.
 - 3. The Engineer will, within a reasonable time, reinspect the Work. The Contractor will be liable for reinspection fees as described in Article 1.04, herein.
- F. When the Engineer finds that the Work is “*substantially complete*”, he will:
 - 1. ***Schedule a walk-through of the treatment facility site to include the Owner.*** The Engineer shall determine the completeness of the punchlist and readiness of the facility for occupancy by the Owner.
 - 2. ***Prepare and deliver to the Owner a tentative Certificate of Substantial Completion*** (Section 00848) with the tentative punchlist of items to be completed or corrected before final inspection.
 - 3. After consideration of any objections made by the Owner, as provided in the Conditions of the Contract, and when the Engineer considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite “Certificate of Substantial Completion” for the treatment facility site, with a revised tentative list of items to be completed or corrected. Any incomplete work allowed on a punchlist must be reinspected upon completion and any deficiencies found will be added to the punchlist.

1.03 Final Inspection

- A. Prior to the Contractor's request for a final inspection, the following submittals and work must be complete:
1. ***Project Record Documents must be approved.***
 2. ***All spare parts, special tools and expendables have been transferred to the Owner*** with a full accounting of the quantities and amounts due per the requirement of the technical sections of the specifications.
 3. The Project ***Operation and Maintenance materials must be suitably delivered*** to the Owner per the requirements of the technical sections of the specifications and Section 01730, "Operation and Maintenance Data".
 4. The Contractor must submit ***evidence of compliance with the requirements of the governing authorities.***
 5. ***All punchlist items identified during the substantial completion inspection shall be finished*** to the satisfaction of the Engineer and Owner.
 6. ***Grease, dirt, dust, paint or plaster splatter, stains, labels, grease pencil markings, fingerprints, and other foreign materials shall have been removed from ALL exposed surfaces.***
 7. ***The Contractor shall have repaired, patched, and touched-up ALL marred surfaces to the specified finish and match adjacent surfaces.***
 8. All exterior paved ***driveways and parking areas shall have been broom cleaned.***
 9. ***All sidewalks, loading areas, structures and other contiguous areas shall have been hosed down and cleaned.***
 10. ***The interior and exterior of all buildings shall be thoroughly cleaned and clean of all debris, garbage, dirt, dust, etc.***
- B. After satisfying the requirements of Article 1.03(A) and when the Contractor considers the Work at the treatment facility site complete, he shall submit written certification that:
1. The Contract Document requirements have been met.
 2. The Work has been inspected for compliance with the Contract Documents.
 3. The Work has been completed in accordance with the Contract Documents.

4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
 5. The entire project site has been thoroughly cleaned, in accordance with the General and Supplementary Conditions, and Section 01710, "Cleaning".
 6. All punchlist items have been corrected or completed and the Work is ready for final inspection.
 7. FDEP Certificates of Completion of Construction or Letter of Release have been received.
 8. Warranties, maintenance bonds, and other legal documents have been turned over to the Owner.
- C. The Engineer will, within reasonable time, make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- D. Should the Engineer consider that the Work is "*incomplete*" or "*defective*":
1. The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
 2. The Contractor shall take immediate steps to remedy the stated deficiencies, and send another written certification to the Engineer that the Work is complete.
 3. The Engineer will, within a reasonable amount of time, reinspect the Work and the Contractor shall be liable for reinspection fees as described in Article 1.04, herein.
- E. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall prepare a Certificate of Final Inspection (Section 00880) and request that the Contractor make all closeout submittals.

1.04 Reinspection Fees

- A. Should the Engineer perform re-inspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
1. The Contractor will compensate the Engineer for such additional services.
 2. ***The reinspection fee will be the Engineers actual salary rate times a multiplier of 5.0 (8 hr minimum) plus any reimbursable expenses.***

3. ***The Contractor shall make payment directly to the Engineer within three (3) calendar days from the date of the reinspection.***
4. ***Failure to reimburse the Engineer for his time, with respect to reinspection of equipment and systems, will constitute a breach of the Project Contract/Agreement and all Work will be suspended until the Engineer is reimbursed and no additional time will be added to the Contract Time.***
5. ***All lost Project time and money due to the Contractor's failure to reimburse the Engineer shall be the sole responsibility of the Contractor. No additional Contract Time shall be added to the Contract.***

1.05 Contractor's Closeout Submittals

- A. Upon completion of the Project, or portions thereof, and prior to final payment, the Contractor shall transfer to the Engineer and Owner all applicable items accumulated throughout the Project Construction Period. These submittals include, but are not limited to, the following:
 1. Spare parts and special tools, as required by the Contract Documents.
 2. Submit the Manufacturer's Warranties and Bonds in accordance with Specification Section 01740, "Warranties and Bonds", and letters of coverage extending beyond the time limitations of the Contractor's guarantee.
 3. Submit, in accordance with the requirements of the General and Supplementary Conditions, all Release of Lien Form and affidavits from the Contractor, subcontractors and all material suppliers.
 4. Certificate of Insurance for Products and Completed Operations.
 5. Salvaged materials or materials and equipment borrowed from the Owner.
 6. Project Record Documents of the completed facilities in accordance with Section 01720, "Project Record Documents".
 7. Releases of liens from the Contractor plus copies of releases of lien from all subcontractors and suppliers.
 8. All keys to all doors, gates and equipment.
 9. Statements from the manufacturer's representatives as called for in the Contract Documents.

10. Releases of Liens from the Contractor plus copies of Releases of Lien from all subcontractors and suppliers.
- B. The closeout requirements of this Section are in addition to the requirements of other Sections, and the General and Supplementary Conditions.

1.06 Final Adjustment of Accounts

- A. Submit a final statement of accounting to the Engineer.
- B. The Final Statement of Accounting shall reflect all adjustments to the Contract Sum including, but not limited to, the following:
 1. The original Contract Sum.
 2. Additions and deductions resulting from:
 - a. Previous change orders or written amendments.
 - b. Allowances.
 - c. Unit prices, if applicable.
 - d. Deductions for uncorrected work.
 - e. Deductions for liquidated damages.
 - f. Deductions for reinspection payments.
 - g. Any other adjustments.
 3. The Total Contract Sum, as adjusted.
 4. Previous payments.
 5. The Sum remaining due.
 6. Evidence that all spare parts, special tools and expendable have been transferred to the Owner with a full accounting of the quantities and amounts due per the requirement of the technical sections of the specifications.

- C. The Engineer will prepare a final Change Order, if necessary, reflecting the approved adjustments to the Contract Sum which were not previously made by Change Orders, and prepare a Certificate of the Engineer and a Certificate of Final Completion.

1.07 Final Application for Payment

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

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01710

CLEANING

1. GENERAL

1.01 Description

- A. Execute cleaning, during the progress of the Work and at the completion of the Work, as required by the General and Supplementary Conditions and as indicated herein.

1.02 Related Work

- A. Cleaning for specific products or work may be identified in individual specification sections.

1.03 Disposal and Cleaning Requirements

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

2. PRODUCTS

2.01 Materials

- A. Use only those cleaning materials which will not create hazards to health or property and that 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 the cleaning material manufacturer.

3. EXECUTION

3.01 Cleaning during Construction

- A. During construction of the work, the Contractor shall, at all times, ***keep the site of the Work 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 the Owner and Engineer, such material, debris, or rubbish constitutes a nuisance or is objectionable.
- B. ***The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.*** The Contractor shall be responsible and liable for all spillage and incur all associated costs including, but not limited to, costs related to repair and maintenance resulting from damages thereof, and fines that may be levied as a result of citations given by State or local regulatory agencies.
- C. ***The Contractor shall, at all times, 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 or personal activities.***
- D. ***Provide an on-site, securely "lidded" metal dumpster and containers for the collection of waste materials, debris and rubbish.*** No construction waste materials shall be buried on-site.
- E. Remove waste materials, debris and rubbish from the site ***a minimum of twice per week*** or move frequently if necessary, or as directed by the Engineer or Owner, and dispose of at legal disposal areas away from the site.
- F. All hazardous material shall be disposed of in a manner specified by local and state regulations. Site personnel shall be instructed in these practices.

3.02 Dust Control

- A. ***The Contractor shall employ construction techniques that minimize the production and distribution of dust.***
- B. Clean all interior spaces prior to the start of finish painting and continue cleaning on an as needed basis until painting is finished.
- C. The Contractor shall schedule operations so that dust and other contaminants resulting from the cleaning process will not fall on wet or newly-coated surfaces.

3.03 Off-Site Vehicle Tracking

- A. The Contractor shall take all necessary measures to ***remove sediment and/or sludge from vehicles before leaving the Project Site to reduce vehicle tracking of sediment both "on-site" and "off-site". Any sediment and/or sludge buildup shall be immediately cleaned and removed by the Contractor at no additional cost to the Owner.***
- B. Measures include, but may not be limited to, vehicle shaking device and/or wheel washing facility.
- C. The Contractor shall maintain areas of site ingress and egress and surrounding off-site public rights-of-way from the buildup of sediment and/or sludge. Any sediment and/or sludge buildup in these areas shall be immediately cleaned and removed by the Contractor at no cost to the Owner.

3.04 Final Cleaning

- A. The Contractor shall employ skilled workmen for the final cleaning process.
- B. At the conclusion of the work, all erection plant, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances in a legal manner.
- C. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, writing on stainless steel, aluminum and other metal surfaces, and other foreign materials from sight-exposed interior and exterior surfaces.
- D. 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.
- E. Wash and shine glazing and mirrors.
- F. Polish glossy surfaces to a clear shine.
- G. The Contractor shall be responsible for the removal of excess dust and mud created by the construction project from all sidewalks, roadways, streets, and highways as directed by the Engineer. Equipment to clean these surfaces shall be subject to approval by the Engineer and Owner.
- H. Broom-clean exterior paved surfaces; rake-clean other surfaces of the grounds.

I. Ventilating Systems

1. Clean permanent filters and replace disposable filters if units were operated during construction.
 2. Clean ducts, blowers and coils if units were operated without filters during construction.
- J. ***Prior to final completion, or Owner occupancy, the Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that they are clean.***

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

1. GENERAL

1.01 Description

A. Scope of Work

1. Maintain at the site during construction, for the Engineer and Owner, one (1) project record copy of:
 - a. Contract Drawings.
 - b. Contract Specifications.
 - c. Addenda.
 - d. Change Orders and other modifications to the Contract.
 - e. Engineer's Field Orders or written instructions.
 - f. Approved Shop Drawings, Working Drawings and Samples.
 - g. Field Test records.
 - h. Construction photographs and the Preconstruction HD Videos (DVD/BD's).
 - i. Field engineering records for compliance with field engineering submittals.
 - j. An updated Project Schedule.

B. General Requirements

1. As the Work progresses, the Contractor shall be responsible for recording information on the approved Contract Documents (Contract Drawings and Technical Specification Sections) concurrently with construction progress.

2. ***The Contractor shall mark on the Contract Drawings all changes in direction and location of structure, piping, equipment, electrical, and mechanical work.***
3. ***The Contractor shall mark on the Technical Specification Sections the manufacturer, trade name, catalog, and supplier of each product actually installed, and mark changes made by Change Order, Word Directive or Field Order.***
4. ***All Record Drawings shall be prepared by the Contractor in AutoCAD format (latest version) using the construction plan sheets provided by the Engineer.***
As-built information shall be field verified, measured, added to the AutoCAD files of the construction plan sheets provided by the Engineer, and certified, signed and sealed by the Contractor's licensed Surveyor who will be responsible for the accuracy of all dimensions and elevations.
5. ***Record Drawings shall clearly show all field changes of dimension and detail including changes made by Field Order, Work Directive or Change Order.***
6. ***The licensed surveyor shall identify the X, Y and (Z) location based on the coordinate system Florida East Zone State Plane Coordinate Feet NAVD 83, of all piping, valves (center of pipe) and valve boxes, hydrants (grade), blow offs (grade), sample points (grade), meter boxes (grade), foundations, structures, etc. and shall be clearly shown on the Project Record Documents.***
Acceptable position accuracy shall be sub-meter or better for compatibility with Global Positioning System (GPS) equipment. The vertical datum used shall be NAVD 88 unless otherwise shown on the Contract Documents.
7. ***The licensed surveyor shall provide the GIS coordinates*** of all installed process equipment, structures, vaults, manholes, etc. as part of this Project (to be used in the City's asset management program).

C. Related Work Specified Elsewhere

Specification Section	Title
01010	Summary of Work
01030	Applications for Payment
01050	Field Engineering
01200	Project Meetings
01300	Shop Drawings, Submittals and Samples
01380	Construction Photographs

Specification Section	Title
01390	Preconstruction Video Recording
01700	Project Closeout

1.02 Maintenance of Documents and Samples

- A. Store documents and samples in the Contractor's field office apart from all documents used for construction.
- B. Provide files and racks for storage of documents.
- C. Provide locked cabinets or secure storage space for storage of samples.
- D. File documents and samples in accordance with CSI format with Section numbers as provided herein.
- E. Maintain project documents in a clean, dry, legible, condition and in good order. **Do not use Project Record Documents for construction purposes.**
- F. Make documents and samples available at all times for inspection by the Engineer or the Owner.
- G. **As a prerequisite for monthly Progress payments, the Contractor is to exhibit the currently updated "Project Record Documents"** for review by the Engineer and Owner. Payment will be withheld if the project record documents are not satisfactorily maintained.

1.03 Marking Devices

- A. Provide marking pens for recording information in the color code designated by the Engineer.

1.04 Recording

- A. Label each document **"PROJECT RECORD DOCUMENT"** with a rubber stamp having one (1) inch high letters, using **"red ink"**.
- B. **Record information concurrently with construction progress.**

C. Do not conceal any work until the required information is recorded.

D. Project Record Drawings

1. Legibly and clearly mark, to scale, each drawing to record actual “As-Built” construction as follows:
 - a. All final grading elevations per the required project final survey.
 - b. Horizontal locations and vertical elevations of all structures, equipment, valves, fittings, electrical and mechanical work, connection points, etc.
 - c. All utility structure top and invert elevations (including pipe inverts, etc.).
 - d. Depths of various elements of foundation in relation to finish first floor datum.
 - e. All underground piping with pipe sizes, material, elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities, valves and appurtenances (valves, fittings, marker locator balls, etc.), referenced to at least two (2) permanent points (surface improvements), and vertical locations of underground utilities and appurtenances, referenced to a permanent point.
 - f. Vertical elevations of all pipelines at crossings of potable water mains (whether the water main is existing or new) to document that the minimum required vertical separation has been met.
 - g. Horizontal offsets from adjacent potable water mains (whether the water main is existing or new) in order to document that the minimum required horizontal separation has been met.
 - h. Utility pipelines tied horizontally to the edge of pavement and right-of-way lines, located every 25 feet plus all changes in horizontal offset.
 - i. Pavement width and elevations at the centerline and edge of pavement every twenty (20) feet plus at all changes in longitudinal slope, cross slope, inlet locations, and at all driveway and street intersections. For parking areas, record centerline and edge of pavement elevations along all drive aisles and islands.
 - j. Lift station surveyed layout (horizontal and vertical) of all structures, valves, panels, conduits, piping, corners of all concrete pads and slabs, and bollards.
 - k. New Building construction or building modification exterior dimensions and horizontal reference to property lines.
 - l. New Building construction or building modification finish floor elevations.

- m. Concrete pad dimensions and elevations at each corner.
- n. The material, diameter, length, elevations and actual slope of all piping installed.
- o. All abandoned in-place facilities including the extent and method of abandonment.
- p. Horizontal and vertical data for any construction that deviates from the approved engineering drawings.
- q. Where the Contract Documents contain specific horizontal location data, such as station and offset, the as-built drawings are to reflect the actual horizontal location.
- r. Where the Contract Documents contain specific vertical elevation data, the "As-Built" drawings are to reflect the actual measured vertical elevation.
- s. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
- t. Field changes of dimension and detail.
- u. Changes to the Project made by Field Order, Work Directive or Change Order.
- v. Details not on the original Contract Drawings.
- w. Equipment and piping relocations.
- x. Stormwater pond top of berm and pond bottom elevations and horizontal dimensions measured at a minimum of twenty (20) locations per pond and at locations designated by the Engineer. The top of pond horizontal dimensions are also to be tied to property corners, easements, and rights-of-way.
- y. Stormwater control structure dimensions, horizontal locations and elevations, including all weirs, slots, orifices, grates, and skimmers.
- z. Stormwater conveyance systems including dimensions, horizontal locations, elevations, contours, and cross sections.
- aa. Actual installed pipe material, class, pipe size, etc. shall be included.
- bb. Major architectural and structural changes including relocation of doors, windows, etc.
- cc. Architectural schedule changes according to Contractor's records and shop drawings.

- dd. Bronze plaque revisions according to the actual installation.
 - ee. Mechanical and electrical changes.
2. For electrical work, as a minimum, show the following:
 - a. Location of stub outs, dimensioned from permanent building lines.
 - b. Location and depth of under-slab and in-slab raceways.
 - c. The routing of all raceways even though they may not have been shown in the drawings.
 - d. Corrected panelboard and equipment schedules.
 - e. Corrected circuit numbers as they appear on panelboard directories.
 - f. Corrected motor horsepower or full load amperages.
 3. Show elevations to the nearest hundredth of a foot for:
 - a. Top of pipe for water mains and force mains at deflection points and every 25 feet along straight runs.
 - b. Top of pipe for water mains and force main fittings.
 - c. Top of pipe for connection to existing facilities.
 - d. Top of operating nut for valves.
 - e. Top of pipe of water and wastewater facilities where they cross other facilities (drainage, telephone, cable TV, electric, etc.).
 4. Show elevations to the nearest hundredth of a foot for:
 - a. Maintenance access structure (manhole) rims.
 - b. Inverts of every gravity sewer pipe and force main connection to maintenance access structures.
 - c. Structure top of slab, bottom, influent pipe invert, etc.
 - d. Lift station top of slab, bottom of wetwell, influent pipe invert and control set points.

E. Specifications and Addenda

1. Legibly mark each section to record:
 - a. Manufacturer, trade name, catalog number of Supplier of each product and item of equipment actually installed.
 - b. Model number and serial number of each piece of equipment and all electrical data (motor size, horsepower, voltage, etc.).
 - c. Changes made by Field Order, Work Directive or Change Order.

F. Shop Drawings (after final review and approval)

1. Provide four (4) sets of “record” shop drawings within the Operation and Maintenance Manual, for each piece of process equipment, piping (including casings), electrical system and instrumentation system.
2. The Contractor shall review the requirements of Section 1730, “Operation and Maintenance Data”.

G. ***Certified site survey, below ground piping survey, and line elevations and stationing at 25-foot increments*** per Section 01050, “Field Engineering”.

H. ***Certified 3D High Definition Laser survey of the Sanford Main WTP site, after project completion, conducted by the “current” surveyor of record for the project and treatment facility (CPH, Inc., no equal) - included on Bid Form as Item 6 for a “pre-negotiated” price.***

1.05 Final Surveys and CADD Files

- A. Prepare and submit four (4) copies of the following ***“certified” surveys*** for the Project:
1. Site Survey.
 2. Below-ground piping survey.
 3. Line elevations and stationing at 25-foot increments.
 4. Building and structure elevations.

- B. The "As-Built's" shall be **certified, signed and seal by a registered land surveyor in the State of Florida** who will be responsible for the accuracy of all dimensions and elevations in accordance with the "Minimum Technical Standards" and Section 01050, "Field Engineering".
- C. **Each sheet of "As-Built" drawings shall be signed and sealed by the registered land surveyor.** The cover sheet shall contain the following statement: *"I hereby certify that the "As-Built" location information of the water and sewer facilities shown on these drawings conforms to the minimum technical standards for land surveying in the State of Florida, Chapter 61G17-6 (Florida Administrative Code), as adopted by the Department of Business and Professional Regulation, Board of Professional Surveyors and Mappers in September 1981, and that said As-Built's are true and correct to the best of my knowledge and belief as surveyed under my direction."* The cover sheet shall include the land surveyor's name, business name, surveyor's number, address and telephone number.
- D. During the course of the Work, if any computer-aided drafting design files are created or used for shop drawings, working drawings, installation drawings, or other details of the Project, **a CD/DVD/BD of such files and a "full-size" reproducible copy of the file shall be given to both the Engineer and Owner.**

1.06 Submittals

- A. Record Drawings are to be prepared by the Contractor, certified by the Contractor's registered surveyor and delivered to the Engineer.
- B. Submit "initial" Project Record Documents, listed herein, to the Engineer with the Contractor's Request for Substantial Completion. **Also deliver a CD/DVD/BD containing the Project Record Drawings, in AutoCAD format, latest version, to the Engineer.** The required field engineering submittals certified by a registered land surveyor, are listed in Section 01050, "Field Engineering".
- C. At Contract closeout, the Contractor shall submit the "final" Project Record Documents to the Engineer for the Owner with a claim for Final Completion and Readiness for Final Payment. The "final" Record Drawings submittal shall contain three (3) copies of the following:
 - 1. Signed and sealed copies of the Record Drawings on 22" x 34" paper.
 - 2. AutoCAD files of the Record Drawings (latest version of AutoCAD).
 - 3. PDF and JPEG copies of the Record Drawings on a CD/DVD/BD or flash drive.

- D. At Contract closeout, submit the “*approved*” Shop Drawings to the Engineer for the Owner with a claim for Final Completion and Readiness for Final Payment. The “*approved*” Shop Drawings submittal shall contain the following:
 - 1. PDF and JPEG copies of the Record Drawings on a CD/DVD/BD or flash drive.
- E. Accompany the closeout submittal with a letter of transmittal (LOT) in duplicate, containing, but not limited to, the following.
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Title and number of each Record Document.
 - 5. Signature of Contractor or his authorized representative.
- F. If the Record Drawings are found to be incomplete or inaccurate, the drawings will be returned to the Contractor for correction.
- G. In cases where the Owner determines partial clearances from permitting agencies are beneficial to the Owner for completed portions of the project, provide preliminary record drawings (AutoCAD, PDF and JPEG formats) to the Engineer for its use in preparing the partial clearance applications for the Owner.
- H. Complete signed and sealed Record Drawings are required to be delivered to the Engineer prior to final inspection of the Project. ***Final inspections will only be scheduled upon receipt of signed and sealed Record Drawings that have been reviewed by the Engineer and delivered by the Engineer to the Owner.***

2. **PRODUCTS - NOT USED**

3. **EXECUTION - NOT USED**

END OF SECTION

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SECTION 01730

OPERATION AND MAINTENANCE DATA

1. GENERAL

1.01 Description

A. Scope of Work

1. Compile product data and related information appropriate for the Owner's operation and maintenance of products furnished under the Contract (whether the materials or products were purchased by Owner or Contractor). Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
2. ***Instruct the Owner's personnel in the maintenance of products and in the operation of the installed equipment and systems.***

B. Related Work Specified Elsewhere

Specification Section	Title
00980	O & M Manual Submittal Form
01300	Shop Drawings, Submittals and Samples
01650	Systems Start-up and Demonstration
01700	Project Closeout
01720	Project Record Documents
Division	Information
6, 10, 11, 12 and 14	Equipment
13	Special Construction - PICS
15	Mechanical
16	Electrical

1.02 Quality Assurance

- A. Preparation of the data shall be performed by personnel who are:
1. **Trained and experienced** in the operation and maintenance of the described products.
 2. Familiar with the requirements of the Specification Section(s).
 3. **Skilled as technical writers** to the extent required to communicate the essential data associated with the referenced equipment and products.
 4. Skilled as draftsmen competent to prepare the required drawings.

1.03 Form of Submittals

- A. Prepare **ALL** data in the form of an instructional manual (hard copy - paper) and in electronic formats (PDF and JPEG), for use by the Owner's personnel.

B. Data Format

1. Size: 8 ½ " x 11"
2. Paper Weight/Color: 24 pound minimum, **bright white paper (99+ on the paper brightness scale)**.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings
 - a. Provide a reinforced punched binder tab; bind in with text.
 - b. Reduce larger drawings to 11" x 17" and fold them to an 8 ½ " x 11" size.
5. Provide a fly-leaf for each separate product, or each piece of operating equipment:
 - a. Provide a typed description of the projects and major component parts of the equipment.
 - b. Provide summary data sheets for each separate product or each piece of operating equipment.
 - c. Provide identified and indexed tabs.

6. ***Provide an electronic copy of the complete O&M Manual from each manufacturer/supplier in both PDF and JPEG formats (on CD/DVD/BD) to the Engineer.***
7. Cover and Spine
 - a. Identify each volume with the following printed title, based on the facility for which the O&M materials are being provided, on the binder cover and spine:

SANFORD MAIN WTP IMPROVEMENTS (2022)

SANFORD, FLORIDA

"OPERATION AND MAINTENANCE MANUAL"

[Owner's Logo] [Engineer's Logo] [Contractor's Logo]

[Date of Completion]

Volume No. ____

- b. Also identify on the binder cover, the following:
 1. Identity of separate structure as applicable.
 2. Identification of general subject matter covered in the Manual.
 3. Identification of the Engineer of Record (CPH, Inc.) for the project and their corporate logo.
 4. Identity of the General Contractor for the project and their corporate logo.

C. Binders

1. ***Commercial quality, three D-ring View-type binders with durable and cleanable white plastic covers.*** Binders shall be of the ***presentation quality type*** with clear vinyl covers on front, back and spine. The Binders shall include two (2) sheet lifters and two, horizontal inside pockets.

2. Maximum D-ring width: **2.5 inches**
3. When multiple binders are used, *correlate the data into related consistent groupings.*

1.04 Content of Manual

- A. Each volume of the Operation and Maintenance Manual shall include, but is not limited, to the following:
 1. ***A neatly computer-generated Table of Contents for each volume***, arranged in a systematic order by division, as listed within the product specifications. Each binder shall have a ***complete Table of Contents for all volumes.***
 2. Equipment Data sheets shall be provided for all project equipment and shall be developed in the format required by the Engineer. ***A copy of the equipment data sheets shall be provided in both PDF and JPEG formats (on CD/DVD/BD), to the Engineer, as previously referenced herein.***
 3. Contractor, name of responsible principal, address, telephone number and e-mail address.
 4. A list of each project item required to be included, indexed to content of the volume.
 5. List the following:
 - a. Subcontractor, manufacturer and installer name, addresses and telephone numbers and e-mail addresses.
 - b. Each product item required to be included, indexed to the content of the volume.
 - c. Identification of the area of responsibility of each product.
 - d. ***Local source of supply for parts and replacement equipment*** including company name, contact person, address, telephone number and e-mail address.
 6. Identify each product item by product name and other identifying symbols as set forth in Contract Documents.
- B. Product Design
 1. ***Provide hydraulic and engineering design criteria*** for each product as it pertains to a particular unit operation or process (submit PDF and JPEG formats also).

2. **Provide a “detailed” description** of each normal product operation as it pertains to a particular unit operation or process (submit PDF and JPEG formats also).

C. Product Data

1. Include only those sheets which are pertinent to the specific product. Hydraulic and engineering design criteria, information and procedures required for normal control, process control and performance evaluations, emergency operation, start-up and shut down operations, listing of spare parts required, maintenance and repair instructions, safety and personnel requirements and a ***detailed “troubleshooting” problem guide shall be included in the manual.*** References to related products, manufacturer and equipment histories, product catalogs, etc. shall not be included within the content of the Operation and Maintenance Manual.
2. Annotate each sheet to:
 - a. Clearly identify the specific product or part installed.
 - b. Clearly identify the data applicable to installation.
 - c. Delete references to inapplicable information.
3. Provide operation and maintenance information as herein specified.
4. ***“Record” and “approved” shop drawings as submitted and approved, by the Engineer, with all corrections made for each product. Include “As-Built” data and modifications with shop drawings for each product. This data shall also be provided in both PDF and JPEG formats (on CD/DVD/BD).***

D. Drawings

1. **Supplement the product data with drawings** as necessary to clearly illustrate:
 - a. Relations of the component parts of equipment and systems.
 - b. Product assembly and disassembly for maintenance and repair procedures.
 - c. Control and flow diagrams.
 - d. Representation of the manufacturer's recommended spare parts and their associated SKU or part numbers and current cost.
2. Coordinate the drawings with information in Project Record Documents to assure the correct illustration of the completed installation.

3. ***Do not use Project Record Documents as maintenance drawings.***
- E. ***A written text, as required to supplement product data*** for the particular installation including, but not limited to, the following:
 1. Organize in a consistent format under separate headings for different procedures.
 2. Provide a logical sequence of instruction of each procedure.
- F. ***A copy of each warranty, bond and service contract issued.*** Provide an information sheet for the Owner's personnel, presenting:
 1. The proper step-by-step procedures in the event of product failure.
 2. Safety instructions for facility personnel in the handling of failed equipment.
 3. Instances which might affect the validity of the warranties or bonds.
- G. ***List of all serial numbers of the equipment furnished.***
- H. ***Tabulation of the motor nameplate horsepower, nameplate current, field-measured current, overload relay setting, and catalog number for polyphase motors.***
- I. List of fuses, lamps, seals and other expendable equipment and devices. Specify the size, type and ordering description. List the name, address, e-mail address, FAX number and telephone number of the vendor.
- J. ***A complete valve tag list*** including the name and function of the pipe in which the valve is mounted and ***I/O list (including all tags)***.

1.05 Manual for Materials and Finishes

- A. ***Submit four (4) copies of the complete Operation and Maintenance Manual in final form per Article 1.07 of this specification section.***
- B. Content for architectural products, applied materials and finishes
 1. Manufacturers' data, giving full information on products
 - a. Catalog number, size, and composition.

- b. Color and texture designations.
 - c. Information required for reordering special manufacturing products (Include SKU or product numbers).
- 2. Instructions for care and maintenance
 - a. Manufacturers' recommendation for types of cleaning agents and methods.
 - b. Cautions against cleaning agents and methods which are or may be detrimental to the product.
 - c. Recommended schedule for cleaning and maintenance.
- C. Content for moisture protection and weather-exposed products
 - 1. Manufacturers' data, giving full information on products
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Details of installation.
 - 2. Instructions for inspection, maintenance and repair of products.
- D. Additional requirements for maintenance data can be found in the respective Sections of the Specifications.

1.06 Manual for Equipment and Systems

- A. ***Submit four (4) copies of the complete Operation and Maintenance Manual in final form per Article 1.07 of this specification section.***
- B. Provide a Table of Contents (TOC) for each item of equipment and/or system.
 - 1. List in its entirety, all sections pertinent to equipment operation and maintenance.
 - 2. Provide a fly-leaf for each individual section identified by corresponding section number.

C. Content for each unit of equipment and system (as appropriate)

1. Description of unit and component parts

- a. Provide general mechanical and process descriptions, function, normal operating characteristics, and limiting conditions.
- b. Performance curves, engineering data and tests as it pertains to the performance requirements as listed in the respective specification sections.
- 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 in the event of equipment failure or emergency situations to insure uninterrupted facility operation. Provide step-by-step instructions to initiate process alternatives.

3. Maintenance Procedures

- a. Provide instructions for maintenance procedures during routine operations.
- b. Provide a thorough, **detailed and complete "troubleshooting guide"** for all facility equipment and operational systems.
- c. Detailed procedures for disassembly, repair and reassembly.
- d. Detailed procedures for alignment, adjusting and checking.

- 4. Servicing and lubrication schedules required, to insure maximum product performance.
- 5. The manufacturer's printed operating and maintenance instructions.
- 6. A description of the sequence of operation by the control manufacturer.

7. The original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance. Also include the following in the submittal:
 - a. Predicted life of parts subject to wear.
 - b. Items recommended to be stocked as spare parts with manufacturers part or SKU number and the current cost for each item.
 8. As-installed control diagrams by the control's manufacturer.
 9. Each Contractor's coordination drawings: As-installed, color coded piping diagrams.
 10. Charts of valve tag numbers identifying the location and function of each valve.
 11. List of the original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
 12. Other data, as required, under the respective specification sections.
 13. "Approved" record shop drawings with all corrections made, and a copy of the warranty statement, checkout memo, demonstration test procedures and demonstration test certification.
- D. Content for each electric and electronic system (as appropriate)
1. Description of the 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 and panelboards
 - a. Electrical service.
 - b. Controls.
 - c. Communications.
 3. As installed color coded wiring diagrams.

4. Operating procedures
 - a. Start-up, routine, normal, shut-down and emergency operating instructions (at a minimum).
 - b. Sequences required.
 - c. Special operating instructions.
 5. Maintenance Procedures
 - a. Provide instructions for maintenance procedures during routine operations.
 - b. Provide a thorough, **detailed and complete "troubleshooting guide"** for all facility equipment and systems.
 - c. Detailed procedures for disassembly, repair and reassembly.
 - d. Detailed procedures for alignment, adjusting and checking.
 6. The manufacturer's printed Operation and Maintenance instructions.
 7. List of original manufacturers' spare parts, SKU/Part numbers, manufacturers' current prices, and recommended quantities to be maintained in storage.
 8. Other data, as required, under the respective Specification Sections.
 9. "Approved" record shop drawings with all corrections made, and a copy of the warranty statement, checkout memo, demonstration test procedures and demonstration test certification.
- E. Prepare and include additional data when the need for such data becomes apparent during instruction of the Owner's personnel.
- F. Additional requirements for Operation and Maintenance Data
1. Additional requirements for maintenance data can be found in the respective Sections of the Specifications.
 2. ***In addition to standard O&M Manuals, all manufacturers supplying equipment and products specified herein shall also submit their operation and maintenance manuals and data to the System Integrator for this Project on CD/DVD/BD's in Corel WordPerfect (latest version), Microsoft Word (latest***

version), or text, ".txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats (integrators preference for the system shall be required). All O&M Manual files shall also be submitted electronically on CD/DVD/BD's to the Engineer in both PDF and JPEG formats, no exceptions.

3. ***The System Integrator shall be responsible to configure and compile the O&M Manuals into "hypertext" window help files for use as computer "on-line" help screens for equipment operation and maintenance. The System Integrator shall return all hypertext files to the equipment and product manufacturer's for review and approval prior to introducing them into the SCADA System at the Sanford Main WTP.***

1.07 Submittal Schedule

- A. ***Submit two (2) copies of a "preliminary draft" of proposed formats and outlines of contents of the Operation and Maintenance Manuals to the Engineer within one hundred twenty (120) days after the Notice to Proceed.***
- B. ***Submit two (2) copies of the completed data in "Preliminary Form" no later than sixty (60) days following the Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01300, "Shop Drawings, Submittals and Samples", but no later than the delivery of equipment. One (1) copy will be returned with comments to be incorporated into the final O&M Manual copies and the other copies will be retained by the Engineer.***
- C. ***Submit four (4) copies of the "approved" Operation and Maintenance Manuals, in "Final Form" (hard copy and electronic formats {PDF and JPEG}), directly to the offices of the Engineer (CPH, Inc.) within ten (10) days after the reviewed copy or last item of the reviewed copy is returned.***
- D. ***Provide four (4) copies of addenda to the Operation and Maintenance Manuals as applicable and certificates, as specified, within thirty (30) days after final inspection, if any.***
- E. ***Failure to meet the deadlines for submittal of the "preliminary" and "final" versions of the Operation and Maintenance Manuals shall be cause for the Project to be "shut down" until such time as the documents are provided, in the proper format, to the Engineer. Any lost construction time and Contractor associated construction costs shall be borne by the Contractor based on his failure to meet the above referenced deadlines.***
- F. All submittals shall be accompanied by the O&M Manual Submittal Form, Section 00980, in the Contract Documents.

1.08 Instruction of Owner's Personnel

- A. ***Prior to the demonstration tests, fully instruct the Owner's designated Operations and Maintenance personnel*** in operation, adjustment and maintenance of products, equipment and systems.
- B. The Contractor shall provide a ***minimum ten (10) calendar day notification, in writing***, to the Engineer of instruction of the Owner's personnel on products, equipment and systems using the form provided in Section 00980.
- C. ***Operation and Maintenance Manuals shall constitute the basis of instruction.*** Review the contents of the O&M Manuals with the Owner's Operations and Maintenance personnel in full detail to explain all aspects of operations and maintenance.
- D. ***The Instructors shall be fully qualified personnel of the manufacturer of the equipment*** as outlined within the individual equipment specification sections. If no specific training specifications are listed with the equipment, the Contractor shall provide the instruction with qualified Contractor personnel.
- E. The Contractor shall provide a list to the Engineer and Owner indicating the date, time and the name of the instructors that will be present for all training sessions with the notification described in Article 1.08(B).
- F. ***The instructors shall provide for and prepare lesson scopes and handouts*** for up to twelve (12) individuals designated by the Owner, and including the Engineer, that outline the items to be covered. Separate sessions for operation and maintenance instruction shall be provided consecutively. ***Handouts shall be submitted to the Engineer with at least fourteen (14) calendar day's notice prior to the training sessions for review and approval.***
- G. ***All instruction sessions shall be filmed with a "high-quality" HD digital recording camcorder (1080p) and DVD's/BD's supplied by the Contractor.*** Filming shall be conducted by a competent, professional filming firm, under the direction of the Engineer and Owner, to provide "***high quality***" digital HD video recordings (1080p), in color. ***The Contractor shall then provide three (3) copies of each filmed session to both the Engineer and Owner for final distribution.***
- H. Videographer qualifications and Camera requirements are presented in Articles 1.02, 2.01 and 2.02 of Section 01390, "Preconstruction Video Recording" of these Contract Documents.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

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SECTION 01740

WARRANTIES AND BONDS

1. GENERAL

1.01 Description

A. Scope of Work

1. Compile specified warranties and bonds, as in "General Conditions" and as specified in these specifications.
2. Co-execute submittals when so specified.
3. Review submittals to verify compliance with the Contract Documents.
4. Submit warranties and bonds to the Engineer for review and transmittal to the Owner.

B. Related work specified elsewhere includes:

Specification Section	Title
00610	Performance Bond
00620	Labor and Materials Payment Bond
00625	Material and Workmanship Bond
00700	General Conditions
00800	Supplementary Conditions
00805	FDEP Supplementary Conditions
01300	Shop Drawings, Submittals and Samples
01700	Project Closeout
Division	Information
11	Equipment

- C. ***A two (2) year Maintenance Bond, or a Letter of Credit or Similar Instrument Satisfactory to the Owner, Equal to Ten Percent (10%) of the final construction costs*** shall be posted before Final Project Acceptance by the Owner and final payment can be made to the Contractor.

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 (TOC)
1. The Table of Contents (TOC) shall be *computer generated*, neat and presented in an orderly sequence. Provide complete and detailed information for each item including, but not limited, to the following:
 - a. Product of work item.
 - b. Firm, name of responsible principal, address, telephone number and e-mail address.
 - c. Scope.
 - d. Date of beginning of warranty, bond or service and maintenance contract.
 - e. Duration of warranty, bond or service maintenance contract.
 - f. Provide the following information for the Owner's personnel:
 1. Proper and detailed procedures to be followed in case of a failure.
 2. Instances which might affect the validity or warranty or bond.
 - g. Contractor, name of responsible principal, address, telephone number and e-mail address.

1.03 Form of Submittals

- A. ***The Contractor shall provide two (2) bound documents to the Engineer no later than sixty (60) calendar days prior to Final Project Acceptance by the Owner.***

B. Format

1. Size: 8-1/2" x 11" (***bright white paper, 99* on the paper brightness scale***), punch sheets for standard three (3) ring, D-ring view binder.
2. Fold larger sheets to 8 1/2" x 11" to fit into the binders.

C. Cover and Spine

1. Identify each volume with the following printed title, based on the facility for which warranties and bonds are being provided, on the binder cover and spine:

SANFORD MAIN WTP IMPROVEMENTS (2022)

SANFORD, FLORIDA

"WARRANTIES AND BONDS"

[Owner's Logo] [Engineer's Logo] [Contractor's Logo]

Volume No. ____

Engineer's and Contractor's Names and Addresses

D. Binders

1. Commercial quality, three (3) D-ring type view binders with durable and cleanable white plastic covers and maximum D-ring width of two and one-half (2 1/2) inches.
2. The binders shall be presentation type with clear vinyl covers (front/back) and spine.
3. The binders shall include two (2) sheet lifters and two (2) horizontal inside pockets.

E. Electronic Submittal

1. The Contractor shall provide an “*electronic*” submittal of the Warranty and Bond Binder, ***to the Engineer no later than sixty (60) calendar days prior to Final Project Acceptance by the Owner. The electronic submittal shall be in both PDF and JPEG formats.***

1.04 Warranty Submittal Requirements

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the Contractor's for a ***period of two (2) years, unless otherwise specified, commencing at the time of Final Project Acceptance by the Owner.***
- B. The Contractor shall be responsible for obtaining certificates for equipment warranties for all major equipment specified under Division 11, “Equipment”; Division 13, “Special Construction”; Division 15, “Mechanical”; and Division 16, “Electrical”; and which has at least a 1.0 hp motor or which lists for more than \$1,000. The Engineer reserves the right to request warranties for equipment not classified as major. ***The Contractor shall still warrant equipment not considered to be "major" in the Contractor's two (2) year warranty period even though certificates of warranty may not be required*** (commencing at the time of Final Project Acceptance by the Owner).
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a two (2) year warranty commencing at the time of Final Project Acceptance by the Owner, the Contractor shall obtain from the manufacturer a three (3) year warranty commencing at the time of equipment delivery to the job site. This three (3) year warranty from the manufacturer shall not relieve the Contractor of the two (2) year warranty, starting at the time of Final Project Acceptance by the Owner.
- D. ***The Owner shall incur no labor or equipment cost during the guarantee period.***
- E. The Guarantee shall cover all necessary labor, equipment, materials, and replacement parts resulting from faulty or inadequate equipment design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by the manufacturer or the Contractor.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

SECTION 01800

MISCELLANEOUS WORK AND CLEANUP

1. GENERAL

1.01 Description

- A. This Section includes operations which cannot be specified in detail as separate items but can be sufficiently described as to the kind and extent of work involved.
- B. The Contractor shall furnish all labor, materials, equipment and incidentals to ***completely and thoroughly clean the Project Site at the completion of the Work.***
- C. The work of this Section includes, but is not limited to, the following:
 - 1. Removal and legal disposal of all broken concrete, wood, scraps, wire, packaging materials, forms, debris, scaffolds and other objectionable rubble created during construction operations.
 - 2. Cleaning of spilled mortar, concrete and metal work.
 - 3. Removal of all temporary manufacturer's labels from and washing of all equipment.
 - 4. Restoring of driveways and fences.
 - 5. Crossing utilities.
 - 6. Relocation of existing water lines, low pressure gas lines, telephone lines, electric lines, cable TV lines and storm drains.
 - 7. Restoring easements and rights of way.
 - 8. Incidental work.

1.02 Qualifications

- A. All work shall be completed in a workmanlike manner by competent workmen in full compliance with all applicable sections of these Specifications.

2. PRODUCTS

2.01 Materials

- A. Materials required for this Section shall be of at least the same type and quality as materials that are to be restored, if any.
- B. Where possible, the Contractor shall reuse undamaged, existing materials that are removed and then replaced, if any.

3. EXECUTION

3.01 Restoring of Fences

- A. At several locations it may be necessary for the Contractor to remove, store and replace existing fences during construction. Only the sections directed by the Engineer shall be removed.
- B. If any section of fence is damaged due to the Contractor's negligence, it shall be replaced with fencing equal to or better than that damaged, and the work shall be satisfactory to the Engineer.
- C. ***All restoration/repair shall be provided by the Contractor at no additional cost to the Owner.***

3.02 Crossing Utilities

- A. This item shall include any extra work required in crossing culverts, watercourses, drainage ditches, drains, water mains, reclaimed water mains, wastewater lines and other utilities, including all sheeting, shoring and bracing, extra excavation and backfill, or any other work required for the crossing, whether or not shown on the Contract Drawings.

3.03 Relocations of Existing Gas Lines, Telephone Lines, Electric Lines and Cable, Utility Lines and Cable TV Lines

- A. The Contractor shall notify the proper authority of the utility involved when relocation of these lines is required.

- B. The Contractor shall coordinate all work by the utility so that the progress of construction will not be hampered.

3.04 Restoring Easements and Rights-of-Way

- A. ***The Contractor shall be responsible for all damage to City and private property due to his operations and shall fix all damage immediately at his own cost.***
- B. The Contractor shall protect from injury all walls, fences, cultivated shrubbery, pavement, underground facilities, such as water pipe, or other utilities which may be encountered along the easement.
- C. If removal and replacement are required, it shall be done in a workmanlike manner so that the replacement is equivalent to that which existed prior to construction.
- D. Existing lawn surfaces damaged by construction shall be ***regraded and resodded***. These areas shall be maintained by the Contractor, at his cost, until Final Project Acceptance by the Owner.

3.05 Clean up

- A. The Contractor shall remove all construction material, buildings, equipment and other debris remaining on the job as the result of construction operations and shall render the site of the work in a neat and orderly condition.
- B. All garbage, debris, trash, unsuitable material, etc., shall be disposed of in a legal manner by the Contractor at no additional cost to the Owner.
- C. Remove excess dust and mud created by the construction of the facilities.
- D. All suitable excess excavated material, as determined by the Engineer and Owner, shall be the property of the Owner and shall remain on-site.
- E. Cleanup During Construction
 - 1. During execution of the work, the Contractor shall clean the site, adjacent properties and public access roads and dispose of waste materials, debris, and rubbish to assure that building, grounds and public properties are maintained free from accumulations of waste materials and rubbish.
 - 2. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

3. Provide containers for collection and disposal of waste materials, debris and rubbish.
4. Cover or wet excavated material leaving and arriving at the Project Site to prevent blowing dust. Clean the public access roads to the site of any material falling from haul trucks.

F. Final Cleanup

1. ***At the completion of all Project Work and immediately prior to final inspection, the Contractor shall clean the entire Project Site.***
 2. Clean, sweep, wash and polish all work and equipment including finishes.
 3. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed interior and exterior finished surfaces.
 4. Repair, patch and touch-up all marred surfaces to match the adjacent surfaces.
 5. Broom clean paved surfaces and rake clean all landscaped areas.
 6. Remove from the Project Site all temporary structures and all materials, equipment and appurtenances not required as a part of, or appurtenant to, the completed work.
- G. The Contractor must also meet all conditions and requirements identified in Section 01560, "Environmental Protection".

3.06 Incidental Work

- A. The Contractor shall do all incidental work, not otherwise specified, but obviously necessary for the proper completion of the Contract as specified and as shown on the Contract Drawings.
- B. ***All incidental work shall be accounted for in the Contractor's Bid Price for the Project.***

END OF SECTION

SANFORD MAIN WTP IMPROVEMENTS

SANFORD, FLORIDA



DIVISION 2

SITework

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DIVISION 2

SITEWORK

Specification Section	<u>Title</u>

02000	Soils and Subsurface Investigation
02050	Demolition and Salvage
02075	Dewatering and Drainage
02100	Site Preparation
02200	Earthwork
02210	Site Grading
02215	Finish Grading
02220	Excavation, Backfilling and Compaction
02276	Gravel and Crushed Rock Base for Structures
02505	Pavement Removal and Restoration
02610	Stabilized Sub-Base
02612	Reinforced Concrete Pipe and Fittings
02640	Hydrant Assemblies
02720	Concrete Sidewalks, Driveways and Pads
02815	Solid Sodding
02830	Fixed Head Irrigation System

DIVISION 2

SITEWORK

Specification Section	<u>Title</u>

02842	Aluminum Ornamental Fence and Gate Systems
02850	Parking Bumpers
02870	Site and Street Furnishings

SECTION 02000

SOILS AND SUBSURFACE INVESTIGATION

1. GENERAL

1.01 Description

- A. An independent geotechnical consultant, Terracon Consultants, Inc., conducted soils and subsurface investigations at the Sanford Main WTP. The geotechnical report is entitled "Geotechnical Engineering Report - Sanford Main WTP Improvements, Sanford, FL, Seminole County, Florida, dated February 27, 2019, Terracon Project No. H1185258.
- B. A copy of the complete soils and subsurface investigation is attached at the end of this specification section.
- C. The Contractor shall remove all undesirable material, as identified in the soils and subsurface investigations, if any, and dispose of it in a legal manner.
- D. The Contractor shall bring in clean fill and compact it in the areas where any undesirable material is removed, if any, and compact this clean fill in accordance with specification Section 02220, "Excavation, Backfilling and Compaction".
- E. The cost of excavation and legal disposal of all undesirable material, if any, and the cost of importing, filling, and compaction of clean fill shall be included in the Contractor's Bid for this Project.
- F. The Soil and Subsurface Investigation Report is provided for information only.
- G. The subsurface information contained in the geotechnical report was obtained for design purposes and investigations and may not be an adequate representation of actual conditions for project construction. Information shown, including water levels, represents existing conditions at the specific boring locations at the time the borings were made.
- H. ***All risks resulting from use or interpretation of the subsurface data in the geotechnical report shall be borne by the Contractor.***

- I. This data is available for information only and may be useful as a guide in estimating and planning the work.
- J. The Contractor shall examine and interpret the geotechnical report and make any additional site and soils investigations deemed necessary to achieve satisfactory completion and acceptance of this Contract. ***If additional soils and subsurface information is required by the Contractor it shall be the Contractor's responsibility to obtain such data.***
- K. ***The Owner and the Engineer disclaim any responsibility*** for the accuracy, true location, and extent of the soils investigation that has been prepared. They further disclaim responsibility for interpretation of that data, as in projecting soil-bearing values, soil stability, and the presence, level, and extent of underground water.
- L. The Contractor shall refer to the General and Supplementary Conditions for a further explanation of subsurface conditions.

END OF SECTION



Geotechnical Engineering Report

**Sanford Water Treatment Plant Improvements
Sanford, Seminole County, Florida**

February 27, 2019

Terracon Project No. H1185258

Prepared for:

CPH, Inc.

Sanford, Florida

Prepared by:

Terracon Consultants, Inc.

Winter Park, Florida



February 27, 2019

CPH, Inc.
500 West Fulton Street
Sanford, Florida 32771



Attn: Ms. Daniella Tow, E.I.
P: (407) 322 6841, Ext. 1041
E: dtow@cphcorp.com

Re: Geotechnical Engineering Report
Sanford Water Treatment Plant Improvements
SR 46A and Country Club Road
Sanford, Seminole County, Florida
Terracon Project No. H1185258

Dear Ms. Tow:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PH1185258 dated August 10, 2018. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

Certificate of Authorization No. 9330

Shenna McMaster, P.E.
Senior Geotechnical Engineer
Florida PE #57537

Jay W. Casper, P.E.
Principal

This report has been electronically signed and sealed by Shenna McMaster, P.E. on February 27, 2019 using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.



REPORT TOPICS

REPORT SUMMARY I

INTRODUCTION..... 1

SITE CONDITIONS..... 1

PROJECT DESCRIPTION 2

GEOTECHNICAL CHARACTERIZATION..... 2

GEOTECHNICAL OVERVIEW 4

EARTHWORK 5

SHALLOW FOUNDATIONS 8

SEISMIC CONSIDERATIONS 10

FLOOR SLABS 10

GENERAL COMMENTS 12

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

- EXPLORATION AND TESTING PROCEDURES
- SITE LOCATION AND EXPLORATION PLANS
- EXPLORATION RESULTS
- SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic ¹	Overview Statement ²
Project Description	The project will include relocation of the existing office building and fluoride storage tank, generator, chlorine storage area, and main water treatment plant control building from the east side of the treatment tanks to the west side of the treatment tanks.
Geotechnical Characterization	Very loose to loose sand to depths of 4 to 8 feet underlain by loose to medium dense sand with silt, clayey sand, and/or silty sand to the boring termination depths of 20 to 30 feet. Groundwater was found at depths of 8-1/2 to more than 10 feet below existing grade.
Earthwork	Due to very loose soil conditions observed in the upper 4 feet at some boring locations, we recommend additional compaction effort below footing locations to achieve a minimum compaction of 95% of the soil's modified Proctor maximum dry density to a depth of at least 2 feet below foundation levels. This may require over-excavation and re-compaction of soils below foundations.
Shallow Foundations	Shallow foundations will be sufficient Allowable bearing pressure = 2,500 psf Expected settlements: < 1-inch total, < 1/2-inch differential Detect and remove zones of fill as noted in Earthwork .
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report
Sanford Water Treatment Plant Improvements
SR 46A and Country Club Road
Sanford, Seminole County, Florida
Terracon Project No. H1185258
February 27, 2019

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed improvements to the existing Sanford Water Treatment Plant located at SR 46A and Country Club Road in Sanford, Seminole County, Florida. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction

The geotechnical engineering Scope of Services for this project included the advancement of five test borings to depths ranging from 20 to 30 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	This project site is located to the southwest corner of the SR 46A and Country Club Road intersection in the City of Sanford, Florida. See Site Location
Current Ground Cover	The water treatment plant consists of tanks and various support structures.

Geotechnical Engineering Report

Sanford Water Treatment Plant Improvements ■ Sanford, Seminole County, Florida

February 27, 2019 ■ Terracon Project No. H1185258



Item	Description
Existing Topography	Site specific topographic information provided on the site plan indicates that the existing ground surface elevation in the location of the proposed structures range from about +55 to +60 feet. Generally, the subject area slopes towards the north.
Surface Water	The USGS topographic quadrangle map "Sanford, Florida" depicts low lying areas and water features to the south of the site, at elevations below +50 feet.

Soil Survey

The Soil Survey of Seminole County, Florida as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS), identifies the soil type at the subject site as Tavares-Millhopper complex, 0 to 5 percent slopes (31). A Soils Map is included with this [GeoReport](#), depicting the applicable Soil Survey map portion for the subject site.

31 – Tavares-Millhopper fine sands, 0 to 5 percent slopes. This soil type is nearly level to gently sloping and moderately well drained. It is typically found on low ridges and knolls on the uplands. In its natural state and during years of normal rainfall, the soils in this map unit have a seasonal high water table at a depth of between 36 and 60 inches (3.0 and 5.0 feet) for 2 to 6 months. The seasonal high water table is apparent in Tavares soil but perched in Millhopper soil. Tavares fine sand is predominantly sandy throughout the defined profile of 80 inches (6.7 feet). Millhopper fine sand is predominantly sandy to a typical depth of 45 inches (3.8 feet), transitioning to silty sand to clayey sand thereafter (USCS Classification symbol SM to SC).

PROJECT DESCRIPTION

Our understanding of the project conditions is as follows:

Item	Description
Information Provided	Site plan of the proposed improvements provided by you.
Project Description	The project will include relocation of the existing office building and fluoride storage tank, generator, chlorine storage area, and main water treatment plant control building from the east side of the treatment tanks to the west side of the treatment tanks.

GEOTECHNICAL CHARACTERIZATION

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/ Density
1	4 to 8	Sand (SP)	Very loose to loose
2	At least 30 feet	Mostly Clayey Sand (SC) and Silty Sand (SM) with occasional lenses of Sand with Silt (SP-SM)	Loose to medium dense

Conditions encountered at each boring location and results of laboratory testing are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types. The in-situ transition between materials may be gradual. Details for each of the borings can be found on the boring logs in the **Exploration Results** section of this report. Descriptions of our field exploration and laboratory testing procedures are included in the **Exploration and Testing Procedures** of this report. General notes for SPT borings and a more detailed description of the Unified Soil Classification System (USCS) are included in the **Supporting Information** section.

Groundwater Conditions

The borings were observed during drilling for the presence and level of groundwater. Groundwater levels were not observed in Borings B-1 through B-4 within a depth of 10 feet. Due to the use of driller's mud to stabilize boreholes, groundwater levels could not be measured below a depth of 10 feet. Boring B-5 found groundwater at a depth of 8-1/2 feet below existing grade. The water levels observed at the boring locations during the field exploration can be found on the boring logs in the **Exploration Results** section.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the boring was performed. In addition, perched water can develop within higher permeability soils overlying less permeable soils. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the boring logs.

We estimate that during the normal wet season with rainfall and recharge at a maximum, groundwater levels will be 4 to 8 feet below existing grade. Our estimates of the normal seasonal groundwater conditions are based on the USDA Soil Survey, the encountered soil types, antecedent weather conditions, and the interpreted water levels. The water levels observed in the

soundings can be found on the sounding logs in **Exploration Results**, and are summarized below along with the estimated normal seasonal high groundwater table.

Boring Number	Approximate depth to encountered water table (feet) ¹	Approximate depth to estimated normal seasonal high groundwater table (feet) ^{1,2}
B-1	>10	4
B-2	>10	4
B-3	>10	8
B-4	>10	8
B-5	8-1/2	6

1. At ground surface.

2. A perched groundwater condition above low permeable silty and clayey sand is anticipated following heavy rainfall events and during the rainy season.

These normal seasonal water table estimates do not represent the temporary rise in water table that occurs immediately following a storm event, including adjacent to other stormwater management facilities. This is different from static groundwater levels in wet ponds and/or drainage canals which can affect the design water levels of new, nearby ponds. The seasonal high groundwater table may vary from normal when affected by extreme weather changes, localized or regional flooding, karst activity, future grading, drainage improvements, or other construction that may occur on or around the site following the date of this report.

GEOTECHNICAL OVERVIEW

Borings encountered very loose to medium dense sands with varying amounts of silt and clayey sand. These materials are generally suitable for construction of the proposed foundations and floor slabs following site preparation according to the recommendations provided in the **Earthwork** section. Due to very loose soil conditions observed in the upper 4 feet at some boring locations, we recommend additional compaction effort below footing locations to achieve a minimum compaction of 95% of the soil's modified Proctor maximum dry density to a depth of at least 3 feet below foundation levels. This may require over-excavation and re-compaction of soils below foundations. The **Shallow Foundations** section addresses support of the building bearing on in-situ sands or engineered fill. The **Floor Slabs** section addresses slab-on-grade support of the building.

Seasonal high groundwater levels should be considered in the civil engineering design for site grading, utility construction, and pavements.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations and floor slabs.

Due to very loose soil conditions observed in the upper 4 feet at some boring locations, we recommend additional compaction effort below footing locations to achieve a minimum compaction of 95% of the soil's modified Proctor maximum dry density to a depth of at least 2 feet below foundation levels. This may require over-excavation and re-compaction of soils below foundations.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed structure areas.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck or heavy roller. The proofrolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Geotechnical Engineering Report

Sanford Water Treatment Plant Improvements ■ Sanford, Seminole County, Florida
February 27, 2019 ■ Terracon Project No. H1185258



Soil Quality ¹	USCS Classification	Acceptable Location for Placement	Maximum Lift Thickness (in.)
Preferred ¹	SP (fines content < 5%)	All locations and elevations	12 ³
	SP-SM (fines content between 5 and 12%) ²	All locations and elevations other than beneath concrete pavements or where superior drainage is required. Strict moisture control will be required during placement, particularly during the rainy season.	8 to 12 ³
Limited	SM, SC (fines content >12%)	Limited to mass fill greater than 2 feet below final grade; strict moisture control will be required during placement.	6 to 8 ⁴

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris.
2. If fines contents are greater than 12 percent, special design and construction procedures may be necessary.
3. Loose thickness when heavy compaction equipment is used in vibratory mode. Lift thickness should be decreased if static compaction is being used, typically to no more than 8 inches, and the required compaction must still be achieved. Use 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is required.
4. Static equipment should be used.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill
Minimum Compaction Requirements ¹	95 percent of the material's maximum modified Proctor dry density (ASTM D 1557).
Moisture Content ²	Within ± 2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction.
Minimum Testing Frequency	One field density test per 5,000 square feet or fraction thereof per 1-foot lift.

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the structures should be backfilled with native soils to avoid creating a preferred flow path through the trenches.

Grading and Drainage

All grades must provide effective drainage away from the structures during and after construction. Final surrounding grades should be sloped away from the structures on all sides to prevent ponding of water. Roof drains, scuppers, downspouts, or other appropriate methods that direct water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. Site grades should be set considering the estimated seasonal high groundwater presented in **Geotechnical Characterization**.

Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

After initial proofrolling and compaction, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and re-compacted prior to floor slab construction.

Trees or other vegetation whose root systems have the ability to excessively remove moisture or that may displace the foundations or flatwork should not be planted next to the structures (foundations, pavements, sidewalks, etc.).

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Terracon Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Terracon Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the structure areas. One density and water content test should be performed for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Terracon Geotechnical Engineer. If unanticipated conditions are encountered, the Terracon Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Terracon Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations. Due to very loose soil conditions observed in the upper 4 feet at some boring locations, we recommend additional compaction effort below footing locations to achieve a minimum compaction of 95% of the soil's modified Proctor maximum dry density to a depth of at least 2 feet below foundation levels. This may require over-excavation and re-compaction of soils below foundations.

Design Parameters – Compressive Loads

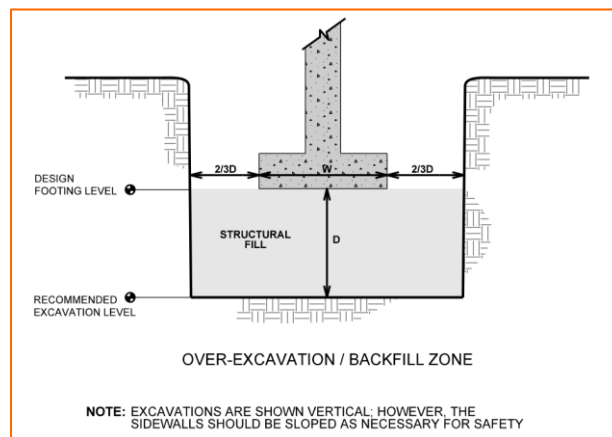
Description	Column Footing	Wall Footing	Monolithic Slab Foundation ⁴
Net allowable bearing pressure ¹	2,500 psf	2,500 psf	2,500 psf
Minimum width	30 inches	18 inches	12 inches
Minimum embedment below finished grade ²	18 inches	18 inches	12 inches
Compaction requirements	95 percent of the materials maximum Modified Proctor dry density for a depth of 2 feet below footing.		
Minimum Testing Frequency	One field density test per footing per foot depth for a minimum depth of 2 feet below the footing subgrade.	One field density test per footing per foot depth for a minimum depth of 2 feet below the footing subgrade..	One field density test per footing per foot depth for a minimum depth of 2 feet below the footing subgrade.
Approximate total settlement ³	<1 inch	<1 inch	<1 inch
Estimated differential settlement ³	<1/2 inch between columns	<1/2 inch over 40 feet	<1/2 inch over 40 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft soils, if encountered, will be undercut and replaced with engineered fill.
2. For erosion protection and to reduce effects of seasonal moisture variations in subgrade soils.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed that the maximum footing width is 10 feet for column footings and 3.5 feet for continuous footings.
4. Turned-down portion of slab. For slab requirements see **Floor Slabs**

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with engineered fill placed, as recommended in the **Earthwork** section.



SEISMIC CONSIDERATIONS

Chapter 1, Part 101.2 of the 2017 Florida Building Code (effective July 2017) states: “Code requirements that address snow loads and earthquake protection are pervasive; they are left in place but shall not be utilized or enforced because Florida has no snow load or earthquake threat.”. Therefore, this report does not further address seismic considerations.

Seismic considerations will seldom control the structural design of buildings in Central Florida (as compared to wind loading conditions). If seismic considerations control the structural design, we can provide a proposal to perform additional services to measure shear wave velocity such as MASW (multichannel analysis of surface waves), ReMi testing (refraction microtremor), seismic cone penetrometer (SCPT) testing to see if the site classification improves.

FLOOR SLABS

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support ^{1,2}	Free draining granular material meeting the preferred fill specification
Estimated Modulus of Subgrade Reaction ³	100 pounds per square inch per inch (psi/in) for point loads
Compaction requirements	95 percent of the materials maximum Modified Proctor dry density

Item	Description
Minimum Testing Frequency	One field density test per 2,500 square feet or fraction thereof for a depth of 12 inches. ³
1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation. 2. We recommend subgrades be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompact. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs. 3. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in Earthwork, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.	

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should

be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet) ¹	Location
3	20	Proposed office building area
2	30	Proposed fluoride storage tank, generator, chlorine storage tank and control structure location.

1. Below ground surface.

Boring Layout: We used handheld GPS equipment to locate borings with an estimated horizontal accuracy of +/-20 feet. Field measurements from existing site features were used.

Subsurface Exploration Procedures: We advanced soil borings with a truck-mounted drill rig using rotary wash techniques as necessary depending on soil conditions. Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. We obtained representative samples primarily by the split-barrel sampling procedure. In the split-barrel sampling procedure, a standard, 2-inch O.D., split-barrel sampling spoon is driven into the boring with a 140-pound automatic SPT (Standard Penetration Test) hammer falling 30 inches. We recorded the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch sampling interval as the standard penetration resistance value, N.

The samples were placed in appropriate containers, taken to our soil laboratory for testing, and classified by a Geotechnical Engineer. In addition, we observed and record groundwater levels during drilling and sampling.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to

Geotechnical Engineering Report

Sanford Water Treatment Plant Improvements ■ Sanford, Seminole County, Florida
February 27, 2019 ■ Terracon Project No. H1185258



methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D1140 Standard Test Method for Amount of Material in Soils Finer than No. 200 (75- μ m) Sieve

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

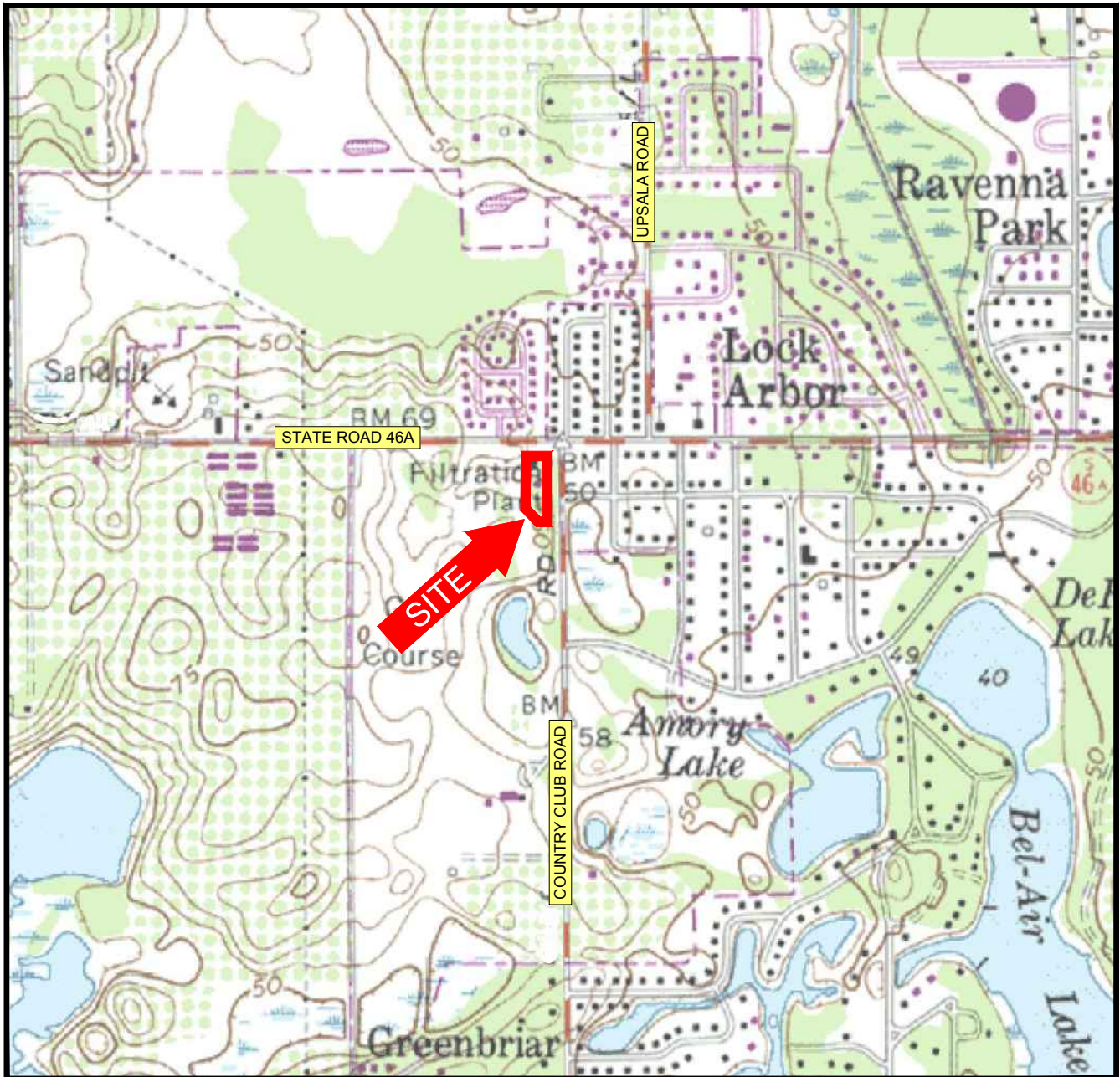
SITE LOCATION AND EXPLORATION PLANS

Contents:

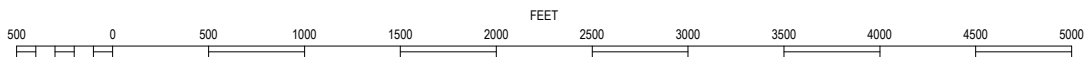
Topographic Vicinity Map

Soils Map

Boring Location Plan



SCALE 1"=1000'



SANFORD, FLORIDA
ISSUED: 1988
7.5 MINUTE SERIES (QUADRANGLE)



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Project Mng:	SM	Project No.	H1185258
Drawn By:	AS	Scale:	AS SHOWN
Checked By:	SM	File No.	H1185258
Approved By:	JWC	Date:	1-22-19

Terracon
Consulting Engineers and Scientists

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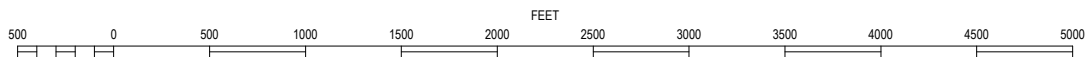
TOPOGRAPHIC VICINITY MAP
GEOTECHNICAL ENGINEERING REPORT
SANFORD MAIN WTP IMPROVEMENTS
STATE ROAD 46A AND COUNTRY CLUB ROAD
SANFORD, SEMINOLE COUNTY, FLORIDA

EXHIBIT

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SCALE 1"=1000'



U.S.D.A. SOIL SURVEY FOR SEMINOLE COUNTY, FLORIDA

SOIL LEGEND

- 2 ADAMSVILLE-SPARR FINE SANDS
- 31 TAVARES-MILLHOPPER COMPLEX, 0 TO 5 PERCENT SLOPES
- 34 URBAN LAND, 0 TO 2 PERCENT SLOPES



Project Mngn:	SM	Project No.	H1185258
Drawn By:	AS	Scale:	AS SHOWN
Checked By:	SM	File No.	H1185258
Approved By:	JWC	Date:	1-22-19

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Consulting Engineers and Scientists

1675 LEE ROAD WINTER PARK, FLORIDA 32789
PH. (407) 740-6110 FAX. (407) 740-6112

SOILS MAP
GEOTECHNICAL ENGINEERING REPORT
SANFORD MAIN WTP IMPROVEMENTS
STATE ROAD 46A AND COUNTRY CLUB ROAD
SANFORD, SEMINOLE COUNTY, FLORIDA

EXHIBIT

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Project Mng:	SM	Project No.	H1185258
Drawn By:	AS	Scale:	AS SHOWN
Checked By:	SM	File No.	H1185258
Approved By:	JWC	Date:	1-22-19

Terracon
Consulting Engineers and Scientists

1675 LEE ROAD WINTER PARK, FLORIDA 32789
PH. (407) 740-6110 FAX. (407) 740-6112

BORING LOCATION PLAN
GEOTECHNICAL ENGINEERING REPORT
SANFORD MAIN WTP IMPROVEMENTS
STATE ROAD 46A AND COUNTRY CLUB ROAD
SANFORD, SEMINOLE COUNTY, FLORIDA

EXHIBIT

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 through B-5)

BORING LOG NO. B-1

Page 1 of 1

PROJECT: Sanford Water Treatment Plant

CLIENT: CPH
Sanford, FL

SITE: SR 46A and Country Club Road
Sanford, FL

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 28.7854° Longitude: -81.3187°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
	DEPTH							
	SAND (SP) , light gray brown			X	2-2-2-2 N=4			
				X	2-2-3-2 N=5			
4.0	CLAYEY SAND (SC) , orange-brown			X	2-2-3-4 N=5			
6.0	SILTY SAND (SM) , trace clay, orange-brown			X	4-4-5-5 N=9	15		27
				X	5-4-5-5 N=9			
		10						
13.5	SILTY SAND (SM) , light gray			X	4-4-6 N=10	23		12
		15						
				X	7-8-8 N=16			
20.0	Boring Terminated at 20 Feet	20						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

Groundwater not observed in 10 feet.

Terracon

1675 Lee Rd
Winter Park, FL

Boring Started: 02-01-2019

Boring Completed: 02-01-2019

Drill Rig: CME 45

Driller: Travis B.

Project No.: H1185258

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL. H1185258 SANFORD WATER TREATMENT PLANT. MODELLAYER.GPJ 2/25/19

BORING LOG NO. B-2

Page 1 of 1

PROJECT: Sanford Water Treatment Plant

CLIENT: CPH
Sanford, FL

SITE: SR 46A and Country Club Road
Sanford, FL

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 28.7854° Longitude: -81.3188°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
	DEPTH							
	SAND (SP) , light brown			X	2-2-1-1 N=3	6		3
				X	1-1-2-1 N=3			
	CLAYEY SAND (SC) , light brown, orange-brown mottled	5		X	1-2-3-5 N=5	17	39-18-21	35
				X	6-8-9-9 N=17			
		10		X	6-7-8-9 N=15			
	SILTY SAND (SM) , trace clay, light brown, orange-brown mottled	15		X	8-9-8 N=17			
				X	4-4-4 N=8			
		20						
	Boring Terminated at 20 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

Groundwater not observed in 10 feet.

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 02-01-2019

Boring Completed: 02-01-2019

Drill Rig: CME 45

Driller: Travis B.

Project No.: H1185258

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL. H1185258 SANFORD WATER TREATMENT PLANT. MODELLAYER.GPJ 2/25/19

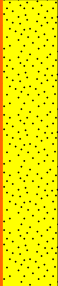
BORING LOG NO. B-3

Page 1 of 1

PROJECT: Sanford Water Treatment Plant

CLIENT: CPH
Sanford, FL

SITE: SR 46A and Country Club Road
Sanford, FL

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 28.7855° Longitude: -81.3188°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
	DEPTH							
	SAND (SP) , light brown			X	3-3-3-3 N=6			
				X	4-4-5-5 N=9			
		5		X	3-2-3-2 N=5	6		2
				X	2-2-2-2 N=4			
		10		X	2-2-2-3 N=4			
	CLAYEY SAND (SC) , orange-brown							
		13.5						
	SAND WITH SILT (SP-SM) , light brown			X	4-6-7 N=13	23		8
		18.5						
	SILTY SAND (SM) , light brown			X	3-4-6 N=10			
		20.0						
	Boring Terminated at 20 Feet	20						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

Groundwater not observed in 10 feet.

Terracon

1675 Lee Rd
Winter Park, FL

Boring Started: 02-01-2019

Boring Completed: 02-01-2019

Drill Rig: CME 45

Driller: Travis B.

Project No.: H1185258

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL. H1185258 SANFORD WATER TREATMENT PLANT. MODELLAYER.GPJ 2/25/19

BORING LOG NO. B-4

Page 1 of 1

PROJECT: Sanford Water Treatment Plant

CLIENT: CPH
Sanford, FL

SITE: SR 46A and Country Club Road
Sanford, FL

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 28.7857° Longitude: -81.3188°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
DEPTH								
	SAND (SP) , light brown	5			2-2-2-2 N=4	6		3
					2-2-3-2 N=5			
					2-2-2-4 N=4			
					2-2-3-3 N=5			
	CLAYEY SAND (SC) , light brown, orange-brown mottled	10			3-4-6-7 N=10	17	36-18-18	25
	SAND WITH SILT (SP-SM) , light orange-brown	25			7-8-8 N=16			
					3-4-3 N=7			
					4-4-4 N=8			
					4-5-7 N=12			
	Boring Terminated at 30 Feet	30						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

Groundwater not observed in 10 feet.

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 02-01-2019

Boring Completed: 02-01-2019

Drill Rig: CME 45

Driller: Travis B.

Project No.: H1185258

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1185258 SANFORD WATER TREATMENT PLANT GPJ 2/25/19

BORING LOG NO. B-5

Page 1 of 1

PROJECT: Sanford Water Treatment Plant

CLIENT: CPH
Sanford, FL

SITE: SR 46A and Country Club Road
Sanford, FL

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 28.7857° Longitude: -81.3189°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
							LL-PL-PI	
	DEPTH							
	SAND (SP) , gray-brown to light brown			X	2-1-1-2 N=2			
				X	1-2-1-2 N=3			
		5		X	2-2-2-3 N=4			
	SILTY SAND (SM) , trace clay, light orange-brown	6.0		X	2-2-2-2 N=4			
	CLAYEY SAND (SC) , light brown, orange-brown mottled to light gray	8.0		X	2-2-3-6 N=5	18	32-20-12	27
				X	8-7-7 N=14			
		15		X	4-7-9 N=16	23		10
	SAND WITH SILT (SP-SM) , light gray to light brown	18.5		X	4-5-7 N=12			
		25		X	5-5-4 N=9			
	Boring Terminated at 30 Feet	30.0						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

 Groundwater observed at 8.5 ft.

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 02-01-2019

Boring Completed: 02-01-2019

Drill Rig: CME 45

Driller: Travis B.

Project No.: H1185258

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL. H1185258 SANFORD WATER TRE.GPJ MODEL LAYER.GPJ 2/25/19

SUPPORTING INFORMATION

Contents:

General Notes

Unified Soil Classification System

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING	 Auger Cuttings	 Rock Core	WATER LEVEL	 Water Initially Encountered	FIELD TESTS	(HP) Hand Penetrometer
	 Grab Sample	 No Recovery		 Water Level After a Specified Period of Time		(T) Torvane
	 Shelby Tube	 Standard Penetration Test		 Water Level After a Specified Period of Time		(DCP) Dynamic Cone Penetrometer
						(PID) Photo-Ionization Detector
						(OVA) Organic Vapor Analyzer

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS	RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
	Descriptive Term (Density)	Automatic Hammer SPT N-Value (Blows/Ft.)	Descriptive Term (Consistency)	Unconfined Compressive Strength Qu, (psf)	Automatic Hammer SPT N-Value (Blows/Ft.)
	Very Loose	< 3	Very Soft	less than 500	< 1
	Loose	3 - 8	Soft	500 to 1,000	1 - 3
	Medium Dense	8 - 24	Medium Stiff	1,000 to 2,000	3 - 6
	Dense	24 - 40	Stiff	2,000 to 4,000	6 - 12
	Very Dense	> 40	Very Stiff	4,000 to 8,000	12 - 24
			Hard	> 8,000	> 24

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification	
					Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-graded gravel ^F	
			$Cu < 4$ and/or $[Cc < 1$ or $Cc > 3.0]$ ^E	GP	Poorly graded gravel ^F	
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}	
			Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}	
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I	
			$Cu < 6$ and/or $[Cc < 1$ or $Cc > 3.0]$ ^E	SP	Poorly graded sand ^I	
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}	
			Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}	
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	$PI > 7$ and plots on or above “A”	CL	Lean clay ^{K, L, M}	
			$PI < 4$ or plots below “A” line ^J	ML	Silt ^{K, L, M}	
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K, L, M, N}
			Liquid limit - not dried			Organic silt ^{K, L, M, O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line	CH	Fat clay ^{K, L, M}	
			PI plots below “A” line	MH	Elastic Silt ^{K, L, M}	
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K, L, M, P}
			Liquid limit - not dried			Organic silt ^{K, L, M, Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat	

^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

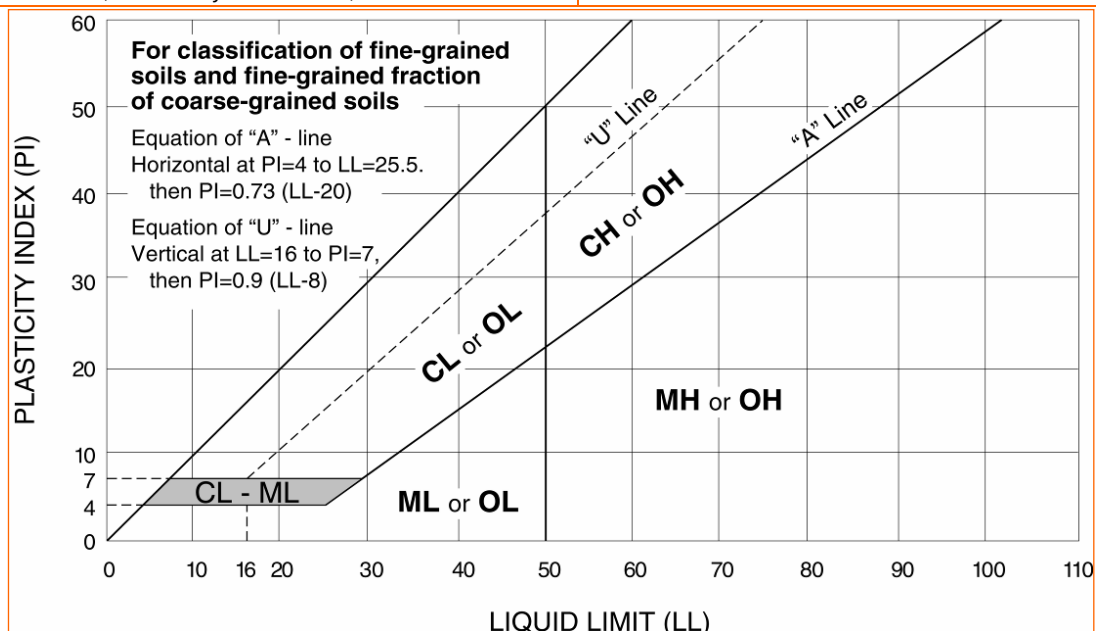
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



SECTION 02050

DEMOLITION AND SALVAGE

1. GENERAL

1.01 Scope of Work

- A. Furnish all material, labor, tools, equipment, plant, appliances and services necessary to complete all demolition, modification, salvage and removal work required above and below grade as shown on the Contract Drawings and as specified herein. As part of the Project Work:
 - 1. The Contractor shall demolish the “existing” Operations Building and all associated infrastructure (after the “new” Main WTP Operations Building is constructed and all systems and equipment have passed demonstration tests and are operational), and the one-story masonry building (offices) and legally disposal of all materials.
- B. The Contractor shall examine the various Contract Drawings, visit the Project site and determine the extent of work affected therein and all conditions under which the work is to be performed.
- C. The Contractor shall fill in all voids in the subgrade created as a result of the removal or demolition of all materials, etc. identified in the Contract Documents.
- D. ***The Contractor shall remove all of the demolished materials and spoils from the Project Site and dispose of them in a legal manner.***
- E. The Contractor shall transport designated salvage material and equipment to be retained by the Owner, if any, as directed by the Engineer in accordance with the Contract Documents.
- F. Work Specified Herein and Elsewhere
 - 1. Sitework: Division 2
 - 2. Equipment: Division 11
 - 3. Mechanical: Division 15
 - 4. Electrical: Division 16

1.02 Quality Assurance

A. Permits and Licenses

1. Conform to applicable State and local codes for demolition of structures, safety of adjacent structures, dust control, and runoff control.
2. Obtain all necessary permits and licenses for performing the Work and furnish a copy of the same to the Engineer prior to commencing the Work.
3. ***The Contractor shall pay all associated fees including disposal costs.***
4. Comply with the requirements of all permits.

B. Notices

1. Issue written notices of planned demolition, a minimum of fourteen (14) calendar days prior to starting the work, to companies or local authorities owning utility conduit, wires, pipes, etc. running to or through the project site. Comply with all of their requirements.
2. Submit copies of said notices to the Engineer.

C. Utility Services

1. Notify the Owner, utility companies or local authorities furnishing gas, water, electrical, telephone or wastewater service, a minimum of fourteen (14) calendar days prior to starting the work, to remove any equipment owned by them in structures to be demolished and to remove, disconnect, cap or plug their services to facilitate demolition.
2. Comply with all utility company or local authority requirements.

D. General

1. Do not close or obstruct roadways, sidewalks, or fire hydrants without appropriate permits.
2. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

1.03 Job Conditions

A. Sequence of Construction

1. ***Interruption of facility operations must be kept to a minimum and no interruption of service to the Owner's customers shall be allowed.***
 2. Coordinate demolition, removal and modification work with the Engineer and Owner and agree upon a sequence of construction designed to minimize down time in operations and avoid any interruption of service.
- B. ***The cost for all demolition work***, including material, labor, tools, equipment, plant, appliances, transportation, disposal costs and all appurtenances and services necessary to complete all demolition, modification, salvage and removal work ***shall be accounted for in the Contractor's Bid.***
- C. ***Facility operation shall not be interrupted during the demolition activities*** unless authorized by the Engineer and Owner. The Contractor shall submit to the Engineer, in writing, any request for interruption of facility service, at least seven (7) calendar days prior to the proposed activities. The request may or may not be approved. A rejection of the request does not relieve the Contractor from completing the work.

1.04 Project Conditions

- A. Structures to be demolished will be discontinued in use and vacated by the Owner prior to starting the demolition Work.
- B. The Owner assumes no responsibility for the condition of structures, materials, equipment, and ancillaries to be demolished or salvaged.
- C. The conditions existing at time of inspection for Bidding purposes will be maintained by the Owner as practicable. Variations within structures, equipment, etc. may occur by the Owner's removal and salvage operations prior to start of demolition work.
- D. Unless otherwise indicated in Contract Documents or specified by the Owner, items of salvageable value to the Contractor shall be removed from the Project site.
- E. Storage or sale of removed items on site will not be permitted, unless otherwise directed by the Owner, and shall not interfere with other work specified in Contract Documents.
- F. Explosives **shall not** be brought to the site or used to demolish structures.

1.05 Disposition of Demolished Materials

- A. ***All demolished materials shall be legally disposed of by the Contractor.***
- B. Store salvaged materials designated as property of the Owner in areas indicated by the Owner and transport them to a final storage site, if any, as directed by the Owner. The Contractor shall promptly remove all other materials from the site.
- C. ***All costs associated with the legal disposal of demolished materials shall be incorporated into the Contractor's Bid.***

1.06 Project Record Documents

- A. ***The Contractor shall accurately record actual locations (horizontal and vertical) of all capped utilities and subsurface obstructions*** that will remain after demolition.
- B. Record documentation shall be in accordance with Section 01720, "Project Record Documents".

2. PRODUCTS - NOT USED

3. EXECUTION

3.01 Preparation

- A. All existing pipelines and utilities shown on the Contract Drawings are not to be interpreted as the exact location or as the only obstacles that may occur on the site. The Contractor shall verify all existing conditions, prior to construction activities, and proceed with caution around anticipated features.
- B. Safety
 - 1. Provide, erect, and maintain temporary safety barriers, erosion control devices, and other safety and security devices, as shown on the Contract Drawings, or as necessary, to protect the public and project personnel from injury due to the demolition work.

2. **Protect from damage all existing work, "new" project work, landscaping materials, equipment and improvements and appurtenances that are to remain and restore all damage caused by the demolition work at no additional cost to the Owner.**
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as needed.
- D. **Mark the location of all utilities.** Protect and maintain, in safe and operable condition, all utilities that are to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized, in writing, by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to the Owner and any governing authorities.
- E. Salvage
1. The Contractor **shall not proceed** with the removal of any equipment, piping, or appurtenances without specific approval of the Engineer and Owner. Any equipment, piping or appurtenances removed without proper authorization, which are necessary for the operation of the existing system or of the proposed facilities, shall be replaced to the satisfaction of the Engineer at the Contractor's expense.
 2. **Any materials to be salvaged shall be identified by the Owner.** The Contractor shall furnish all labor and material to identify, clean, protect, crate, box and deliver/store any salvaged materials as part of the Project Work.
 3. Pieces of equipment weighing 150 pounds or more shall be provided with suitable skids before storing.
 4. Wherever piping is removed for disposition, adjacent pipe, and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.
 5. Equipment to be retained by the Owner shall be carefully removed from the present location, cleaned, and immediately stored "on-site" or delivered to their final destination by the Contractor, as designated by the Owner, at no additional cost to the Owner.
 6. The Contractor shall take all necessary precautions against damaging the material and equipment to be stored. **The Contractor shall repair any damage resulting from his operations, as directed by and to the satisfaction of the Engineer, at no additional cost to the Owner.** Itemized lists of materials removed and stored shall be given to the Engineer daily. Four (4) copies of a final typed itemized list shall be furnished to the Engineer at the completion of construction. The list shall include items, method of packaging, and place of storage.

F. Equipment to be Retained

1. All equipment removed shall remain the property of the Owner unless designated otherwise by the Owner. Designated items to be salvaged shall be identified by the Owner, prior to the commencement of demolition operations, if any.
2. If the Owner elects not to retain ownership of a certain item, the item shall become the property of the Contractor and shall be removed from the site at the Contractor's expense and legally disposed of.

3.02 Performance

A. General

1. Completely remove and dispose of existing structures and appurtenances from the site as indicated on the Contract Drawings and/or specified herein. Bring in "clean", organic-free, compactable fill for filling those areas where in-ground structures will be removed. All fill shall be compacted in accordance with these specifications.
2. Salvage all items indicated by the Owner, if any, and clean up the site after completion of the demolition work.
3. Perform demolition and removal in compliance with applicable laws and ordinances and in such a manner as to avoid hazard to persons and property and to prevent spread of dust and flying particles.
4. Conduct demolition operations to minimize interference with adjacent structures, walls/fencing or pavements.
5. Cease demolition operations immediately if adjacent structures appear to be in danger. Immediately notify the Owner/Engineer and authority having jurisdiction. Do not resume demolition operations until directed by the Engineer or governing authority.
6. Conduct operations with a minimum of interference to public or private access. Maintain ingress and egress at all times.
7. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or limit access to their property.
8. ***Sprinkle demolition work with water to minimize the generation of dust.*** Provide hoses and water connections for this purpose.
9. Locate demolition equipment and remove materials so as to prevent excessive loading to supporting walls, floors, or framing.

10. Demolish concrete and masonry in small sections.
11. Comply with governing regulations pertaining to environmental protection.
12. ***Clean and/or repair all adjacent structures and improvements of dust, dirt, debris and damage caused by the demolition operations. Return adjacent areas to their "original" condition existing prior to start of work, or to a "new" condition.***
13. The Contract Documents identify major structures and items to be demolished. Include incidental demolition to completely demolish structures whether indicated on the Contract Documents or not.

B. Equipment Removal

1. Prior to demolition of structures, remove all mechanical and electrical equipment installed therein and carefully remove all items that are to be salvaged, if any.

C. Concrete Slabs and Vaults

1. Remove concrete slabs, foundation walls and concrete vault walls and tops as indicated on the Contract Documents.
2. Remove and cap all piping as indicated on the Contract Drawings.

D. Piping and Valves

1. Remove all process and yard piping and valves which are in conflict with the proposed work and are not to remain in service.
2. Salvage valves identified by the Owner, if any, and remove all piping, fittings and valves from the property, unless otherwise noted, and dispose of them in a legal manner at the Contractor's expense.

E. Asphalt Pavement

1. Remove existing asphalt paving where shown on the Contract Drawings. Where only part of the pavement is to be removed, first mechanically saw cut the pavement along the limits of removal to prevent damage to the remaining pavement.
2. Remove the demolished material/debris from the Project site and legally dispose of the materials at no additional cost to the Owner.

F. Sidewalks/Walkways

1. Remove existing concrete sidewalks and/or walkways where shown on the Contract Drawings.
2. Where only part of the sidewalk/walkway is to be removed, first mechanically saw cut the concrete sidewalk and/or walkway along the limits of removal to prevent damage to the remaining concrete sidewalk and/or walkway.
3. Remove the material from the Project site and legally dispose of the materials at no additional cost to the Owner.

G. Modifications

1. Cut and remove all existing Work necessary for modifications and installation of the new Work with a minimum of damage to the Work that is to remain.
2. ***Repair or restore any damage done to existing facilities which are to remain, at no cost to, and to the satisfaction of the Owner.***
3. Remove on a daily basis all debris created within facilities which are to remain in service during the modification work, and clean the area at the end of each day's operation.
4. Do not subject personnel, homeowner's or the citizens of the area in which the work is to be completed to hazardous areas while performing their duties to maintain the systems in service.
5. Follow other specific instructions for the modification work given in other Sections of these Specifications and as shown on the Contract Drawings.

3.03 Filling of Voids

- A. Completely fill all below grade areas and voids resulting from demolition or removal of structures, pipelines, underground fuel storage tanks, wells, cisterns, etc., using approved select fill materials consisting of clean fill, stone, gravel, and sand free from debris, trash, frozen materials, roots, and other organic matter.
- B. Ensure that areas to be filled are free of standing water, frost, or unsuitable material, trash, and debris prior to fill placement.
- C. Place fill materials in accordance with Division 2, "Sitework", unless subsequent excavation for new Work is required.

- D. Grade the surface to match adjacent grades and to provide positive flow of surface drainage after placement of fill and compaction. Solid sod shall then be placed.

3.04 Cleanup

- A. Clean the Project site to a condition satisfactory to the Engineer, free from demolished materials, rubbish or debris. Grade the site to meet adjacent contours and provide a positive flow for surface drainage.
- B. ***Restore items intended to remain that have been damaged by demolition work at no cost to, and to the satisfaction of the Owner.***
- C. Return all interrupted utility services to their pre-demolition state and disconnect temporary services, unless otherwise specified.

3.05 Disposal of Demolished Materials

- A. ***Remove from the Project Site and legally dispose*** of all debris, structures, piping, fittings, valving, pumps, miscellaneous metals, rubbish, concrete and other materials resulting from the demolition operations.
- B. ***No burning of any material, debris, or trash on-site or off-site will be allowed.***
- C. Transport materials removed from the demolition operations with appropriate vehicles and legally dispose of them off-site to areas which are approved for disposal by governing authorities and appropriate property owners, at no additional cost to the Owner.

END OF SECTION

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SECTION 02075

DEWATERING AND DRAINAGE

1. GENERAL

1.01 Description

- A. The Work to be performed under this Section shall include the design and installation of a temporary dewatering and drainage system until completion of project construction to remove subsurface/storm waters from structure/utility trench excavations as required.
- B. ***The Contractor shall be responsible for all permitting activities, including permit fees***, associated with obtaining applicable permits from the State Water Management District having jurisdiction over the installation and operation of the dewatering systems.
- C. Structures, water pipes, sanitary pipes, sanitary structures, building foundations, process structures, etc., may require dewatering. It is the Contractor's responsibility to determine the extent of the dewatering area and requirements for construction.
- D. Related Work Specified Elsewhere

Specification Section	Title
01500	Temporary Facilities
01560	Environmental Protection
01570	Temporary Erosion and Sedimentation Control
02200	Earthwork
02220	Excavation, Backfilling and Compaction
Contract Drawings and General Provisions of the Contract	

1.02 Responsibility

- A. ***The Contractor is solely responsible for the design, permitting, installation, operation, and subsequent removal of dewatering systems***, including well point systems, and their safety and conformity with local codes and regulations.

- B. **All costs for Project dewatering operations, if necessary, shall be incidental to the Contract and shall be included in the Contractor's Bid.**
- C. **No additional payment will be made for any supplemental measures** to control seepage, groundwater, or artesian head.

1.03 Quality Assurance

A. Qualifications

1. The temporary dewatering system shall be designed by a firm who regularly engages in the design of dewatering systems and who is fully experienced, reputable and qualified in the design of such dewatering systems.
 2. The firm shall have a successful record of operation for a **minimum of five (5) years prior to the Bid date**. The design firm shall supply the Engineer with previous installation details of at least five (5) successful dewatering operations of a similar nature in the State of Florida.
- B. In lieu of experience, the Contractor shall provide a performance and warranty bond for **one hundred fifty percent (150%)** of the total installed cost of the temporary dewatering system. This bond shall be executed prior to Award of the Project and/or Contract execution.

C. Standards

1. The dewatering of any excavation areas and the disposal of water during construction shall be in strict accordance with all local and state government rules and regulations.
2. If a Consumptive Use Permit (CUP) is required by the water management district, **the Contractor shall be responsible for obtaining said permit and all associated costs therein.**

1.04 Submittals

- A. **Submit to the Engineer for review and approval, within fourteen (14) days of the Notice to Proceed and before the installation of the dewatering system, the proposed method of dewatering (Dewatering Plan).** The Engineer's review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.

- B. Submittals shall be in accordance with Section 01300, "Shop Drawings, Submittals and Samples", and shall include the following:
 - 1. Design Notes and Drawings.
 - 2. Descriptive literature of the temporary dewatering system.
 - 3. Layout of all piping involved.
 - 4. Observation well locations, if used
 - 5. Bill of materials.

1.05 Dewatering System Criteria

- A. The dewatering system shall be developed to the point that is capable of dewatering such that pipe, structures, etc., can be installed and the surrounding fill compacted satisfactorily as shown on the Contract Drawings.
- B. Each wellpoint system shall be capable of dewatering and maintaining groundwater levels at the respective structures, pipelines or excavations.
- C. Observation wells shall be constructed for the purpose of testing each system.
- D. Dewatering System Design
 - 1. ***Design and provide a dewatering system using accepted and professional methods consistent with current industry practice*** to eliminate water entering the excavation under hydrostatic head from the bottom and/or sides. ***Design the dewatering system to prevent differential hydrostatic head*** which would result in floating out soil particles in a manner termed as a "***quick***" or "***boiling***" condition.
 - 2. The dewatering system shall not be dependent solely upon sumps and/or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability.
- E. Observation Wells
 - 1. ***Prior to excavation, the Contractor shall install groundwater observation wells*** at locations as directed by the Contractor's Geotechnical Engineer, who shall be registered in the State of Florida, and as approved by the Engineer, adjacent to structures under construction for the purpose of measuring water levels during

excavations. The observation well shall consist of screen, casing and cap of approved size and material of construction. The observation well shall be placed in a 2½-inch borehole which shall be carried to an elevation at least to the final bottom grade of the structure(s). The annular space surrounding the intake point and the riser pipe shall be sealed in such a way as to prevent infiltration from surface water. The observation well shall be developed in such a manner as to ensure proper indication of subsurface water levels adjacent to the well.

2. The Contractor shall be responsible for maintaining the observation wells and for observing and recording the elevation of groundwater in them until the adjacent structures and utilities are completed and backfilled. **Each observation well shall be observed and recorded daily. Measurements shall be supplied daily to the Engineer.** The Engineer may require that the observation wells reflect true groundwater levels by adding water to the well, recording the drop in the level from the time the water was added. Any plugged observation well shall be redeveloped, if necessary, to indicate true groundwater levels.
3. Observation wells shall be abandoned when directed by the Engineer, and in a manner acceptable to the Engineer, and applicable regulatory agencies. **Abandoned observation wells shall be backfilled with neat cement grout** in accordance with the Chapter 40C-3 requirements of the St. Johns River Water Management District.

1.06 Pumping and Drainage

- A. 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 an extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels.
- B. **The Contractor shall submit to the Engineer, for review, a plan for dewatering systems prior to commencing Work (Dewatering Plan). The dewatering systems installed shall be in conformity with the overall construction plan, and certification of dewatering systems shall be provided by a Geotechnical Engineer** (at the Contractor's expense). The Geotechnical 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.

- C. 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 the excavation and to preserve the integrity of adjacent structures. As a minimum, **the water level shall be two and one-half (2.5) feet below the trench, structure or excavation bottom.** Well or sump installations shall be constructed with proper sand filters to prevent the drawing of fine grained soil from the surrounding ground.
- D. 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.
- E. The Contractor shall take all additional precautions or prevent uplift of any structure during construction.
- F. **The conveying of water in "open" ditches or trenches shall not be allowed.** Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the Controlling Authority and Owner. **No flooding of streets, driveways, or private property will be permitted.** 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 the Contractor shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored at no additional cost to the Owner.
- G. Flotation shall be prevented by the Contractor 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 the dewatering system.
- H. **Removal of the dewatering equipment shall occur after the Contractor and the Engineer agree that the system is no longer required;** the material and equipment constituting the system, shall be removed by the Contractor.
- I. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater or receiving water quality.
- J. The Contractor shall be responsible for and shall repair, without cost to the Owner, any damage to work in place, or other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation, including, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.

2. PRODUCTS

2.01 General

- A. The equipment specified herein shall be standard dewatering equipment of proven ability as designed, manufactured, and installed by firms having experience in the design and production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practices and methods.
- B. ***The Contractor shall engage a Geotechnical Engineer registered in the State of Florida to design the temporary dewatering system for all structures. The Contractor shall submit a conceptual plan for the dewatering system prior to commencing Work (Dewatering Plan).*** The dewatering system installed shall be in conformity with the overall construction plan and certification of this shall be provided by the Geotechnical Engineer. The Geotechnical Engineer shall be required to monitor the performance of the dewatering system at the Contractor's expense during the progress of the work and require such modifications as may be required to assure that the systems will perform satisfactorily.
- C. ***The Dewatering System(s) shall be designed in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed structures or utilities and to preserve the integrity of any adjacent structure(s).***
- D. ***Dewatering equipment shall be electrically driven in lieu of diesel engine driven to avoid possible problems associated with spillage of fuel.*** Equipment shall have a noise (audible) limit of 67 dB at fifteen (15) feet from the equipment. No equipment is to be located within fifty (50) feet of a residential or commercial building unit.

3. EXECUTION

3.01 General Requirements

- A. The Contractor shall control, by acceptable means, all water regardless of source and be fully responsible for disposal of the water.
- B. Discharge water in accordance with acquired permits (if required), the regulations of any and all regulatory authorities, and the Contract Documents.
- C. Commence dewatering prior to any appearance of water in the excavation operations and continue until the Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.

- D. The Contractor shall control groundwater in a manner that preserves the strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary to these purposes, lower water level in advance of excavation, utilizing wells, wellpoints, jet educators, or similar positive methods. The water level shall be maintained a minimum of two and a half (2½) feet below the trench, structure or excavation bottom.
- E. Install wells and/or wellpoints, if required, with suitable screens and filters, so that continuous pumping of fines does not occur. During normal pumping, and upon development of well(s), levels of fine sand or silt in the discharge water shall not exceed five (5) ppm. Install a sand tester on the discharge of each pump during testing to verify that these levels are not exceeded.
- F. Control grading around excavations to prevent surface water from flowing into excavation areas.
- G. **Remove subgrade materials rendered unsuitable** by excessive wetting and replace with approved backfill material at no additional cost to the Owner.
- H. Walls shall not be exposed to water pressure before the structural work, at the next higher level, has properly cured and the cantilever action of walls is eliminated.

3.02 Installation

A. Dewatering

1. The Contractor shall install a temporary dewatering system for the removal of subsurface water and stormwater encountered during construction of the proposed structures, piping, utilities, etc.
2. **Dewatering shall be a continuous operation.** Interruptions due to power outages, or any other reason will not be permitted.
3. The Contractor shall provide a standby system for emergency operation in case of failure of the primary power source or mechanical failure of the system. If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.
4. System maintenance shall include, but not be limited to, 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavations in a dewatered condition.

B. Consumptive Use Permit (CUP)

1. If dewatering and pumping requirements exceed any of the following regulatory limits, the Contractor shall pay for and obtain a CUP from the local water management district for such pumped volumes:
 - a. Dewatering volume greater than 100,000 gpd.
 - b. Dewatering system pump capacity greater than 1.0 MGD.
 - c. Pump volute equal to or greater than six (6) inches.

3.03 Inspection and Testing

- A. ***The Contractor's Geotechnical Engineer shall be required to assure that the dewatering system is operating properly.***
- B. ***The Contractor's Geotechnical Engineer shall monitor the performance*** and instruct any adjustment to the Contractor during construction of the Work.

3.04 Protection and Site Clean-Up

- A. Continuously maintain excavations in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.
- B. At all times during the progress of the work, the Contractor shall use all reasonable precautions to prevent either tampering with the wellpoints, if used, or the entrance of foreign material.
- C. Immediately upon completion of the Project dewatering operations, the Contractor shall remove all of his equipment, materials and supplies from the site of the work, remove all surplus materials and debris, fill in all holes or excavations, and grade the site to elevations of the surface levels which existed before the work started or as dictated on the Contract Drawings. ***The site shall be thoroughly cleaned and graded as directed by the Engineer.***
- D. ***Wells shall be removed or cut off a minimum of three (3) feet below final grade, capped, and abandoned*** in accordance with regulations by agencies having jurisdiction and/or the Engineer.

END OF SECTION

SECTION 02100

SITE PREPARATION

1. GENERAL

1.01 Description

A. Work under this Section includes, but is not limited to the following items:

1. Protection of bench marks.
2. Layout of work.
3. Protection of trees to remain.
4. Clearing and grubbing.
5. Stripping.
6. Disposal of debris.

B. Related work specified elsewhere:

Specification Section	Title
01120	Special Project Procedures
01560	Environmental Protection
01570	Temporary Erosion and Sedimentation Control
02200	Earthwork
02210	Site Grading
02220	Excavation, Backfilling and Compaction
Contract Drawings and General Provisions of the Contract	

C. This Section covers clearing, grubbing, and stripping of the Project Site, complete as specified herein, and disposal of the cleared and grubbed material. The Contractor is expected to visit the site of the work and determine the extent of the clearing and grubbing necessary for the construction operations.

D. ***The Contractor's attention is directed to any Soil Erosion and Sediment Control Ordinances in force.*** The Contractor shall comply with all applicable sections of these ordinances.

- E. ***The Contractor shall clear and grub all of the area within the limits of actual construction as required***, which includes, but is not limited to, roadways, trenchwork, structures, and open areas. The width of the area to be cleared shall be approved by the Engineer prior to the beginning of any clearing.
- F. A line locate for any and all utilities is to be conducted prior to clearing and grubbing operations at the Project Site. The Owner of the utility or utilities known to be in the vicinity of the work is to be contacted by the Contractor to request a line locate. If lines are not located properly before work begins and the Contractor damages the line in any way, the Contractor shall pay for repair and/or replacement of the utility at no additional cost to the Owner. Once lines are located, the Contractor is to take care not to damage the existing utilities. Again, if the Contractor damages the line in any way, the Contractor shall pay for repair and/or replacement of the utility at no additional cost to the Owner.

1.02 Terminology

- A. Clearing: *Remove and dispose of shrubs, brush, limbs, and other vegetative growth. Remove all evidence of their presence from the surface including sticks and branches. Remove and dispose of trash piles and rubbish that currently is scattered over the construction site or collects there during construction. Protect trees, shrubs, vegetative growth, and fencing which are not designed for removal. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, so as to provide for safety of employees and others.*
- B. Grubbing: *Grubbing shall consist of the complete removal of all stumps, roots larger than one (1) inch in diameter, matted roots, brush, timber, logs, and any other organic or metallic debris remaining after clearing not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of twenty-four (24) inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.*
- C. Stripping: *Remove and dispose of all organics and sod, topsoil, grass, and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. Grass, grass roots and organic material in areas to be excavated or filled shall be stripped to the depth as noted in the soils report. In areas so designated, topsoil shall be stockpiled. Strippings and unsuitable material, such as organic material, shall be disposed of by the Contractor unless directed otherwise by the Engineer.*

1.03 Bench Marks and Monuments

- A. Maintain all existing bench marks, monuments and other reference points; if destroyed, replacement costs will be deducted from payments due the Contractor.

1.04 Laying Out Work

- A. Permanent base lines, property lines, easement lines and bench marks have been established and are shown on the Contract Drawings. If disturbed as a result of construction activities, the Contractor shall reestablish such items at his expense.
- B. The Contractor shall stake out the construction, establish lines and levels, temporary bench marks, batterboards, centerlines and reference points for the work, and verify all dimensions relating to interconnection with existing features. The Contractor shall be held responsible for any errors in these lines and levels.
- C. The Contractor shall report any inconsistencies in the proposed grades, lines and levels, dimensions and locations to the Engineer before commencing work.
- D. Unless otherwise directed by the Owner or Engineer, the Contractor is expected to contain all construction activities within the right-of-way, easements, and property secured by the Owner, as shown on the Contract Drawings. At no time shall the Contractor disturb surrounding properties or travel on surrounding properties without written consent from the property owner. Any repair or reconstruction of damaged areas in surrounding properties shall be repaired by the contractor on an immediate basis. All costs for repairs shall be the responsibility of the Contractor.

1.05 Utilities in the Area

- A. The Contractor shall notify the following utility owners which have utilities in the project area and coordinate with them to avoid service interruptions and/or safety hazards:
 - 1. City of Sanford Public Works/Utility Department
 - 2. Florida Power and Light
 - 3. AT&T
 - 4. Florida Public Utilities Company
- B. Contact "Sunshine 811" to determine if there are other utilities in the area, and their location.

1.06 Preservation and Protection of Trees and Shrubs

- A. Existing decorative trees, shrubbery, and other vegetative material may not be shown on the Contract Drawings. Inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein. Preserve, in place, trees that are specifically shown on the Contract Drawings and designated to be preserved or undisturbed.
- B. Preservation of Trees, Shrubs and Other Plant Material
 - 1. All plant materials (trees, shrubbery and plants) beyond the limits of clearing and grubbing shall be saved and protected from damage resulting from the Work.
 - 2. No filling, excavating, trenching, or, stockpiling of materials will be permitted within the drip line of these plant materials. The drip line is defined as *"a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants"*. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.
 - 3. When trees are close together, restrict entry to area within the drip line by fencing. In areas where no fence is erected, the trunks of all trees two (2) inches or greater in diameter shall be protected by encircling the trunk entirely with boards held securely by 12-gauge wire and staples (other Engineer-approved methods of protection may be used) before any work is started. This protection shall extend from ground level to a height of six (6) feet.
 - 4. Cut and remove tree branches where such cutting is necessary to affect construction operation. Remove branches other than those required to affect the work to provide a balanced appearance of any tree. Scars resulting from the removal of branches shall be treated with a tree sealant.

1.07 Relocation of Utilities

- A. Active utilities which do not interfere with the work shall be supported and protected from damage.
- B. After obtaining the Engineer's approval, relocate or remove active utilities which will interfere with the Work as indicated.
- C. The Contractor shall pay for all damage to active utilities and for relocation or removal of all interfering utilities which are ascertainable from Contract Drawings, surveys, site inspection or encountered during construction.

- D. ***Inactive or abandoned utilities and appurtenant structures encountered shall be filled or removed to avoid interference as directed by the Engineer.*** Exposed ends of abandoned lines shall be plugged or capped in a water-tight manner.
- E. The Contractor shall construct all grading and swale improvements around the “new” Sanford Main WTP Operations Building and Project site, as identified on the Contract Drawings, and bring in clean fill, if necessary, to bring the project to the elevations indicated.

2. PRODUCTS - NOT USED

3.0 EXECUTION

3.01 Clearing and Grubbing

- A. All excavation areas associated with the proposed improvements shall be cleared and grubbed in accordance with the Contract Drawings and Contract Documents.
- B. Remove trees outside of these areas only as indicated on the Contract Drawings or as approved in writing by the Engineer.
- C. All debris and refuse from the site preparation shall be removed from the Project Site and legally disposed of by the Contractor.
- D. Clearing
 - 1. The surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish, and all other objectionable obstructions resting on, or protruding through, the surface of the ground.
 - 2. Those trees which are designated by the Engineer shall be preserved as specified herein.
 - 3. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, so as to provide for the safety of employees and others.

E. Grubbing

1. Grubbing shall consist of the complete removal of all stumps, roots larger than one (1) inch in diameter, matted roots, brush, timber, logs, and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of twenty-four (24) inches below the subgrade.
2. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

F. Clearing and Grubbing Limits

Area	Clearing and Grubbing Limits
Roadway and Paved Area	Two (2) feet below existing grade and replace with compacted backfill
Proposed Structures	Two (2) feet below existing grade within a five (5) foot margin of each structure and replaced with compacted backfill as specified herein.
Building Site Areas Not Specifically Noted Above	Two (2) feet below existing grade within a five (5) foot margin of each structure and replaced with compacted backfill as specified herein.
All other Areas	One (1) foot below the completed surface within a five (5) foot margin of each structure and replaced with compacted backfill as specified herein.

- G. ***The Contractor shall exercise extreme care during the clearing and grubbing operations to not damage existing structures, pipes or utilities.***

3.02 Stripping

- A. ***All areas to be occupied by the proposed improvements shall be stripped of all brush, weeds, grass, roots and other material to a depth of four (4) inches.***
- B. Stockpile areas shall also be stripped.
- C. Remove all loamy, organic topsoil suitable for seeding and planting to whatever depth encountered and store separately from other excavated material. Stockpile in areas designated by the Engineer and Owner and provide for proper drainage of said materials. Cover storage piles as required to prevent windblown dust.

- D. Stripped materials suitable for topsoil shall be stockpiled and shall be protected until it is replaced. Any topsoil remaining after all of the work is complete shall remain the property of the Owner.
- E. In the event that inadequate space within the Project Site or work area is available for stock-piling topsoil without interfering with other construction operations, the Contractor shall contact the Owner for determination of another storage location. **Transportation costs for "off-site" storage and retrieval of said materials shall be incidental to the Contract.**
- F. Dispose of unsuitable topsoil and stripping as specified in Article 3.04 of this Specification Section.
- G. Any topsoil remaining after all of the work is complete shall remain the property of the Owner. **The excess "good" topsoil shall be relocated on the project site per the Owners directions.**

3.03 Burning

- A. **Burning is not allowed!**

3.04 Disposal of Debris

- A. **The Contractor is responsible for the removal and legal disposal of the accumulated debris, refuse, etc. at the Project Site.**
- B. Any costs associated with impacts to the normal operation of the treatment facility, effluent quality, or construction activities **shall be borne solely by the Contractor and shall be deducted from his Pay Application.**
- C. **All other project debris and materials resulting from Project operations shall become the property of the Contractor and shall be "legally" removed and disposed of "off-site" at the Contractor's cost.**

3.05 Preservation or Removal of Trees

- A. Trees outside the limits of construction shall be carefully protected from damage. The Contractor shall erect such barricades, guards, and enclosures as may be considered necessary for him for the protection of the trees during all construction operations,

- including damage from piled material, contact with equipment, subsurface damage to roots, soil contamination, and general construction operations. Care shall be taken to prevent damage not only to the tree trunk, but also the root system and overhanging branches and limbs.
- B. When trees are close together, the Contractor shall restrict entry to the area within the drip line by fencing. In areas where no fence is erected, the trunks of all trees two (2) inches or greater in diameter shall be protected by encircling the trunk entirely with boards held securely by 12-gauge wire and staples. This protection shall extend from ground level to a height of six (6) feet above grade.
 - C. Cut and remove tree branches where such cutting is necessary to affect the construction operation. Remove branches other than those required to affect the work to provide a balanced appearance of any tree. Scars resulting from the removal of branches shall be treated with a tree sealant approved by a tree surgeon.
 - D. If found necessary, removal or trimming of trees within the limits of construction shall be in accordance with applicable local ordinances. The Contractor shall apply for and pay for all costs associated with the permitting of and removal of trees from the proposed developed area. The Contractor is required to repair or replace trees damaged or removed during construction.
 - E. Cutting of branches, limbs, and roots, when deemed necessary, shall be subject to the approval of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. Cut or injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint. Such cutting or repairing shall be performed by a qualified tree surgeon. ***All costs shall be incidental to the Contract.***

END OF SECTION

SECTION 02200

EARTHWORK

1. GENERAL

1.01 Description

A. Scope of Work

1. This section includes materials, testing, and earthwork for excavations, fills, and embankments not under roads, in trench work, or under buildings or structures.

B. Related Work Specified Elsewhere

1. Site Grading:	Section 02210
2. Excavation, Backfilling and Compaction:	Section 02220

1.02 SUBMITTALS

- A. Submit excavation and shoring drawings for worker protection in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples".
- B. ***Submit three (3) copies of a certified report from a testing laboratory verifying that the material used for all backfilling, fills and structural backfills meets the specified criteria and gradation and contains less than one percent (1%) asbestos, by weight.***

1.03 TESTING REQUIREMENTS

A. Laboratory Moisture-Density Relationship

1. Determination of laboratory moisture-density relationship and maximum density shall be by the Modified Proctor Method of ASTM D-1557.

2. At least one (1) test per soil type shall be made.
- B. In-Place Soil Density
1. In-place soil density shall be determined by one of the following methods:
 - a. Nuclear Density Meter: ASTM D-2922
 - b. Drive Sleeve Method ASTM D-2937
 2. ***In place field densities shall be taken, in accordance with Article 1.01(C) of Section 01410, "Testing and Testing Laboratory Services" and at not greater than one (1) foot vertical intervals for all fill areas under structures and pavement. Density tests are required for all pipe and foundation work in accordance with the aforementioned Article in Section 01410.***
- C. ***Fill material from "off-site" shall be tested using a minus 200 sieve wash to check grain size.*** At least one (1) such test shall be run per one hundred (100) cubic yards of material brought from "off-site" locations.
- D. Sample backfill materials by ASTM D-75.
- E. Determine the relative density of cohesionless soils by ASTM D-2049.
- F. Compaction shall be deemed to comply with the Specifications when no tests fall below the specified relative compaction. The Contractor shall pay the costs of any retesting of work not conforming to the Specifications.
- G. *"Relative compaction"* is defined as the ratio, expressed as a percentage, of the in-place density to the laboratory maximum density.
- H. ***Density tests will be made for determination of specified compaction by an independent testing laboratory provided and paid for by the Contractor, as part of this Contract, and as approved by the Engineer and Owner as specified in Section 01410, "Testing and Testing Laboratory Services".*** Testing shall be performed in locations reviewed and approved by the Engineer. If any tests are unsatisfactory, the Contractor shall re-excavate and re-compact the fill or backfill until the desired compaction is obtained. Additional compaction tests will be taken on each side of an unsatisfactory test at locations approved by the Engineer to determine the extent of re-excavation and re-compaction necessary.

- I. **The testing report shall clearly indicate the exact location of all testing, either referenced to a visible monument or on a scaled drawing.** The vertical location of all tests shall be referenced to both finish grade and with respect to the depth of fill placed.
- J. **The Contractor shall pay for each failed compaction test and for each additional test taken to determine the extent of re-excavation and re-compaction** as previously described and there shall be no cost to the Owner and the Contract Time shall not be increased due to failed compaction tests.
- K. If based on the Geotechnical Engineers testing reports and inspection, fill which has been placed is below the density required by the Contract Documents, the Contractor shall provide additional compaction and testing prior to commencing further construction in the area. **Copies of the testing reports and inspections shall be provided to the Engineer in an electronic format (PDF).** Should the fill not meet the compaction requirements identified in Section 02220, "Excavation, Backfilling and Compaction", **the Contractor shall remove the unsuitable fill and replace it with clean fill that will meet the compaction requirements, at no additional cost to the Owner.**

2. PRODUCTS

2.01 Fill and Backfill

- A. Fill and backfill shall be clean, granular sand that is free from organic matter, roots, debris, and rocks larger than two (2) inches in the greatest dimension and having less than 10 percent (10%) passing the No. 200 U.S. sieve size.
- B. Water for Compaction
 - 1. Water shall be free of acid, alkali, or organic materials and shall have a pH between 7.0 and 9.0, a maximum chloride concentration of 250 mg/L and a maximum sulfate concentration of 250 mg/L.
 - 2. **The Contractor shall provide all of the water needed for earthwork.**
 - 3. The Contractor shall provide all temporary piping and valves to convey water from the source to the point of use.
 - 4. The Contractor shall provide any meters and ancillary equipment necessary, if the water is taken from the Owner's potable or reclaimed water distribution line. **The Contractor shall pay for all water taken from the Owner at the Owner's standard rate or a "negotiated" monthly fee.**

3. EXECUTION

3.01 Compaction Requirements

- A. ***Unless otherwise specified or shown on the Contract Drawings, compact fill, embankments, and backfills in grassed or landscaped areas in accordance with Section 02220, "Excavation, Backfilling and Compaction".***
- B. Following clearing and grubbing, the exposed ground surface shall be proof-rolled with a heavy self-propelled vibration roller. Proof-rolling shall involve multiple overlapping passes to ***achieve 95% relative compaction (98% relative compaction beneath structures and paved areas) for a depth of one (1) foot or more below finished grade***. Groundwater should be lowered as necessary to two (2) feet below stripped or excavated grade elevation prior to proof-rolling.
- C. Dewatering
1. Provide and operate equipment adequately to keep excavations and trenches free of water in accordance with Section 02075, "Dewatering and Drainage".
 2. Remove water during the period when concrete is being deposited, when pipe is being laid, during the placing of structural fill and backfill, and for inspection/testing of the structural subgrade.
 3. Maintain the groundwater level a minimum of two and one-half (2½) feet below the bottom of the excavation for all structures and open excavations.
 4. Avoid settlement or damage to adjacent property.
 5. Dispose of water to an on-site drainage system, if applicable.
 6. When dewatering open excavations, dewater from outside the structural limits and from a point below the bottom of the excavation.
 7. Comply with all permit conditions, if any, for the dewatering operations.
 8. The Contractor shall provide and maintain pumps, sumps, well points, suction and discharge lines and other dewatering system components as necessary.
- D. Excavation is unclassified. Perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction.
- E. Placing and Compacting Fill Material
1. Excavated material which conforms to the specifications may be used for fill or backfill.

2. Place all materials at optimum moisture content.
3. Place fill in lifts, as specified in the Contract Documents (Table 02220-1, Section 02220, "Excavation, Backfilling and Compaction"), and compact each lift to the extent specified.

F. Foundation Requirements

1. All structure foundation bottoms shall be re-compacted and retested after excavation to densify soils loosened in the excavation process.
2. Soils placed adjacent to footings or walls shall be carefully compacted to avoid damaging the footing or wall. Approved structural sand fills placed in footing excavations above the bearing level, in the trench of pipeline excavations within the structure area plus ten (10) feet beyond the perimeter walls, and in other areas which are expected to provide slab support and/or foundation embedment constraint shall be placed in loose lifts not exceeding six (6) inches.
3. Compaction requirements are presented in Table 02220-1 of Section 02220, "Excavation, Backfilling and Compaction".

G. Moisture Control of the Earth Material

1. During the compaction operations, maintain the optimum practicable moisture content required for compaction purposes in each lift of the material.
2. Maintain a uniform moisture content throughout the lift. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the material.
3. At the time of compaction, the water content of the material shall be at optimum water content or within two (2) percentage points above optimum.
4. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.
5. Moisture contents greater than two percent (2%) above optimum or below optimum will be permitted only if it can be clearly demonstrated, to the satisfaction of the Engineer, that satisfactory compaction is being achieved.
6. ***Flooding or puddling with water to consolidate backfill is unacceptable.***

H. Site Grading

1. Perform earthwork to the lines and grades shown on the Contract Drawings. Shape, trim and finish slopes to conform with the lines, grades and cross-sections as shown on the Contract Drawings.
2. Make slopes free of exposed roots and loose rocks exceeding two (2) inches in diameter.
3. Round tops of banks to circular curves as shown on the Contract Drawings.
4. Neatly and smoothly trim rounded surfaces. Do not over-excavate and backfill to achieve the proper grade.
5. ***Final grades shall be within ± 0.02 feet of the required elevation.***

I. Disposal of Excess Excavation

1. Dispose of excess excavated suitable materials at designated on-site soil areas indicated on the Contract Drawings, if any, or as directed by the Engineer.
2. If on-site disposal is not indicated or directed by the Engineer, ***legally dispose of excess excavated materials off-site at no additional cost to the Owner.***
3. The Contractor shall make his own arrangements for the legal disposal of all excess suitable or unsuitable material and bear all costs associated with said disposal.

J. Temporary Stabilization

1. Where construction activity ceases for at least fifteen (15) days and the top soil has been disturbed, the Contractor shall stabilize the affected areas with temporary seed and mulch.
2. ***Temporary stabilization shall be in accordance with a Stormwater Pollution Prevention Plan (SPPP) to be submitted to the Engineer.***

K. Off-Site Vehicle Tracking

1. ***The Contractor shall take all necessary measures to remove truck sediment before leaving the site*** to reduce vehicle tracking of sediment off-site. Measures may include, but are not limited to, vehicle shaking devices and/or a wheel washing facility.

2. The Contractor shall maintain areas of site ingress and egress and surrounding off-site public rights-of-way from the build-up of sediment. ***Any and all sediment build-up on these areas shall be immediately cleared and removed by the Contractor at no cost to the Owner.***

END OF SECTION

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SECTION 02210

SITE GRADING

1. GENERAL

1.01 Description

- A. The Work in this section consists of furnishing all necessary labor, equipment, material, transportation and ancillaries necessary to bring the roads, drives, proposed buildings and structures, paved areas, open areas and the remainder of the project site to the lines and grades shown on the Contract Drawings.

B. Related Work Specified Elsewhere

Specification Section	Title
02100	Site Preparation
02200	Earthwork
02215	Finish Grading
02220	Excavation, Backfilling and Compaction
02815	Solid Sodding
Contract Drawings and General Provisions of the Contract	

- C. ***The Contractor shall be responsible for the determination of earthwork quantities and the volume of material required for the site.***

D. Terminology

- Open Areas: *Open areas are those areas that do not include building sites, paved areas, limerock areas, access and road rights-of-way and parking areas.*
- Maximum Density: *Maximum weight, in pounds per cubic foot, lb/ft³ (pcf), of a specific material.*

3. Optimum Moisture: *Percentage of water in a specific material at maximum density.*
4. Rock excavation: *Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as, jackhammers, sledges, chisels, or other similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.*

1.02 Submittals

- A. Submit four (4) copies of a report from a certified testing laboratory, in accordance with Section 01300, "Shop Drawings, Submittals and Samples", verifying that off-site borrow material, if used, conforms to the gradation specified.

1.03 Protection

- A. Prevent damage to existing fencing, trees, landscaping, natural features, bench marks, pavement, structures, and utility lines. The Contractor shall correct any damage at no cost to the Owner.

1.04 Testing Requirements

- A. Determination of laboratory moisture-density relationship and maximum density shall be by the Modified Proctor Method of ASTM D-1557. At least one (1) test per soil type shall be made.
- B. In-place soil density shall be determined either by use of a Nuclear Density Meter per ASTM D-2922, Sand Cone Method per ASTM D-1556 or by use of the Drive Sleeve Method per ASTM D-2937. In-place field densities shall be taken in accordance with Article 1.01(C) of Section 01410, "Testing and Testing Laboratory Services", and at not greater than one (1) foot vertical intervals for all fill areas under structures and pavement. One (1) density test is required for each pad or isolated footing and for every twenty (20) linear feet of strip/wall footing length.
- C. All fill placed and compaction requirements shall be in accordance with Section 02220, "Excavation, Backfilling and Compaction".
- D. Compaction shall be deemed to comply with the Specifications when no tests fall below the specified relative compaction. The Contractor shall pay the costs of any retesting of work not conforming to the Specifications at no additional cost to the Owner.

- E. Relative compaction is defined as the ratio, expressed as a percentage, of the in-place density to the laboratory maximum density.
- F. Density tests will be made for determination of specified compaction by an independent testing laboratory provided by the Contractor and as approved by the Engineer and Owner as specified in Section 01410, "Testing and Testing Laboratory Services". Testing shall be performed in locations reviewed and approved by the Engineer. If any tests are unsatisfactory, the Contractor shall re-excavate and re-compact the fill or backfill until the desired compaction is obtained. Additional compaction tests will be taken on each side of an unsatisfactory test at locations approved by the Engineer to determine the extent of re-excavation and re-compaction necessary.
- G. ***The Contractor shall pay for each failed compaction test and for each additional test taken to determine the extent of re-excavation and re-compaction as previously described and at no additional cost to the Owner.***

2. PRODUCTS

2.01 Materials

A. Suitable Materials

- 1. Suitable materials for fills shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M - 145 and shall be free from vegetation and organic material.
- 2. ***Not more than 10 percent (10%) by weight of fill material shall pass the No. 200 sieve.***
- 3. The Contractor shall furnish all additional fill material required for the Project from legal **off-site** locations.

B. Suitable Materials to be Placed in Water

- 1. Suitable material for fills to be placed in water shall be classified as A-1 or A-3 in accordance with AASHTO Designation M - 145.

C. Unsuitable Materials

- 1. Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-8 or any material not specified in Article 2.01(A) above in accordance with AASHTO Designation M - 145.

D. Water for Compaction

1. Water shall be free of acid, alkali, or organic materials and shall have a pH between 7.0 and 9.0, a maximum chloride concentration of 250 mg/L and a maximum sulfate concentration of 250 mg/L.
2. ***The Contractor shall provide all of the water needed for earthwork.***
3. The Contractor shall provide temporary piping and valves and a means to convey water from the source to the point of use.
4. The Contractor shall provide any meters and ancillary equipment necessary, if the water is taken from the Owner's potable or reclaimed water distribution line. ***The Contractor shall pay for all water taken from the Owner at the Owner's standard rate or a "negotiated" monthly fee.***

3. EXECUTION

3.01 Preparation

- A. The Contractor shall follow the requirements of Section 02100, "Site Preparation" and Section 02200, "Earthwork".

3.02 Performance

- A. Unless otherwise specified or shown on the Contract Drawings, compact fill, embankment and backfills to Modified Proctor Density specified in Section 02220, "Excavation, Backfilling and Compaction".
- B. Excavation
 1. Excavation shall conform to the limits indicated on the Contract Drawings or specified herein. This work shall include shaping and sloping and other work necessary in bringing the earthwork to the required grade, alignment and cross section.
 2. All suitable materials removed from the excavation shall be used as far as practicable in the formation of the embankments, subgrades, shoulders, building sites and other places as directed. Excavated material shall not be wasted without permission, and where necessary to waste such material, it shall be at the direction

of the Engineer. Unsuitable material shall be removed to the required depth and replaced to the satisfaction of the Engineer with suitable material. Unsuitable material existing in open areas may remain, and these open areas may be used for disposal areas for any excess suitable material only when and as directed by the Engineer.

3. All excess excavated **suitable** material or borrow fill shall be considered property of the Owner and disposed of as directed by the Owner or Engineer. **Excess unsuitable material shall be legally disposed of by the Contractor at no additional cost to the Owner.**

C. Fills

1. Fills shall be formed of suitable material placed in layers in accordance with Section 02220, "Excavation, Backfilling and Compaction", measured loose and rolled and/or vibrated with suitable equipment until compacted. Thickness of layers may be increased provided the equipment and methods used are proven by field density testing to be capable of compacting thicker layers to specified densities. Layer thickness shall be decreased if equipment and methods used are proven to be incapable of compacting the layers to specified densities.
2. Rock that will not pass through a two (2) inch diameter ring shall not be placed within the top twelve (12) inches of the surface of the completed fill. Rock that will not pass through a one (1) inch diameter ring shall not be placed within the top four (4) inches of the completed fill. Broken concrete or asphaltic pavement shall not be used in fills.
3. **Muck or other unsuitable material shall not be used in any areas on the Project site.**
4. All fill placed as part of the improvements defined under this Project shall be compacted in maximum lifts and to a density as specified in Section 02220, "Excavation, Backfilling and Compaction".
5. **Final elevations shall be within ± 0.02 feet of the required elevation and surfaces shall be sloped to drain as shown on the Contract Drawings.**

- D. Siltation barriers and other erosion control and pollution and erosion control measures required by regulatory agencies are to be accomplished as part of the work without additional compensation.

E. Subgrades

1. The construction of subgrades shall conform to the requirements set forth hereinafter and shall consist of bringing the top of the roadway subgrade between

the outer limits of the base course, to a surface conforming to the grades, lines and cross section shown on the Contract Drawings, of uniform density, ready to receive the base course.

2. All material of the subgrade within the indicated limits shown on the Contract Drawings which provide a Limerock Bearing Ratio of less than 40 shall be stabilized as specified under Section 02610, "Stabilized Sub-Base".
3. In areas of pavement removal, the existing base material shall be removed and, if uncontaminated by unsuitable material, may be stock-piled for use in the proposed subbase. Excavated base material may not be utilized as base material on new pavement areas. The existing subgrade must then be reworked to meet the subgrade requirements specified herein.
4. After the subgrade has been properly shaped and stabilized, if required, it shall be brought to a firm, unyielding surface by rolling the entire area with an approved three (3) wheel power roller weighing not less than ten (10) tons. All areas inaccessible to the roller shall be thoroughly compacted with hand tampers weighing not less than fifty (50) pounds, the face of which shall not exceed one hundred square inches (100 in²) in area. Unless the subgrade material at the time of the rolling contains sufficient moisture to insure proper compaction, it shall be watered as directed and then compacted. Subgrade material containing excess moisture, as determined by the Engineer, shall be permitted to dry to the proper consistency before being compacted.
5. The top twelve (12) inches of the subgrade, including cut and fill sections, shall be compacted to the density specified in Section 02220, "Excavation, Backfilling and Compaction".
6. After the subgrade has been prepared, the Contractor shall maintain it free of ruts, depressions and damage resulting from the hauling and handling of any material, equipment, tools, etc. Ditches or drains shall be constructed and maintained along the completed subgrade section. Just before the base course is laid, the subgrade shall be checked for crown and elevation. ***The final elevation of the subgrade shall be within ±0.02 feet of the required elevation.***
7. Slope the grade away from buildings/structures at a minimum rate of ¼-inch per foot for ten (10) feet or a minimum of two (2) inches, whichever is greater), unless indicated otherwise on the Contract Drawings.
8. ***Cultivate subgrade to a depth of four (4) inches, where topsoil is to be placed.*** Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted the subsoil.

3.03 Topsoil

- A. Topsoil shall be material obtained from stripping or excavation free of roots, brush, stumps or other debris and suitable for or capable of supporting the growth of grass or other plant life.
- B. When this topsoil material is available from the on site excavation operations, the topsoil shall be placed to a depth of four (4) inches in all areas of new grading and in areas where seeding, sodding and grading is to occur in lieu of topsoil shipped to the site.
- C. Topsoil shall be spread evenly and compacted to a thickness of not less than four (4) inches (twelve (12) inches in landscaped areas) and to the proposed elevations and grades. Grade flush with walks, curbs, and paving, or to the elevations indicated on the Contract Drawings.
- D. Topsoil around trees, plants, buildings and structures shall be spread manually to prevent damage that may be caused by grading equipment. The Contractor shall be responsible to repair any and all damages at no additional cost to the Owner.
- E. Topsoil specifications and placement are presented in Section 02215, "Finish Grading", Articles 2.02 and 3.02, respectively.

3.04 Finish Grading

- A. After site grading is completed, the disturbed areas shall be finish graded as specified in Section 02215, "Finish Grading".
- B. Any lumber, undesirable materials and rocks larger than the one (1) inch size shall be removed from the surface and the surface shall be prepared for sod and/or seeding and mulching.
- C. The completed surface shall be shaped and sloped to drain as indicated on the Contract Drawings.
- D. **The completed surface shall be within ± 0.02 feet of the finish elevations** shown on the Contract Drawings, unless otherwise approved by the Engineer.

3.05 Moisture Control of Earth Material

- A. During the compaction operations, maintain optimum practicable moisture content required for compaction purposes in each lift of material.

- B. Maintain moisture content uniform throughout the lift.
- C. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the material.
- D. At the time of compaction, the water content of the material shall be at optimum water content or within two (2) percentage points above optimum.
- E. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

END OF SECTION

SECTION 02215

FINISH GRADING

1. GENERAL

1.01 Description

A. The Work in this section consists of furnishing all necessary labor, equipment, and material necessary to bring the project site to the lines and grades shown on the Contract Drawings, including, but not limited to:

1. Finish grade subsoil.
2. Cut out areas to receive stabilizing base course materials.
3. Place, finish grade and compact topsoil.

B. Related Work Specified Elsewhere

Specification Section	Title
02100	Site Preparation
02200	Earthwork
02210	Site Grading
02220	Excavation, Backfilling and Compaction
02720	Concrete Sidewalks
02815	Solid Sodding
Contract Drawings and General Provisions of the Contract	

1.02 Protection

A. Prevent damage to existing fencing, trees, landscaping, natural features, bench marks, pavement, structures, and utility lines. ***The Contractor shall correct any damage at no cost to the Owner.***

1.03 Quality Assurance

- A. When requested, the Contractor shall provide the necessary certification that the topsoil conforms to the requirements of Article 2.02 of this specification section.

2. PRODUCTS

2.01 General

- A. The Contractor shall provide topsoil for use under all sodded areas.

2.02 Topsoil

- A. Topsoil shall be fertile, friable, natural loam topsoil typical of the area, from well drained sites, free from subsoil, stones, plants, roots, grass, excessive amounts of weeds, or other extraneous material and shall not be used while muddy or frozen.
- B. Where possible, topsoil removed during the clearing and grubbing stage shall be used. The topsoil shall be free of roots, brush, stumps or other debris and suitable for or capable of supporting the growth of grass or other plant life.
- C. **Topsoil shall contain not less than eight percent (8%) nor more than twenty-five percent (25%) organic matter (AASHTO T-194) with an acidity range (pH) of 5.5 to 7.5.** The topsoil shall consist of either natural topsoils typical of the locality and free from coarse stone aggregate or surface soils stripped from the site and enriched with humus at a rate of eight percent (8%) by volume. The soil mixture prepared by mixing surface soils and humus shall be free of oil, cinders, coarse stone, and woody root material.
- D. Topsoil sample tests, if required, shall be made at the discretion of the Engineer.

3. EXECUTION

3.01 Subsoil Preparation

- A. Rough grade subsoil 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 subsoil that has been contaminated with petroleum products.

- B. Cut out areas to subgrade elevation, which are to receive stabilizing base for paving, driveways, sidewalks, etc.).
- C. Bring the subsoil to the required levels, profiles, and contours. ***Make gradual changes in grade. Blend slopes into level areas.***
- D. ***Slope the grade away from buildings and structures a minimum of two (2) inches in ten (10) feet unless indicated otherwise on the Contract Drawings.***
- E. ***Cultivate subgrade to a depth of four (4) inches, where topsoil is to be placed.*** Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted the subsoil.
- F. All finish grading shall be done in a manner that provides positive drainage.

3.02 Placing Topsoil

- A. Place topsoil in all areas of new grading and in areas where sodding, grading, planting and landscaping is to occur. Topsoil shall be spread evenly and compacted to the following minimum depths:
 - 1. Twelve (12) inches in landscaped areas.
 - 2. Six (6) inches for seeded areas, if any.
 - 3. Four and one-half (4½) inches for sodded areas.
 - 4. Four (4) inches everywhere else.
- B. The topsoil shall be relatively dry and placed during dry weather.
- C. Remove stone roots, grass, weeds, debris and other foreign material while spreading.
- D. Topsoil around trees, plants, buildings and structures shall be spread manually to prevent damage that may be caused by grading equipment. The Contractor shall be responsible to repair any and all damages at no additional cost to the Owner.
- E. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of subgrades.
- F. Grade flush with walks, curbs, and paving, or to the elevations indicated on the Contract Drawings.

- G. Lightly compact placed topsoil.

3.03 Surplus Material

- A. All excess ***suitable*** material, subsoil, topsoil or borrow fill shall be considered property of the Owner and moved to either a storage location on-site or at an off-site location as directed by the Owner. disposed of as directed by the Owner or Engineer. ***Excess unsuitable material shall be "legally" disposed of by the Contractor at no additional cost to the Owner.***
- B. Leave stockpile areas and the entire Project Site clean and raked, ready to receive landscaping, solid sodding or loaming, seeding and mulching.

END OF SECTION

SECTION 02220

EXCAVATION, BACKFILLING AND COMPACTION

1. GENERAL

1.01 Description

A. Scope of Work

1. The Work in this section consists of dewatering, excavating, trenching, sheeting/shoring, grading, backfilling, and compacting those soil materials required under, adjacent to, and for the construction of buildings, structures, piping, utilities, roads, appurtenances and the stormwater management systems as shown on the Contract Drawings and specified herein.

B. Related Work Specified Elsewhere

1. Dewatering and Drainage:	Section 02075
2. Site Preparation:	Section 02100
3. Site Grading:	Section 02210
4. Finish Grading:	Section 02215
5. Asphaltic Pavement:	Section 02500
6. Stabilized Sub-Base:	Section 02610
7. Reinforced Concrete Pipe and Fittings:	Section 02612
8. Ductile Iron Pipe and Fittings:	Section 15060

C. ***The Contractor shall be responsible for the determination of earthwork quantities and the volume of material required for the site.***

D. Terminology

1. Maximum Density: *Maximum weight, in pounds per cubic foot, lb/ft³ (pcf), of a specific material.*
2. Optimum Moisture Content *The optimum moisture content shall be determined by ASTM D-1557 specified to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the ¾-inch sieve.*

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 other 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 a non-cohesive, non-plastic, granular local sand (classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M - 145) that shall be free from vegetation, organic material, marl, silt or muck. Not more than ten (10) percent by weight of fill material shall pass the No. 200 Sieve. The Contractor shall furnish all additional fill material required.*
5. Unsuitable: *Unsuitable materials are highly organic soil (peat or muck) classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, and A-B in accordance with AASHTO Designation M - 145.*

E. Plan for Earthwork

1. 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 that can, in any way, affect the work under this Contract according to Section 00700, "General Conditions".
2. ***Prior to commencing the excavation, the Contractor shall submit a plan (Earthwork Plan) of his proposed operations to the Engineer for review.*** The Contractor shall reflect the equipment and methods to be employed in the excavation. ***Prices established in the Proposal for the Work to be done will reflect all costs pertaining to the Work. No claims for extras based on substrata or groundwater table conditions will be allowed.***

F. Trench Safety Act

1. The Contractor shall comply with all of the requirements of the Florida Trench Safety Act (Chapter 90-96, CS/CB 2626, Laws of Florida). The Contractor shall acknowledge that included in various items of his Bid proposal and in the Total Bid Price are costs for complying with the provisions of the Act (Section 00430).
2. Additionally, the Contractor is required to break out the costs for complying with the Florida Trench Safety Act. ***FAILURE TO COMPLY WITH THE REQUEST IN THIS SECTION SHALL RESULT IN THE BID BEING DECLARED NON-RESPONSIVE.***

3. Failure to comply with the provisions of the Act shall result in a per item penalty, of a dollar amount dictated by the governing authority (\$1,000 minimum), per day that the work is out of compliance.

1.02 Applicable Publications

- A. All publications and standard specifications referred to herein are the latest or current issue of that publication or specification as of the specification date.

1.03 Quality Assurance

- A. The requirements for testing and laboratory services are specified in Section 01410, "Testing and Testing Laboratory Services".
- B. A Testing Laboratory employed by the Contractor, as part of this Contract, and **approved by the Engineer and Owner**, shall make such tests that are deemed advisable.
- C. The Contractor shall schedule his work so as to permit reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress.
- D. **Costs for all testing shall be paid by the Contractor and be included in the Contract Price.** Any and all tests that have to be repeated, because of failure of the tested material to meet specification, shall be paid for by the Contractor.

1.04 Federal and State Regulatory Requirements

- A. All trench excavations which exceed four (4) feet in depth shall comply with the applicable trench safety standards as stated in the OSHA Excavation Safety Standards, 29 CFR S.1926.650, Subpart P, as regulated and administered by the Florida Department of Labor and Employment Security as the "Florida Trench Safety Act".

1.05 Job Conditions

- A. If, in the opinion of the Engineer, conditions encountered during construction warrant a change in the footing elevation, or in the depth of removal of unsuitable material from that indicated in the geotechnical investigation (soils report), an adjustment may be made in the Contract Price, as provided in the General and Supplementary Conditions.

- B. Locate existing underground utilities in areas of work. Provide adequate means of support and protection during earthwork operations.
- C. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, if any, consult the utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner at no additional cost to the Owner.
- D. Do not interrupt existing utilities serving occupied facilities.
- E. The use of explosives is not permitted.
- F. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by vibration, settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.06 Pre-Construction Survey

- A. Prior to commencing excavation, backfill or dewatering, ***the Engineer and Contractor shall jointly conduct a survey of those existing structures which, in the opinion of the Engineer, may be subject to settlement or distress resulting from excavation or dewatering operations.*** This shall include both private and public property, both on the project site(s) and in and adjacent to the project right-of-ways.
- B. The Contractor will monitor the structures surveyed to ascertain evidence of settlement or distress. If settlement or distress becomes evident the Contractor shall be required to repair the structures to their previous condition, to the satisfaction of the Engineer. Costs shall be paid by the Contractor and shall be considered to be incidental to the Contract.

1.07 Submittals

- A. Submit to the Engineer, for review, the proposed methods of construction, including dewatering, excavation, sheeting and shoring, bedding, filling, compaction and backfilling for the various portions of the Work.
- B. The Engineer's review shall be for "method" only.
- C. The Contractor shall remain responsible for the adequacy and safety of the methods.

2. PRODUCTS

2.01 Materials

A. General

1. All fill material from “on-site” and “off-site” sources shall be subject to the approval of the Engineer and shall contain less than 1.0% asbestos by weight or volume.
2. All fill material shall be unfrozen and free of organic material, trash, or other objectionable material. Excess or unsuitable material, as designated by the Engineer, shall be removed in a legal manner from the job site by the Contractor at no additional cost to the Owner and shall be considered incidental to the Contract.

B. Soil Materials

1. Satisfactory soil materials are ASTM D-2487 soil classification groups GW, GP, SW and SP.
2. Unsatisfactory soil materials are ASTM D-2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH and PT.

C. Sub-Base Materials

1. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.

D. Drainage Fill

1. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with one hundred percent (100%) passing a 1½-inch sieve and not more than five percent (5%) passing a No. 4 sieve.

E. Common Fill Material

1. Common fill shall be sand not containing stones, rock, concrete or other rubble larger than one (1) inch in diameter. It shall have physical properties which allow it to be easily spread and compacted.
2. The Contractor shall utilize as much suitable excavated material as possible for reuse in accordance with the Contract Drawings and Specifications or as directed by the Engineer.

- The Engineer shall direct the Contractor on the type of material allowed in certain sections of the earthwork operations.

F. Structural Fill

- Structural Fill shall be well graded sand to gravelly sand having the following gradation:

U.S. Sieve Size	Percent Passing by Weight
1-inch	100
No. 4	75 - 100
No. 40	15 - 80
No. 100	0 - 30
No. 200	0 - 10

G. Class I Soils

- Class I soils are not defined in ASTM D-2487.
- Class I soils shall be manufactured angular, granular material, ¼-inch to 1½ - inches (6 to 40 mm) in 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 shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C-33 stone size No. 89 and with particle size limits as follows:

U.S. Sieve Size	Percent Passing by Weight
½	100
¾	90 - 100
No. 4	20 - 55
No. 8	5 - 30
No. 16	0 - 10
No. 50	0 - 5

H. Class II Soils

1. Class II soils shall be in accordance with ASTM D-2487, Class II soils shall have less than five percent (5%) passing a No. 200 sieve as presented below:
2. **GW:** Well-graded gravels and gravel-sand mixtures with little or no fines. Fifty percent (50%) or more retained on No. 4 sieve and more than ninety-five percent (95%) retained on a No. 200 sieve. All material shall be clean.
3. **GP:** Poorly graded gravels and gravel-sand mixtures with little or no fines. Fifty percent (50%) or more retained on No. 4 sieve and more than ninety-five percent (95%) retained on a No. 200 sieve. All material shall be clean.
4. **SW:** Well-graded sands and gravelly sands with little or no fines. More than fifty percent (50%) passes a No. 4 sieve. More than ninety-five percent (95%) retained on a No. 200 sieve. All material shall be clean.
5. **SP:** Poorly graded sands and gravelly sands with little or no fines. More than fifty percent (50%) passes a No. 4 sieve. More than ninety-five percent (95%) retained on a No. 200 sieve. All material shall be clean.

I. Coarse Sand

1. Coarse sand shall consist of clean mineral aggregate with particle size limits as follows:

U.S. Sieve Size	Percent Passing by Weight
No.10	100
No. 20	0 - 30
No. 40	0 - 5

J. Other Material

1. All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Engineer.

3. EXECUTION

3.01 Preparation

- A. Clearing and grubbing shall be performed in accordance with Section 02100, "Site Preparation".
- B. Strip and dispose of topsoil off-site, unless otherwise directed to stockpile the material by the Engineer.

3.02 Sheeting, Shoring and Bracing

- A. ***Furnish, put in place, and maintain sheeting and bracing as required to support the sides of excavations***, to prevent movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling. If the Owner is of the opinion that sufficient or proper supports have not been provided, he may order additional supports be installed 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 beside 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 cost to the Owner.
- B. The Contractor shall construct sheeting outside the neat lines of the foundation unless deemed otherwise for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall withstand all pressure to which the structure or trench will be subjected. Any deformation shall be corrected by the Contractor, at his own expense, so as to provide the necessary clearances and dimensions.
- C. ***Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Structural Engineer, registered in the State of Florida, to design the sheeting and bracing.*** The sheeting and bracing installed shall conform with the design, and certification of this shall be provided by the Professional Structural Engineer.
- D. 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.

- E. The Owner may direct the Contractor, in writing, to leave in place at any time, during the progress of the Work for the purpose of preventing injury to structures, utilities, or property, whether public or private.
- F. Steel sheeting shall be of adequate strength for the purpose intended. Where conditions permit, steel drag shields or trench boxes may be used. Voids left by the advancement of the shield shall be carefully backfilled and compacted in accordance with trench backfill requirements.
- G. Steel sheeting above the crown elevation of pipe may be completely removed when sufficient backfill has been placed to prevent damage to the Work and/or existing structures. Care shall be exercised to prevent the opening of voids during the extraction process.
- H. All sheeting placed below the crown elevation of pipe shall be cut off above the pipe crown elevations and left in place.
- I. 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 for that purpose, or otherwise directed by the Owner.
- J. The right of the Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
- K. The Contractor shall comply with all applicable safety regulations and laws.
- L. The structural strength and safety of all sheeting, shoring, and bracing shall be the sole responsibility of the Contractor. The Contractor shall repair any damage resulting from failure to provide adequate supports at his expense.

3.03 Dewatering and Drainage

- A. The Contractor shall at all times during construction, where groundwater level affect the construction activities, 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 water levels to return to natural levels as stipulated in Section 02075, "Dewatering and Drainage".

- B. ***The Contractor shall engage the services of a Professional Geotechnical Engineer, registered in the State of Florida, to design the dewatering systems for all structures. The Contractor shall submit to the Engineer, for review, a plan for dewatering systems prior to commencing Work (Dewatering Plan) in accordance with Section 02075, "Dewatering and Drainage".*** The installed dewatering system shall be in conformity with the overall construction plan, and certification of this shall be provided by the Professional Geotechnical Engineer. The Professional Geotechnical 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.
- C. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation and to preserve the integrity of adjacent structures. Well or sump installations shall be constructed with proper sand filters to prevent intermixing of finer grained soil from the surrounding ground.
- D. 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.
- E. All water pumped or drained from the excavated area shall be disposed of in a suitable manner without undue interference with other work, without damage to the surrounding property, and in accordance with pertinent rules and regulations.
- F. ***The Contractor shall take all additional precautions to prevent buoyant uplift of any structure during construction.***
- G. No construction, including pipe laying, shall be allowed in water. Groundwater levels shall be maintained at least thirty (30) inches below the excavation. No water shall be allowed to come into contact with masonry or concrete within twenty-four (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.
- H. The conveying of dewatered liquids in open ditches or trenches will not be allowed. 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. 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 Owner or the authority having jurisdiction, at no cost to the Owner.
- I. The Contractor shall be required, at his expense, to excavate below grade and refill with approved fill material if the Owner determines that adequate drainage has not been provided.

- J. **Flotation shall be prevented by the Contractor 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.
- K. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system, shall be removed by the Contractor.
- L. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.
- M. The Contractor shall review all of the requirements of Section 02075, "Dewatering and Drainage", as well as the General and Supplementary Conditions (Division 0).

3.04 Excavation for Structures and Utilities

- A. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.
- B. Excavation shall be made to such dimensions as will give suitable room for bracing and supporting, for pumping and draining, for installing the pipelines, and for all other work required. **Conform to the elevations and dimensions shown on the Contract Drawings within a tolerance of ± 0.02 feet.**
 - 1. Excavation for precast or prefabricated structures shall be carried to an elevation two (2) feet lower than the proposed outside bottom of the structure to provide space for the structural backfill material.
 - 2. Excavation for structures constructed or cast-in-place in dewatered or dry excavations shall be carried down to an elevation two (2) feet below the bottom of the structure where dewatering methods are such that a dry evacuation 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 No. 57 stone or Class B concrete.**
- C. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.
- D. Encounters with subsurface obstructions shall be hand excavated.

- E. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Contract Drawings and should anticipate the encounter of unknown obstructions during the course of the Work.
- F. Excavation and dewatering shall be accomplished by methods which 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 undercut a minimum of twelve (12) inches and replaced with FDOT No. 57 Stone*** as required by the Engineer at the Contractor's expense.
- G. The bottom of excavations shall be rendered firm and dry before placing any structure or pipe. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor in a legal manner at no additional cost to the Owner. The bedding schedule for pipes shall be as shown in Table 02220-2 presented at the end of this specification section.
- H. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.
- I. ***All structure and pipe locations and elevations as required herein, must be permanently documented by the Contractor, on the Project Record Drawings prior to the Engineer's approval of the Application for Payment for that Work.***
- J. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered. No excavated material or other construction material shall be placed within thirty (30) feet of the edge of pavement of any roadway.

3.05 Undercut

- A. If the bottom of any excavation is below that shown on the Contract 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 as directed by the Engineer.

3.06 Stabilization

- A. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact.

- B. ***Subgrades for concrete structures or trench bottoms which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel.*** Not more than a ½-inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations shown on the Contract Drawings.
- C. All stabilization work shall be performed by and at the expense of the Contractor.

3.07 Fill and Compaction

A. Materials

1. To the maximum extent available, excess earth obtained from structure and trench excavation shall be used for the construction of fills and embankments.
2. Materials used as backfill shall be free from rocks or stones larger than one (1) inch in their greatest dimension; brush, stumps, logs, roots, debris, and organic or other deleterious materials; and must be acceptable to the Engineer.
3. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials be in any backfill, fill or embankment.

B. Placement and Compaction

1. Backfill materials shall be placed in approximately horizontal layers in accordance with Table 02220-1, in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.
2. Each layer of material being compacted shall have the best practicable uniform moisture content to ensure satisfactory compaction. The Contractor will be required to add water and harrow, disc, blade, or otherwise work the material in each layer to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted by rolling or other method acceptable to the Engineer, to the densities indicated in Table 02220-1 (ASTM D1557, latest revision).

3. Whenever a trench passes through a backfill or embankment, material shall be placed and compacted to an elevation twelve (12) inches above the top of the pipe before the trench is excavated.
- C. Compact and backfill excavations and construct embankments for structures according to the schedule listed in Table 02220-1 provided at the end of this specification section. Backfill schedule for pipes is listed in Table 02220-2 also presented at the end of this specification section (Modified Proctor shall be ASTM D-1557, latest edition).
- D. Pipe shall be laid in open trenches unless otherwise indicated on the Contract Drawings or elsewhere in the Contract Documents.
- E. Excavations shall be backfilled to the original grade or as indicated on the Contract Drawings. Deviation from this grade because of settling shall be corrected. 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.
- F. Embankments shall be constructed true to lines, grades and cross sections shown on the Contract Drawings or ordered by the Owner. Embankments shall be placed in successive layers of not more than the maximum lift thickness identified in Table 02220-1, of 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.
- G. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such a request shall be in writing to the Engineer. Approval 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 Engineer's approval will be in writing.
- H. Foundation Preparation
1. ***The existing ground beneath proposed tankage, building foundations and equipment base slabs and slabs on grade shall be removed and the area proof-rolled.*** Proof-rolling should consist of at least ten (10) passes of a self-propelled vibrator compactor capable of delivering a minimum impact force of 40,000 pounds per drum to the soils. To minimize the effects of compaction induced vibrations on adjacent existing structures, the compaction operation shall be limited to a distance no closer than twenty-five (25) feet from the existing structures. Each pass should overlap the preceding pass by thirty percent (30%) to insure complete coverage.

2. Backfilled areas shall be compacted, in maximum lift thicknesses (loose measure) and to the densities (ASTM D1557, (latest)) identified in Table 02220-1, **for a depth of not less than two (2) feet below the bottom of the foundations or concrete slabs**. Any unsuitable foundation material shall be removed and replaced with suitable material.
3. Slabs On Grade
 - a. Subgrades for concrete slabs shall be removed, backfilled, and compacted to the required grade.
 - b. The top two (2) feet of concrete slab subgrade in cut sections and all fill material shall be compacted, in maximum lift thicknesses (loose measure) and to the densities (ASTM D1557, (latest)) identified in Table 02220-1.

3.08 Trench Excavation

- A. ***The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the Work. One hundred (100) feet shall be the maximum length of open trench on any line under construction.*** All trench excavation shall be open cut from the surface. The Contractor shall review the typical pipe trench sections in earth presented as Figure 02220-1 through 02220-4 at the end of this Section.

1. Alignment, Grade, and Minimum Cover
 - a. The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes.
 - b. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith shall be in conformity with requirements of the section covering installation of pipe.
2. Where pipe grades or elevations are not definitely fixed by the Contract Drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of forty-two (42) inches where in paved or graded streets where surface grades are definitely established and thirty-six (36) inches in other locations. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation.

B. Limiting Trench Widths

1. Trenches shall be excavated to a width that will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. However, minimum permissible sidewall clearances between the installed pipe and each trench wall, expressed in inches, shall be as follows:

Pipe Size (inches)	Minimum Sidewall Clearance (inches)
60	24
54	21
48	19
≤ 36	12

2. Stipulated minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required.
3. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interface with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one (1) foot above the top of the pipe.

C. Mechanical Excavation

1. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, and other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.
2. Mechanical equipment used for trench excavation shall be of the type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one (1) foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

D. Pavement Cutting

1. Cuts in concrete pavement, asphalt pavement, and asphalt base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with an asphalt or concrete saw in a manner which will provide a clean groove for the full depth of pavement along each side of the trench and along the perimeter of cuts for structures.
2. Asphalt pavement and asphalt base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than six (6) inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. The trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.
3. Pavement removed for connections to existing lines or structures shall not be greater than necessary for the installation as determined by the Engineer.
4. The Contractor shall review and conform to the requirements of Section 02505, "Pavement Removal and Restoration".

E. Artificial Foundations in Trenches

1. Whenever so ordered by the Engineer, the Contractor shall excavate to such depth below grade as the Engineer may direct and the trench bottom shall be brought to grade with such material as the Engineer may order installed.
2. All piling, concrete, or other foundations made necessary by unstable soil shall be installed as directed by the Engineer.
3. Compensation for extra excavation and piling, concrete, or other foundations, except where provided by contract unit prices, shall be made in accordance with the Contract provisions for extra work.
4. Additional work and materials must be approved by the Owner and Engineer, in writing, prior to the Contractor performing said work and placing materials, or the Contractor shall not be paid for these items.

F. Bell Holes

1. Bell holes shall provide adequate clearance for tools and methods used in installing pipe.

2. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

3.09 Tests

- A. As stipulated in the quality control section and Section 01410, "Testing and Testing Laboratory Services", all tests required for preliminary review of materials shall be made by an independent testing laboratory supplied by the Contractor and approved by the Engineer and Owner.
- B. Two initial gradation tests shall be made for each type of backfill material and one additional gradation test shall be made for each additional three hundred (300) tons of each material by the independent testing laboratory.
- C. *Moisture-density (Proctor) tests and relative in-place density tests on the materials, and all in-place field density tests, **shall be made at the expense of the Contractor.***
- D. Testing is specified in Section 01410, "Testing and Testing Laboratory Services".

3.10 Drainage Maintenance

- A. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway to prevent impounding water after the pipe has been laid.
- B. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches.
- C. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original sections, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3.11 Final Grading

- A. After other outside work has been finished, and backfilling completed and settled, all areas on the site of the Work which are to be graded shall be **brought to grade with**

the tolerance of ± 0.02 feet at the indicated elevations, slopes, and contours where sodding or seeding is not required or, where sodding is required within three (3) inches of finished grade.

- B. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage. Unless otherwise shown, a slope of at least one (1) percent shall be provided.
- C. After grading and where sodding or seeding is required, topsoil shall be evenly spread to a minimum depth as indicated in Article 3.02(A) of Section 02215, "Finish Grading". Topsoil shall be from an Engineer approved source and shall be clear of trash, debris and surface vegetation.
- D. Grading and surfacing shall be completed to the satisfaction of the Engineer.

3.12 Excess Excavated Materials

- A. Insofar as needed, suitable excavated materials shall be used in fills and embankments shown on the Contract Drawings. All suitable excess excavated material shall be placed at an "on-site" stockpile area as directed by the Owner.
- B. The Contractor shall segregate different types of excavated materials (i.e. sands, clayey sands, etc.) as possible in the stockpile area. All debris, junk, stones, logs, stumps, roots, and other unsuitable materials shall be disposed of by the Contractor off-site in a legal manner and at no cost to the Owner.
- C. The Contractor shall slope and compact the stockpile with a light roller type vehicle to maintain stability. The Contractor shall maintain proper soil and erosion control measures.

3.13 Settlement

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the correction period stipulated in Section 00700, "General Conditions".
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within thirty (30) days after notice from the Engineer or Owner.

END OF SECTION

TABLE 02220-1
COMPACTION AND BACKFILL SCHEDULE FOR STRUCTURES

Area	Material	Maximum Lift Thickness	Compaction *
Beneath structures, foundations, slabs, and pavements (minimum 5-foot depth below concrete foundation)	Structural Fill [Article 2.01(F)]	8-inch	Compacted to 98% of the soil's Modified Proctor maximum dry density. Fill should not be placed over any in-place soils until those layers have been compacted to 98% of the soil's Modified Proctor maximum dry density.
Around structures, foundations and slabs (minimum 5-foot spacing)	Structural Fill [Article 2.01(F))]	8-inch	Compacted to 98% of the soil's Modified Proctor maximum dry density. Use light rubber-tired or vibratory plate compactors
From cleared existing surface to subgrade for paved and gravel roadway surfaces	Common Fill [Article 2.01(E)]	12-inch	Compacted to 98% of the soil's Modified Proctor maximum dry density.
Disturbed area requiring solid sodding	Topsoil	12-inch	Compacted to 95% of the soil's Modified Proctor maximum dry density.
Disturbed area requiring seeding and mulching	NOT USED	-----	NOT USED

* Percentage of the maximum density at optimum moisture content as determined by the Modified Proctor Method, ASTM D-1557 (latest revision) / AASHTO T-180.

TABLE 02220-2

BACKFILL SCHEDULE FOR GRAVITY AND PRESSURE PIPING

Pipe Material	Pipe Size	Trench Condition	Bedding Material	Pipe Envelope				Others
				Primary Zone		Secondary Zone		
				Material	Depth ^c	Material	Depth	
Ductile Iron, Stainless Steel, Culvert Pipe and Prestressed Concrete Cylinder Pipe	< 16"	Normal ^a	Compacted Common Fill	Coarse Sand	0.50 O.D.	Coarse Sand	0.5 O.D. + 12"	
		Special ^b	Class I	Coarse Sand	0.50 O.D.	Coarse Sand	0.5 O.D. + 12"	
	≥ 16"	Normal ^a	Class II	Common Fill	0.25 O.D.	Common Fill		Class II Material should not have stones (size > 2"). Organic content < 1.1% by wt.
		Special ^b	Class I	Common Fill	0.25 O.D.	Common Fill		
Fiberglass, PVC and other Plastic Pipe	< 16"	Normal ^a	Coarse Sand	Coarse Sand	0.70 O.D.	Coarse Sand	0.3 O.D. + 12"	
		Special ^b	Class I	Coarse Sand	0.70 O.D.	Coarse Sand	0.3 O.D. + 12"	
	≥ 16"	Normal ^a	Class II	Class II	0.70 O.D.	Class II	0.3 O.D. + 12"	
		Special ^b	Class I	Class II	0.70 O.D.	Class II	0.3 O.D. + 12"	
RCP and CCP	< 48"	Normal ^a	Class II	Class II	0.50 O.D.	Common Fill		
		Special ^b	Class I	Class II	0.50 O.D.	Common Fill		

TABLE 02220-2

BACKFILL SCHEDULE FOR GRAVITY AND PRESSURE PIPING

Pipe Material	Pipe Size	Trench Condition	Bedding Material	Pipe Envelope				Others
				Primary Zone		Secondary Zone		
				Material	Depth ^c	Material	Depth	
RCP and CCP (Cont'd)	≥ 48"	Normal ^a	Class II	Class II	0.25 O.D.	Common Fill with max. stone size ≤2"	0.75 O.D. + 12"	
		Special ^b	Class I	Class II	0.25 O.D.	Common Fill with max. stone size ≤2"	0.75 O.D. + 12"	
Pipe laid in rock (min. trench req's) except for fiberglass and PVC Pipe		Rock	Class I	Class II	0.50 O.D.	Common Fill with max. stone size ≤2"	0.50 O.D. + 12"	
Gravity Pipe (not specified above)		Normal	Coarse Sand	Coarse Sand	0.50 O.D.	Common Fill	0.50 O.D. + 12"	
Pressure pipe (not specified above)		Normal	Suitable undisturbed Earth or compacted common fill	Common fill with max. stone size ≤ 2"	0.50 O.D.	Common Fill with max. stone size ≤2"	0.50 O.D. + 12"	

^a Dry Soils^b Saturated Soils^c Outside Diameter of pipe = O.D.

Notes

1. No special bedding shall be required in the case of suitable undisturbed earth type trench bottom.
2. Bedding thickness shall be twelve (12) inches unless specified otherwise.
3. The backfill shall be compacted to 98% Modified Proctor maximum dry density and shall be placed in 6-inch lifts for the pipe envelope and in 12-inch lifts from the secondary zone to grade. Common fill shall be used as final backfill material.
4. It is intended that additional excavation be conducted to remove unsuitable material below the pipe bedding level which prevents bedding compaction as required herein and replace such materials with suitable materials. Over excavation, geotextile fabric, gravel blanket, granular fill and other acceptable stabilization methods shall be placed within four (4) feet of the bedding level or within ten (10) feet of the existing ground (whichever is greater depth) at no additional cost to the Owner. Construction required beyond these limits shall be executed in accordance with the General Conditions, as amended by the Supplementary Conditions. When indicated on the Contract Drawings, the Contractor shall remove unsuitable material below bedding level to the limits indicated and replace them with coarse sand or other acceptable stabilization method up to the bedding level without any additional compensation to the Owner.

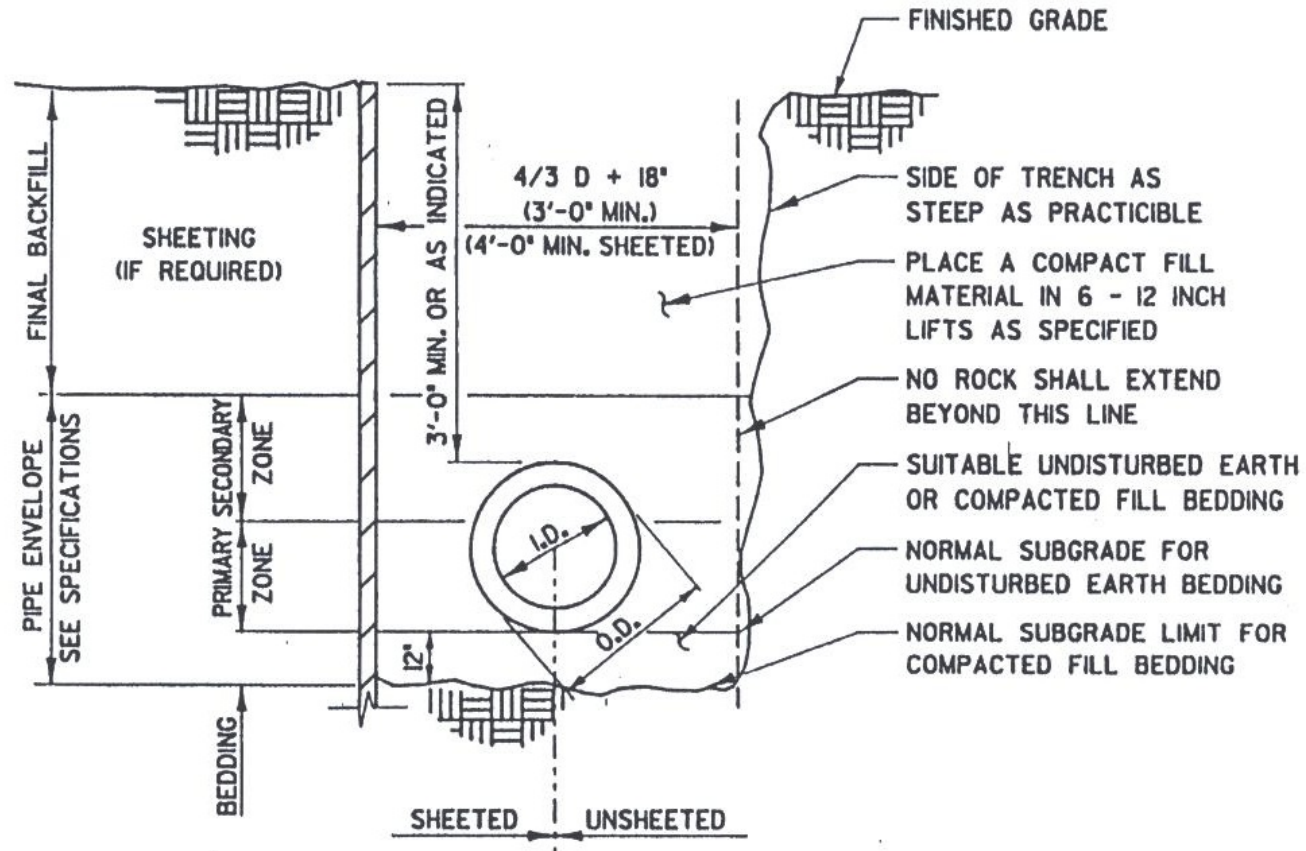


FIGURE 02220-1

TYPICAL PIPE TRENCH SECTION IN THE EARTH



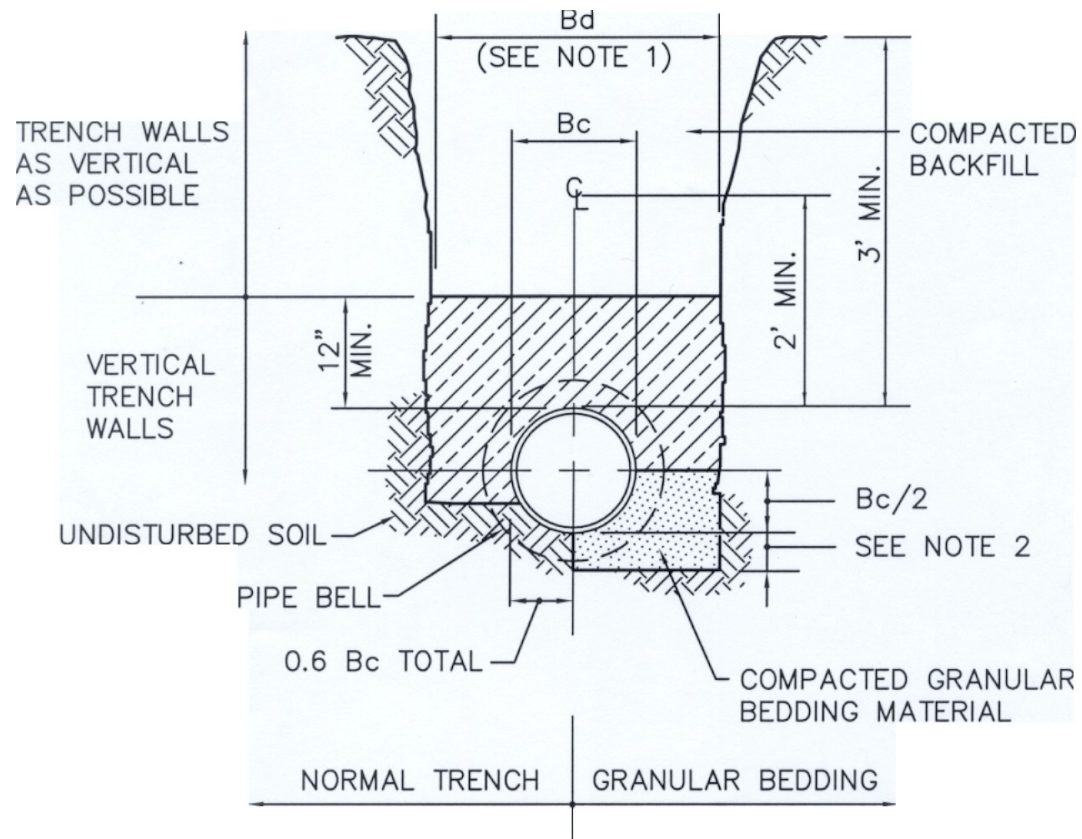
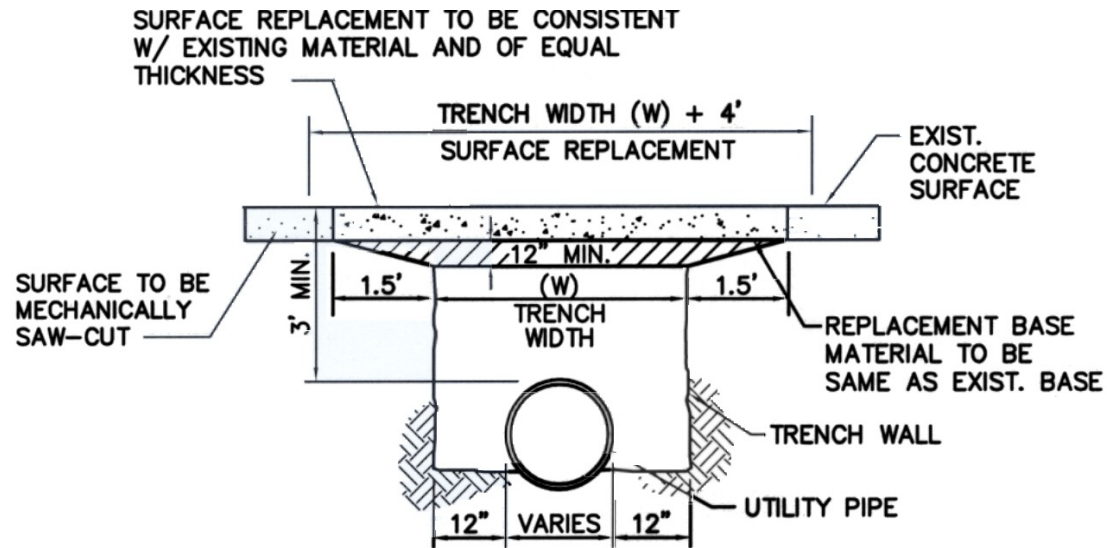


FIGURE 02220-3

CLASS "B" BEDDING - NORMAL CONDITIONS

**NOTES:**

1. BACKFILL SHALL BE IN ACCORDANCE WITH SECTION 125-8 OF THE FDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 1991 , AS AMENDED.
2. BASE MATERIALS TO BE PLACED IN TWO OR THREE LAYERS, ROLLED AND TAMPED TO SPECIFIED DENSITY FOR BACKFILL.

FIGURE 02220-4

CLASS "C" BEDDING - FOR CONCRETE

BEDDING AND TRENCHING NOTES

1. B_c = Pipe O.D.
 B_d = Trench Width at Top of Pipe
Max. B_d = $B_c + 24"$
Min B_c = Max. dimension of bell + 8-inches (unsheeted trench)
= Max. dimension of bell + 12-inches (sheeted trench)
2. The depth of removal of unsuitable material shall be as required to reach a suitable foundation for non-cushioning material. The depth shall be a minimum of six (6) inches below the bottom of the utility.
3. Sheet piling shall be driven below the utility invert if required for lateral support or unsuitable removal where driven below the pipe invert. Sheet piling shall be cut off a minimum of twelve (12) inches above the top of the pipe, or higher as authorized by the Engineer, and left in place. In no case shall sheet piling left in place extend higher than thirty (30) inches below the surface grade unless specifically approved. Bracing shall be provided as required by the Contractor.
4. Protective concrete slabs are required whenever the depth of cover is less than thirty-six (36) inches and shall be in accordance with Division 3.
5. Backfill shall be compacted to 98% density of AASHTO T-180 modified proctor in areas to be paved or receive concrete and 95% in lawn and landscaping areas. All other areas shall be compacted in accordance with this specification section.

SECTION 02276

GRAVEL AND CRUSHED ROCK BASE FOR STRUCTURES

1. GENERAL

1.01 Description

A. Scope of Work

1. The Work included in this Section consists of all labor, materials testing and installation of gravel and crushed rock bases for structures (manholes, vaults, etc.).

B. Related Work Specified Elsewhere

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
01410	Testing and Testing Laboratory Services
02200	Earthwork
02220	Excavation, Backfilling and Compaction
03300	Cast-in-Place Concrete
Contract Drawings and General Provisions of the Contract	

1.02 Submittals

- A. ***Submit three (3) copies of a report from a testing laboratory verifying that material contains less than one percent (1%) asbestos by weight or volume and conforms to the specified gradations or characteristics.***

- B. Submit the above referenced report in accordance with Section 01300, "Shop Drawings, Submittals and Samples".

1.03 Testing for Compaction

- A. **The Contractor shall test for compaction** as described below and in accordance with Section 01410, "Testing and Testing Laboratory Services" and Section 02220, "Excavation, Backfilling and Compaction".
- B. **Determine the density of the gravel and rock**, in place, by the sand cone method, ASTM D-1556 or D-2167.
- C. **Determine the relative density of the gravel and rock** by ASTM D-4253 and D-4254.
- D. Sample backfill materials by ASTM D-75.
- E. Compaction shall be deemed to comply with the specifications when no more than one test of any three consecutive tests falls below the specified relative compaction. The one test shall be no more than three (3) percentage points below the specified compaction. The Contractor shall pay the costs of retesting work not conforming to the specifications.

2. PRODUCTS

2.01 Gravel and Crushed Rock

- A. Crushed rock base and gravel are defined as natural or crushed rock, free from organic matter and containing less than one percent (1%) asbestos by weight or volume, and meeting the following gradation:

Sieve Size	Percent Passing By Weight
1½ inches	100
¾-inch	90 - 100
No. 4	35 - 55
No. 30	10 - 30
No. 200	0 - 5

- B. The Durability Index shall be at least 40 per ASTM D-3744.

3. EXECUTION

3.01 General

- A. Place crushed rock or gravel base beneath all structures, as required by the conditions, or as directed by the Engineer.
- B. ***Excavate a minimum of twenty-four (24) inches below the required grade for the bottom of the structure and refill with crushed rock or gravel as specified above.***
Compact the base as follows unless otherwise indicated:

Lift	Relative Density
Lower lift	98%
Upper lifts	98%

- C. Place base material in maximum lifts of eight (8) inches.

END OF SECTION

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SECTION 02505

PAVEMENT REMOVAL AND RESTORATION

1. GENERAL

1.01 Scope of Work

- A. The Contractor shall furnish all labor, materials, tools, transportation, equipment, and incidentals required for cutting, removing, protecting and replacing existing pavements of the various types encountered, including, but not limited to, roadways, driveways, sidewalks, curb combination curb as shown on the Contract Drawings and/or specified herein.
- B. This Section does not include the construction of new roadway, driveway, sidewalk or curb and gutter surfaces or the complete restoration of an existing roadway.
- C. Related Work Specified Elsewhere
 - 1. Shop Drawings, Submittals and Samples: Section 01300
 - 2. Concrete Sidewalks, Driveways and Pads: Section 02720

1.02 Permits

- A. The Contractor shall obtain the necessary permits prior to any roadway work.
- B. The Contractor shall provide advance notice to the appropriate authority, as required, prior to construction operations.

1.03 Protection of Existing Improvements

- A. ***The Contractor shall be responsible for the protection of all pavements, sidewalks and other improvements within the work area.*** All damage to such improvements, as a result of the Contractor's operations, beyond the limits of the work of pavement replacement as described herein, shall be repaired by the Contractor at his expense.

1.04 Jurisdictional Requirements

- A. All work within City of Sanford public thoroughfares and easements shall conform to the City's Land Development Code, these specifications, and details contained in the Contract Drawings.
- B. All work within Seminole County public thoroughfares and easements shall conform to the County's Land Development Code, these specifications, and details contained in the Contract Drawings.
- C. Portions of the Standard Specifications for Road and Bridge Construction of the Florida Department of Transportation and Supplement, latest revisions, hereinafter referred to as the FDOT Specifications, are referred to herein and amended, in part, and the same are hereby made a part of this Contract to the extent of such references, and shall be as binding upon the Contract as though reproduced herein in their entirety.

1.05 Miscellaneous Provisions

- A. The Contractor shall refer to Sections 01380, "Construction Photographs", and 01390, "Preconstruction Video Recording" relative to photographs and videotaping required prior to construction.
- B. All damage done, as a result of work under this Project, shall be repaired in a manner satisfactory to the Engineer. Bid prices shall include the furnishing of all labor, materials, equipment, and incidentals necessary for the cutting, repair, and restoration of the damaged areas unless pay items for specific types of repair are included in the Bid Form.
- C. The Contractor shall keep the surface of the backfilled area of excavation in a safe condition and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable Owner or State requirements for pavement repair and as described herein.
- D. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable Owner or State requirements for pavement repair and as described herein.
- E. **All materials and workmanship shall be "first class"** and nothing herein shall be construed as to relieve the Contractor from this responsibility. The Owner reserves the right to require soil bearing or loading tests or materials tests, should the adequacy of the foundation or the quality of materials used be questionable. Costs of these tests shall be borne by the Contractor.

- F. All street and road repair shall be made in accordance with the details indicated on the Contract Drawings and in accordance with the applicable requirements of these Specifications and meeting the approval of affected local and State agencies.

2. PRODUCTS

2.01 Materials

- A. Materials, including limerock, bituminous prime and tack coat, and asphaltic concrete for the above work shall meet the requirements established therefore by the FDOT Specifications.
 - 1. Limerock shall be Miami or Ocala Limerock.
 - 2. Bituminous prime coat material shall be cutback asphalt Grade RC-70.
 - 3. Bituminous tack coat material shall be emulsified asphalt Grade RS-2.
 - 4. Asphaltic concrete shall be conform to FDOT specifications for Superpave 12.5 mm traffic level "C" asphaltic concrete, with PF76-22 Polymer Modified Binder

3. EXECUTION

3.01 Preparation

- A. Where the work crosses or interferes with pedestrian crossings, extreme care shall be taken by the Contractor to insure the safety of pedestrians.

3.02 Performance

A. Removals

1. Asphaltic Pavement Removal

- a. Where small amounts of existing pavement are to be removed, the surfacing shall be by mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.

- b. Where large amounts of existing pavement are to be removed from construction planned along the length of various streets, bike paths or parking lots, the surfacing shall be removed by milling. All removed material shall be stockpiled as needed to restore the lower level of road base in place of limerock up to three (3) inches thick. All milling shall be in accordance with Section 327 of the FDOT specifications.
 - c. ***Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration.*** Said surfacing shall remain for ten (10) days in order to assure the stability of the backfill under normal traffic conditions. Following this period and prior to fifteen (15) days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.
 - d. ***In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions.*** Following the above operation, the Contractor shall proceed immediately with final pavement restoration in accordance with the requirements set forth in the governing authority's Land Development Code and these requirements.
2. Sidewalk, Drive and Curb Removal
- a. Concrete sidewalks, curbs, combination curb and gutter, walks, drive ribbons, or driveways shall be removed by initially sawing the structure, with a suitable power saw, as specified above for pavement.
 - b. When a formed joint in the concrete exists within three (3) feet of the proposed saw cut and parallels the proposed saw cut, the removal line shall be extended to the formed joint. After sawing, the material shall be removed from the site and legally disposed of by the Contractor.

B. Restorations

1. General

- a. Street or roadway pavement cut and removed in connection with trench excavation shall be replaced or restored in an "equal" or "better" condition than the original condition and as shown on the Contract Drawings.
- b. The Contract Drawings indicate minimum requirements.

2. Asphaltic Pavement Restoration

- a. **The limerock base course shall be a twelve (12) inch layer compacted to not less than one hundred percent (100%) of maximum density** as determined by AASHTO Designation T-180. The field density of limerock base in place shall be determined by AASHTO Designation T-238.
- b. Construction methods and equipment shall generally meet the requirements therefor as established in the FDOT Specifications, but shall be modified to meet any relatively narrow strip construction conditions. Any such modifications shall be approved by the Engineer prior to their use.
- c. After the application of the prime coat on the base, the prime coat shall be allowed to cure without sanding for a period of twenty-four (24) hours. The Contractor shall take all necessary precautions to protect the primed surface against damage during this interval. If, at the end of the twenty-four (24) hour period, it is not proposed to proceed at once with the application of the surface course, the primed surface shall be given a light application of clean sand and opened to traffic.
- d. **Joints with existing surface and base shall be straight and neat.** If necessary to obtain a straight neat joint, the Contractor shall cut out sufficient existing material and replace it with new material.
- e. The upper surface of the completed base course shall be compacted to an elevation to permit the full depth of the surface course to be constructed without deviating from the grade of the pavement surface. The completed surface shall match the line and grade of the existing surface.
- f. When pavement is removed to the edge of the roadway, the replaced base course shall extend **not less than six (6) inches beyond the edge of the surfacing.**

3. Asphaltic Driveway Restoration

- a. Driveway pavement, with a limerock base, cut and removed in connection with project excavation shall be replaced or restored as specified above for street or roadway pavement, except the new limerock base course shall equal the existing base course in thickness.
- b. However, **in no case shall new driveway base course be less than twelve (12) inches in thickness.** Remove and replace any muck or unsuitable material found under existing driveway construction.

4. Concrete Sidewalk, Walkway, Driveway Ribbon and Curb Restoration

- a. Concrete sidewalks, walkways, driveways, driveway ribbons and curbs required to be removed for the installation of facilities under this Contract shall be restored.
- b. Class B concrete with a 28-day compressive strength of 3,000 psi, as specified in Section 03300, "Cast-in-Place Concrete", shall be used in all cases.
- c. Replaced portions of these items shall conform to the lines, grades and cross sections of the removed portions. Concrete sidewalks and walkways shall have a thickness of four (4) inch thickness; concrete driveways and driveway ribbons shall have a thickness of six (6) inches and heavy duty concrete pavement shall have a thickness of eight (8) inches. Replaced concrete curb and/or gutter shall joint neatly to the remaining section.

5. Concrete Pavement Restoration

- a. Rigid pavement shall be replaced, in kind, with Class B concrete, using high early strength cement.
 - b. The base course for rigid pavement shall be limerock base material and compacted to a thickness to match the existing base.
6. Non-surfaced streets, alleys and driveways shall be restored with eight (8) inches of compacted limerock base material placed in the top of the trench.

3.03 Heavy Duty Concrete Pavement

- A. Heavy duty concrete pavement, where shown on the Contract Drawings, shall be constructed as detailed in Figures 02505-1 through 02505-3.

3.04 Adjusting Existing Structures

- A. Existing structures within the limits of the proposed Work, which do not conform to the finished grade of the proposed pavement or the finished grade designated on the Contract Drawings for such structure shall be cut down or extended and made to conform to the new grade. The materials and construction methods for this work shall be approved by the Engineer.

3.05 Miscellaneous Restoration

- A. ***Grassed yards, shoulders and parkways shall be restored to match the existing sections with sod***, as indicated on the Contract Drawings or as specified by the Engineer, of a type matching the existing grass.

3.06 Cleanup

- A. After all repair and restoration or paving has been completed, ***all excess asphalt, dirt, and other debris shall be removed by the Contractor and disposed of in a legal manner.***
- B. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

END OF SECTION

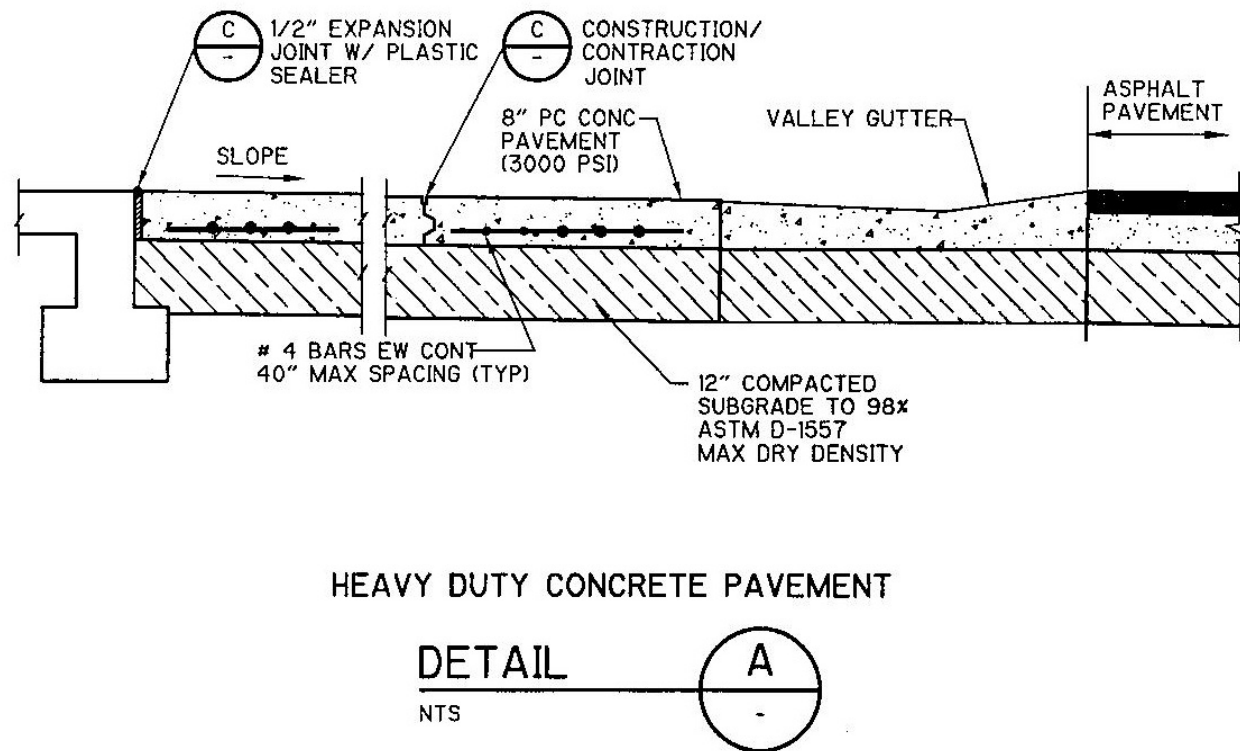


FIGURE 02505-1

HEAVY DUTY CONCRETE PAVEMENT - VALLEY GUTTER APPLICATION

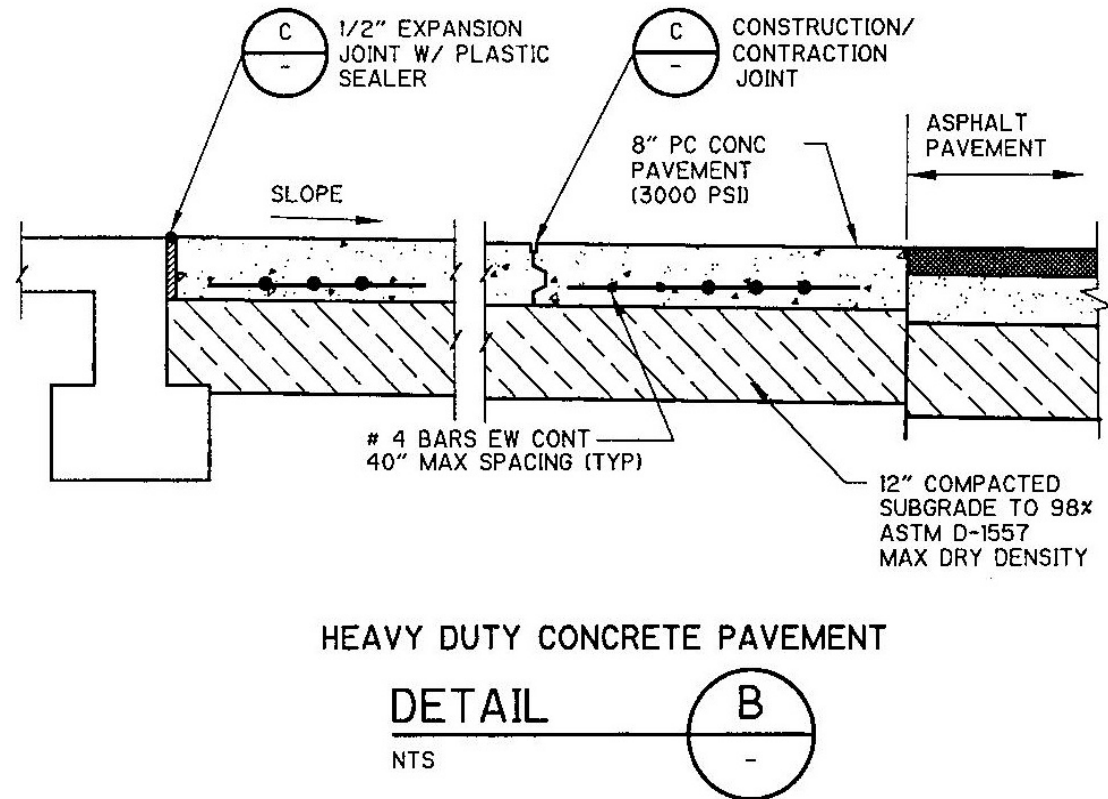


FIGURE 02505-2

HEAVY DUTY CONCRETE PAVEMENT - ASPHALTIC ROADWAY OPTION

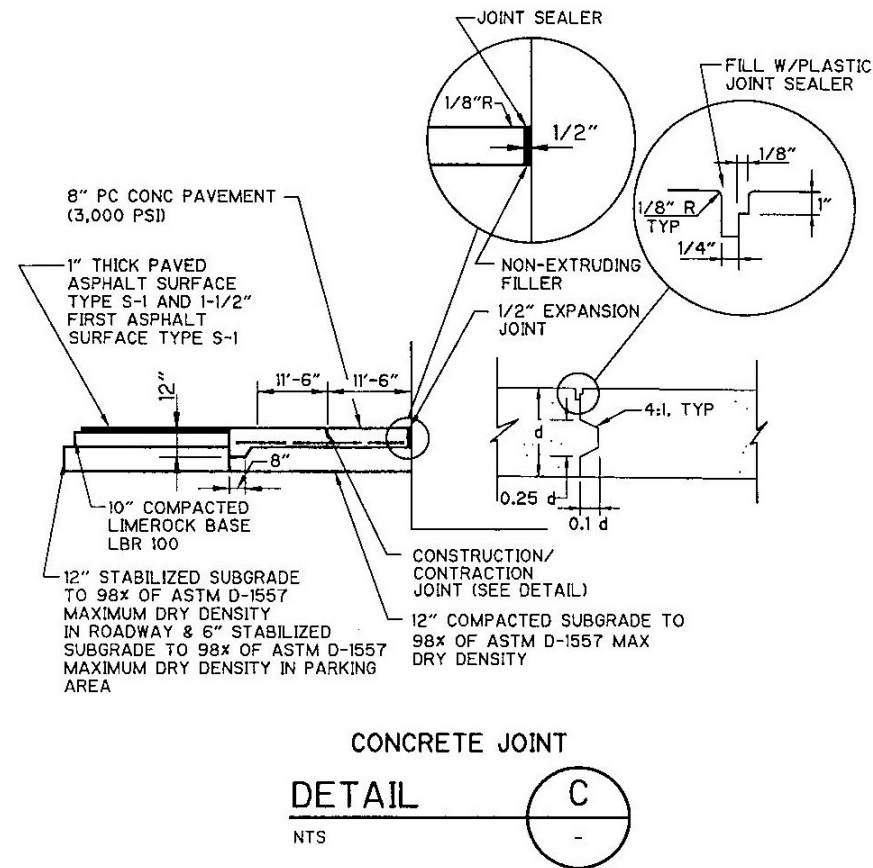


FIGURE 02505-3

HEAVY DUTY CONCRETE PAVEMENT - JOINT DETAILS

SECTION 02610

STABILIZED SUB-BASE

1. GENERAL

1.01 Description

- A. The work included in this Section consists of furnishing all labor, material, equipment, transportation, tools and testing and for the construction of a firm and unyielding stabilized sub-base as shown on the Contract Drawings.

2. PRODUCTS

2.01 Materials

- A. Use local or hauled-in clean sand or sand and clay.

2.02 Stabilizers

- A. Use high bearing-value soil, sand-clay, ground limestone or crushed limestone.
- B. ***Do not use muck, trash, hardpan, material having a plasticity index of more than 10 or a liquid limit greater than 40.***

3. EXECUTION

3.01 Construction Methods

- A. Test local material for compliance with the required Florida Bearing value. If the natural in-place soils do not meet the required stability, uniformly mix, to depth shown in the Contract Documents, or as recommended by the Contractor's geotechnical engineer, sufficient borrow material for stabilization with the in-place soils to produce the required bearing value.

- B. Compact the stabilized sub-base in both cuts and fills to a density of ninety-eight percent (98%) of the relative density as required by AASHTO T-180 (Modified).
- C. Shape the sub-base to within ¼-inch of the cross section grade shown on the Contract Drawings prior to making the density tests. ***Make the density tests before other work proceeds.***
- D. Maintain the required density and cross section until the base or pavement has been laid or until the aggregate materials for the base or pavement course have been spread in place.

3.02 Required Bearing Value

- A. Unless otherwise specified in the Contract Documents or shown on the Contract Drawings, ***stabilized sub-base shall have a minimum Florida Bearing Value of 40.***

3.03 Tests

- A. Density and bearing value tests shall be made by an independent testing laboratory in accordance with Section 01410, "Testing and Testing Laboratory Services" (Minimum testing at intervals not more than one hundred (100) feet in roadways or 1,000 ft² in area paving, whichever is less).
- B. ***If any test results are unsatisfactory, re-excavate and recompact the sub-base until the desired compaction is obtained.*** Make additional tests on each side of an unsatisfactory test to determine the extent of re-excavation, re-mixing and re-compaction necessary.

END OF SECTION

SECTION 02612

REINFORCED CONCRETE PIPE AND FITTINGS

1. GENERAL

1.01 Description

A. Scope of Work

1. The work included in this Section consists of furnishing all labor, material, equipment, transportation, tools and testing for the installation of reinforced concrete pipe and fittings of the type(s) and size(s) and in the location(s) shown on the Contract Drawings and as specified herein.

1.02 Quality Assurance

- A. Reinforced-concrete pipe and fittings shall be manufactured by a reputable manufacturer with a minimum of five (5) years experience in the design and fabrication thereof.

B. Standards

1. Pipe: ASTM C-76, C-507 or AWWA 302-74, unless otherwise specified herein
2. Gasket: ASTM C-443, or ASTM D-412
3. Steel reinforcement: ASTM A-82
4. Portland Cement: ASTM C-150
5. FDOT Standard Specifications for Road and Bridge Construction and Roadway and Traffic Design Standards, latest editions.

C. Acceptable Manufacturers

1. Price Brothers Company.	3. Cemex.
2. U.S. Concrete Pipe Company.	4. Or approved equal.

1.03 Submittals

- A. Submit shop drawings in accordance with the General and Supplementary Conditions and Section 01300, "Shop Drawings, Submittals and Samples showing pipe dimensions, reinforcement, joints, piping materials, curing compounds, gaskets, coating systems, fasteners and other details prior to fabrication.
- B. Submit certified copies of mill test reports for all tests as outlined for concrete pipe under ASTM C-76 or AWWA 302-74.

1.04 Product Delivery, Storage and Handling

- A. ***Do not ship pipe units that are damaged and until they have aged for at least five (5) days at an average minimum temperature of 60° F.***
- B. Prevent earth, water, and other material from entering the pipe at all times.
- C. Furnish devices to permit satisfactory support of the pipe and pre-cast unit when they are lifted and handle each unit in a manner and by such means as recommended by the manufacturer.

2. PRODUCTS

2.01 Materials

- A. Pipe
 - 1. Interior surfaces shall be free from roughness, projections, indentations, offsets, or irregularities of any kind.
 - 2. All pipe shall be Class III (ASTM C-76).
 - 3. ***All pipes shall be wall thickness "B"***. If wall thickness "B" is not listed in ASTM C-76 for the class of pipe required, then the wall thickness shall be that required for wall "B" of the next higher class of pipe.
 - 4. ***The minimum laying length shall be eight (8) feet***, unless otherwise approved by the Engineer.
 - 5. Reinforcement shall be cold-drawn steel wire conforming to ASTM A-82. Elliptical reinforcement will not be permitted.

6. Curing shall be as specified under ASTM C-76 or AWWA 302-74.
7. ***Interior surfaces shall be protected by an epoxy coating. The epoxy coating shall be applied in three (3) coats*** as described here:
 - a. Properly cleaned surfaces shall receive a primer coat of Proco Armor Coat Epoxy sealer, or approved equal, at a coverage rate of 250 to 300 ft² per gallon.
 - b. The intermediate coat shall be Proco Armor Coat Epoxy Sealer mixed equal parts by volume with clean, kiln dried bagged silica sand to give a DFT of twelve (12) mils.
 - c. The finish coat shall be Proco Armor Coat Epoxy Sealer applied at a minimum coverage of 145 square feet per gallon to give a DFT of three (3) mils. Epoxy coatings shall be applied as per manufacturer's recommendations. The coating shall be as manufactured by Protective Coatings, Inc., Tampa, Florida; or equal.
8. Elliptical Concrete Pipe
 - a. Elliptical concrete pipe shall conform with the requirements of ASTM C-507.
 - b. Standard elliptical concrete pipe shall meet the requirements of Table I for Class HE-III and special elliptical pipe shall meet the requirements of Table I for HE-IV.
 - c. Furnish pipe without lifting holes.
 - d. Use preformed flexible joint sealer conforming to Federal Specification SS-5-00210 (GSA-FSS).

B. Joints

1. All joints shall be sealed by rubber gaskets conforming to Section 2.11 of AWWA C302-74.
2. All joints shall be constructed to remain watertight during service and to allow movement due to expansion, contraction, and normal settlement.
3. The joint shall be so proportioned that the spigot, or spigots, shall readily enter the bell or sleeve of the pipe.
4. The joint shall be so dimensioned that when the gasket to be used is placed on the spigot it will not be stretched more than fifteen percent (15%) of its original length.

5. The space provided for the gasket shall be a groove in the spigot end of the pipe and such space, when the joint is made, shall not be more than one hundred ten percent (110%) of the volume of the gasket.
6. The joint shall be so designed that when the outer surface of the spigot and the inner surface of the bell come into contact at some point on the periphery, the diametric deformation in the gasket at the point of contact shall not be greater than fifty percent (50%) of the normal gasket diameter, and the diametric deformation in the gasket at the point opposite the contact point shall not be less than twenty percent (20%) of the normal gasket diameter.
7. When the pipes are joined there shall be parallel surfaces on both the bell and the spigot, extending from the edge of the gasket toward the bell face for a distance of not less than $\frac{3}{4}$ -inch. These parallel surfaces shall in no case be further apart than $\frac{1}{8}$ -inch when the spigot is centered in the bell. The tapers on these surfaces shall not exceed three degrees (3°).
8. The inside surface of the bell at the end of the bell shall be flared to facilitate joining the pipe sections without damaging or displacing the gasket.
9. Contact surfaces shall be free from air holes, chipped or spalled concrete laitance, and other such defects.
10. Pipes showing minor manufacturing imperfections or handling injuries to the bell or spigot may be acceptable if such defects can be, and are, acceptably repaired as prescribed below.
11. Individual air holes (trapped air), or spalled areas with a length of up to one-half of the pipe radius, or 12 inches, whichever is smaller, may be repaired by careful use of a hand-placed, stiff, pre-shrunk, one-to-one mortar of cement and fine sand, and with no additional preparation other than a thorough washing with water of the defect. Curing shall be done either by moisture curing under wet burlap or by application of an approved membrane curing compound. Such repaired pipe which is sound, properly finished and cured, and which otherwise conforms to specification requirements will be considered acceptable.
12. External joints of the pipe laid below the groundwater table shall be sealed by external sealing bands conforming to ANSI/ASTM C-877. The external sealing bands shall be as manufactured by Cadilloc, Inc., Escanaba, Michigan; or equal.

C. Membrane Curing Compound

1. **Membrane curing compound shall conform to the requirements of AASHTO M-148** (Type 1 for clear compound and Type 2 for white-pigmented compound), and the following additional requirements:

- a. The membrane curing compound shall be of a consistency suitable for spraying at temperatures prevalent at the time of construction operations, and which forms a continuous, uniform film. It shall be free from precipitated matter caused by conditions of storage or temperature. The compound shall be relatively non-toxic.
- b. The curing compound shall be delivered to the job in the manufacturer's original container, labeled with the manufacturer's name, plant location, grade designation of compound, lot number and quantity, and no material will be acceptable unless all such requirements are complied with.

D. Gaskets

1. ***All gaskets shall be continuous rings of a composition and texture that will assure a watertight and permanent seal.***
2. ***All gaskets shall be suitable in size to fill the groove on the spigot when pipe lengths are assembled.***
3. ***All gaskets shall have smooth surfaces free from pitting, blisters, porosity, and other imperfections.***
4. Except where O-ring type gaskets are specified for special cases and for special type pipe, round rubber gaskets for use in concrete pipe joints shall meet with the requirements of Article 5.9 of ASTM C-361, with the additional requirements that the gasket used shall be of such cross-sectional area and perimeter as to properly fit the space provided in the pipe joint in which it is to be used.
5. Prior to use, the gasket shall be stored, in as cool a place as practicable.
6. Elliptical Concrete Pipe Gaskets
 - a. For sealing elliptical concrete pipe joints, cold adhesive preformed plastic gaskets may be used.
 - b. Cold adhesive preformed plastic gaskets shall be of a material, shape and size so as to effect a permanent water tight seal in joints of elliptical concrete pipe. A minimum of two (2) pieces of gasket material shall be used in each joint.
 - c. The gasket material shall be protected by a two-piece removable wrapper. To facilitate application, the two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half.

- d. The size of the gasket shall be in accordance with the manufacturer's recommendation for the particular joint in which it is to be used. However, the minimum size for each of the gaskets used in a joint shall be in accordance with the following:

Pipe Size (inches)	Nominal Gasket Size (inches)	Minimum Cross Section (in ²)
Up to 19 x 30	1½	1.75
19 x 30 to 53 x 83	1¾	2.50
Over 53 x 83	2	3.25

The above minimum size requirements are based on a joint designed with a maximum taper of ten degrees (10°) and an in-place annular space of approximately ¼-inch.

7. The gasket sealing the joints shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert material filler. The material shall contain no solvents and shall not produce irritating fumes or obnoxious odors. The gasket shall not depend on oxidizing, evaporation or chemical action for its adhesive or cohesive strength.
8. The chemical composition of the gasket material shall meet the following requirements:

Item	Minimum *	Maximum *
Bitumen, petroleum plastic content	50	75
Ash-inert mineral matter	30	50
Volatile Matter, at 325°F		2.0

* Percent by weight

9. The gasket joint sealing compound when immersed for thirty (30) days at ambient room temperature separately in a 5% solution of caustic potash, a mixture of 5% hydrochloric acid, a 5% solution of sulfuric acid, and a saturated hydrogen sulfide solution shall show no visible deterioration.
10. The physical properties of the gasket joint sealing compound as shipped shall meet the following requirements:

Item	Minimum	Maximum
Specific Gravity at 77°F	1.20	1.35
Ductility at 77°F (cm)	5.0	
Softening Point at 77°F		
Penetration at 77°F, 150 gms, 5 sec	50	120

The manufacturer of the gasket material shall furnish the Engineer certified test results covering the shipment of material to the project.

E. Concrete

1. The Concrete shall consist of cement, sand and crushed stone or crushed or uncrushed gravel accurately proportioned for density and strength.
2. ***Minimum cement content shall be six bags (564 pounds) per cubic yard.***
3. The aggregate for the cement shall be hard, durable particles, clean and free from loam and organic materials.
4. The water used shall be clean and free from deleterious amounts of acids, alkalis, and organic materials.
5. ***The minimum strength of the concrete shall be 3,000 psi at 7 days, and 4,500 psi at 28 days.***

F. Fittings

1. Fitting shall be of the same strength as the concrete pipe.
2. All joints shall be compatible with the pipe.

G. Markings

1. Clearly mark the following information on each unit of pipe:
 - a. Class of Pipe.
 - b. Date of Manufacture.
 - c. Name of Manufacturer.

H. Precast Concrete Drainage Structures

1. Drainage structures, tops, castings, etc., shall conform to the applicable requirements of the Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest edition and the FDOT Roadway and Traffic Design Standard (latest edition).

I. Inspection Independent of Tests

1. The following imperfections in a pipe or special fitting will be considered injurious and cause for rejection without consideration of the test results herein above specified:

a. Cracked Pipe

- 1) A single crack in the barrel of the pipe, extending through the entire thickness, regardless of the length of such crack.
- 2) A single crack which extends through one-fifth of the barrel thickness and is over three (3) inches long.
- 3) Any surface fire crack that is more than $\frac{1}{32}$ -inch wide at its widest point.

b. Surface Imperfections

- 1) Surface imperfections such as lumps, blisters, pits, or flakes on the interior surface of the pipe or fitting.

c. Socket-out-of-Round

- 1) When the bore or socket of the pipe varies from a true circle by more than three percent (3%) of its nominal diameter.

d. Broken Pipe

- 1) A joint of pipe with a piece broken from either the socket or spigot end.

e. Foreign Matter Fused to the Pipe

- 1) Pipe joints that have tramp clays, grog, or other foreign matter fused permanently to the exterior surface of the pipe or fitting.

3. EXECUTION

3.01 Installation

- A. Inspect all pipe prior to installation.
- B. Replace pipe discovered to be defective either before or after installation.
- C. Install all pipe and fittings to the lines and grades shown on the Contract Drawings as recommended by the manufacturer.
- D. Pipe Trenches
 - 1. Pipe trenches shall be prepared in accordance with Section 02220, "Excavation, Backfilling and Compaction".
- E. Laying Drainage pipe
 - 1. All pipe shall be carefully laid true to the line and grade shown on the Contract Drawings. Any deviation from true alignment or grade which would result in a displacement from the normal position of the gasket of as much as 1/4-inch, or which would produce a gap exceeding 1/2-inch between sections of pipe for more than one-third (1/3) of the circumference of the inside of the pipe, will not be acceptable and where such occurs, the pipe shall be relaid without additional compensation. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the gasket joint shall be applied to the gap.
 - 2. Pipes having defects that have not caused their rejection are to be so laid that these defects will be in the upper half of the sewer.
 - 3. Gasketing and Jointing
 - a. Before installation of the pipe gasket, the gasket and the surface of the pipe joint, including the gasket recess shall be clean and free from grit, dirt, or other foreign matter at the time the joints are made.
 - b. Provide gasket feeler gauges for use by the pipe layer and the Engineer for checking the position of the rubber gaskets in the completed joints.
 - c. Thoroughly lubricate the bell and gasket with the lubricant supplied by the manufacturer.
 - d. Joint all lengths of pipe in accordance with the manufacturer's installation instructions.

4. **All pipes shall be laid with bells or grooves uphill.** As the pipes are laid throughout the Work, they must be thoroughly cleaned and protected from dirt and water. No length of pipe shall be laid until the two (2) preceding lengths have been thoroughly embedded in place so as to prevent any movement or disturbance of the finished joint. No walking on or working over the pipes after they are laid, except as may be necessary in tamping earth and refilling, will be permitted until they are covered to a depth of one (1) foot. **No pipe shall be laid except in the presence of the authorized inspector (Engineer's RPR).** Fill placed around the pipe shall be deposited on both sides simultaneously to approximately the same elevation and uniformly compacted. Whenever the pipe laying is discontinued, as at night, the unfinished end is to be securely protected from displacement due to caving of the banks or from other injury and a suitable stopper is to be inserted therein.
- F. During installation, close open ends of the pipe with temporary, water-tight plugs to prevent the entrance of earth, water, and other material from entering the pipe.
1. Mortar each joint by completely filling the entire recess around the outside of the pipe with a one (1) to two (2) mortar mix.
 2. Mortar the inside joint recess of pipes 24-inches in diameter and larger by troweling flush with a one (1) to one (1) mortar mix.
- G. Backfilling for Pipe Culverts
1. After the pipe has been installed, approved selected material from excavation at a moisture content which will facilitate compaction shall be placed along side the pipe in layers not exceeding six (6) inches loose measure in depth.
 2. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted by rolling or tamping with mechanical rammers. This method of filling and compacting shall be continued until the fill is twelve (12) inches above the pipe, then the remainder of the backfill shall be placed in lifts not exceeding nine (9) inches.
 3. The operation of heavy equipment shall be conducted so that no damage to the pipe will result. Backfill material twelve (12) inches and above the top of the pipe shall be compacted to not less than ninety-five percent (95%) of the maximum density as determined by AASHTO Designation T-180.
 4. Selected material for backfill shall not contain any stones or rock larger than one (1) inch in diameter.
 5. Tests for density of compaction may be made at the option of the Engineer, and deficiencies shall be corrected by the Contractor without additional cost to the Owner.

3.02 Separation of Storm Sewer Lines and Potable Water Mains

- A. The outside of non-pressurized storm sewer lines shall be separated horizontally a minimum of three (3) feet from the outside of any existing or proposed water main.
- B. Wherever possible, storm sewer shall cross under existing or proposed water mains, so the outside of the storm sewer is at least six (6) inches below the outside of the water main. Where it is not possible for the storm sewer to cross under existing or proposed potable water mains, then the storm sewer can cross over the water main provided the outside of the sewer is at least twelve (12) inches above the outside of the water main. At the crossing, the proposed pipe joints shall be arranged so that all potable water main joints are at least three (3) feet from storm sewer joints.
- C. The following are acceptable alternative construction variances where it is not possible to meet the separation requirements, and are only to be implemented upon receipt of expressed written consent from the Engineer. Implementation of these measures without the expressed written consent of the Engineer could result in the requirement that the installed unapproved measures be removed and replaced at no cost.
 - 1. Where the storm sewer is less than the required minimum horizontal distance from a potable water main and or where the storm sewer crosses a potable water main and joints in the storm sewer are less than the minimum required distance between the joints in the potable water main:
 - a. Use of pressure rated pipe conforming to AWWA standards for a gravity or vacuum type pipeline.
 - b. Use of welded, fused, or otherwise restrained joints for either pipeline.
 - c. Use of watertight casing pipe or concrete encasement at least four (4) inches thick for either pipe.
 - 2. Where sewer is less than three (3) feet horizontally from a water main and or where a storm sewer crosses a potable water main at less than the required minimum separation:
 - a. Use of pipe or casing pipe, having high impact strength (at least equal to ¼-inch thick ductile iron pipe), or concrete encasement at least four (4) inches thick for both the storm sewer and the potable water main.

3.03 Lamping

- A. After the pipe has been installed and the compacted backfill placed, “*lamp*” the installed drainage pipe between manholes, inlets or other structures in order to ascertain that they are clear and to correct alignment. The diameter of lamp image shall have no

vertical reduction from that of the pipe inside vertical diameter and not more than 20 percent (20%) horizontal reduction. The Engineer and/or Owner may observe the lamping.

- B. If lamping indicates any faulty installation of the pipe, or dirt or debris in the pipe or structures, the Contractor shall clean, repair or replace the pipe at no additional cost to the Owner.

3.04 Inspection

- A. Acceptance will be on the basis of tests of materials, absorption tests, plant load bearing tests, pressure tests, and inspection of the completed product.
- B. Inspection may be made at the place the manufacturer or on the construction site after delivery, or both, and the pipe shall be subject to rejection at any time due to failure to meet all of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture.
- C. Immediately remove from the project site all rejected pipe at no expense to the Owner.

END OF SECTION

SECTION 02640

HYDRANT ASSEMBLIES

1. GENERAL

1.01 Description

A. Scope of Work

1. The work included in this Section consists of furnishing all labor, material, equipment, transportation, tools and testing for the installation of fire hydrants (potable water) and/or reclaimed water hydrants of the type(s) and size(s) and in the location(s) shown on the Contract Drawings and as specified herein.
2. Related Work Specified Elsewhere

Specification Section	Title
01300	Shop Drawings, Submittals and Samples
15060	Ductile Iron Pipe and Fittings
15065	Polyvinyl Chloride (PVC) Pipe and Fittings
15100	Valves and Appurtenances
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

- A. Hydrants shall conform to AWWA C-502 and all hydrants shall be from a single manufacturer.
- B. Acceptable hydrant manufacturers and models are as follows:
 1. Mueller Company: Model A-423 (Super Centurion)
 2. American: Model B-84-B

3. Kennedy Valve Manufacturing Co.: Model K81A
4. Clow: Medallion F-2545

1.03 Submittals

- A. The Contractor shall submit shop drawings, in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples" for review by the Engineer, complete sets of detailed and dimensioned working shop drawings.

1.04 Product Delivery, Storage and Handling

- A. Do not ship hydrants and assemblies until the shop drawing have been approved by the Engineer.
- B. Prevent earth, water, and other material from entering the hydrants and assemblies.
- C. Store and handle the hydrants and assemblies in accordance with the manufacturer's recommendations.

2. PRODUCTS

2.01 Materials

- A. Hydrants
 1. The hydrants shall have 5¼-inch valve opening and shall comply with AWWA Standard C-502 for fire hydrants for water works.
 2. Each hydrant shall have 6-inch mechanical joint ends with harnessing lugs ("dog-ears") and shall open by turning to the left (counter-clockwise).
 3. Fire hydrant shall be of ample length for a 3½-foot depth of bury.

4. Connections

a. Hose Connections

- 1) Two (2) 2½-inch hose connections.
- 2) One (1) 4½-inch pumper connection.

3) Threads

- a) 2½-inch: 60° V threads, 7½ threads to the inch, external outside diameter (OD) 3¹/₁₆-inch, National Standard.
- b) 4½-inch: Four (4) threads to the inch, external outside diameter (OD) 5¾-inches, National Standard.

b. Inlet Connection

- 1) Six (6) inch mechanical joint bottom inlet.
- 2) Main valve openings shall not be less than five (5) inches.

- c. Operating nuts shall be the AWWA Standard which is pentagonal, measuring 1½--inch point to flat.

5. Fire hydrants shall be equipped with "O-Ring" packing.

6. Pressure Rating

- a. Working Pressure: 150 psi

7. Working Parts

- a. Bronze and shall open counterclockwise (CCW).
- b. Removable from the top of the hydrant while in place.

8. Design

- a. Hose caps chained to the hydrant barrel fitted with nuts similar to the hydrant operating nut.

- b. Stand pipe breaking ring or breakable sections.
- c. Constructed in at least two (2) sections bolted together.
- d. Renewable O-ring stem seals.

9. Coatings

- a. All iron parts of the hydrant both inside and outside shall be painted in accordance with AWWA C-501. All inside surfaces and the outside surfaces below the finished ground elevation shall be coated with bituminous paint. They shall be covered with two (2) coats, the first having dried thoroughly before the second is applied.
- b. The outside of the hydrant above the finished ground elevation shall be thoroughly cleaned and thereafter painted with one (1) coat of primer paint with a durable composition.
- c. The finish coat of all potable water hydrants shall be two (2) coats of **lime-yellow** color paint as manufactured by Ames Research, Inc., or approved equal.
- d. The finish coat of all reclaimed water hydrants shall be two (2) coats of **purple** paint as manufactured by Tnemec, Carboline, Induron, Devoe, or approved equal.

3. EXECUTION

3.01 Preparation

A. Location Next to the Pavement

- 1. Hydrants are to be located a minimum of five (5) feet from the nearest edge of pavement, as indicated on the Contract Drawings.
- 2. Hydrants shall be installed so that the larger (4½") hose port faces (is parallel to) the pavement.
- 3. The centerline of the large hose port shall be not less than eighteen (18) inches, nor more than twenty-four (24) inches above the finished grade at the hydrant.

B. Location Next to Landscaping

1. No above grade structures, objects or any planting other than turf or ground cover that cannot grow taller than twelve (12) inches may be within the area defined by an arc centered on the top of the operating nut of the hydrant, with a thirty-six (36) inch radius and continuing from the hydrant to the nearest edge of pavement where a fire engine can park six (6) feet wide.
2. Within this area, no growth or structure may overhang lower than eight (8) feet above the finished grade,

END OF SECTION

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SECTION 02720

CONCRETE SIDEWALKS, DRIVEWAYS AND PADS

1. GENERAL

1.01 Scope of Work

- A. The work included in this Section consists of furnishing all labor, material, equipment, transportation, and tools for the construction of the concrete sidewalks, walkways, driveways, pads and related items to the lines and grades as shown on the Contract Drawings.

B. Related Work Described Elsewhere

1. Earthwork:	Section 02200
2. Site Grading:	Section 02210
3. Finish Grading:	Section 02215
4. Excavation, Backfilling and Compaction:	Section 02220
5. Concrete Formwork:	Section 03100
6. Concrete Reinforcement:	Section 03200
7. Cast-in-Place Concrete:	Section 03300

- C. ***Construct all sidewalks four (4) inches thick, driveways six (6) inches thick, and heavy duty concrete pavement eight (8) inches thick***, after being thoroughly consolidated in place in accordance with the Contract Documents, unless indicated otherwise on the Contract Drawings.

1.02 Submittals

- A. Submit to the Engineer, as provided in the General Conditions and in accordance with Section 01300, "Shop Drawings, Submittals and Samples", shop drawings showing dimensions and layouts of sidewalks and reinforcement for concrete work.
- B. All materials specified shall be certified by the producer or manufacturer that the furnished material meets the specific requirements of the Contract Documents.

1.03 Testing

- A. Testing requirements and frequencies for concrete sidewalks, walkways, driveways, pads and related items shall be as outlined in Section 03300, "Cast-in-Place Concrete".
- B. Sample backfill materials by ASTM D-75.
- C. "*Relative compaction*" is defined as the ratio, expressed as a percentage, of the in-place density to the laboratory maximum density.
- D. Compaction shall be deemed to comply with the Specifications when no tests fall below the specified relative compaction. The Contractor shall pay the costs of any retesting of work not conforming to the Specifications.
- E. ***Density tests will be made for determination of specified compaction by an independent testing laboratory provided by the Contractor and as approved by the Engineer*** as specified in Section 01410, "Testing and Testing Laboratory Services". Testing shall be performed in locations reviewed and approved by the Engineer and as specified in the Contract Documents.
- F. ***If any tests are unsatisfactory, the Contractor shall re-excavate and re-compact the fill or backfill until the desired compaction is obtained.*** Additional compaction tests will be taken on each side of an unsatisfactory test at locations approved by the Engineer to determine the extent of re-excavation and re-compaction necessary. ***All testing shall be incidental to the Contract.***
- G. ***The Contractor shall pay for each compaction test, each failed compaction test and for each additional test taken to determine the extent of re-excavation and re-compaction as previously described.***

2. PRODUCTS

2.01 Concrete

- A. ***All concrete, for whatever final purpose, shall be Class B concrete with a minimum 28-day compressive strength of 3,000 psi and a maximum slump of four (4) inches*** as specified in Section 03300, "Cast-In-Place Concrete".
- B. ***Construct all sidewalks and walkways to a thickness of four (4) inches and all driveways to a minimum thickness of six (6) inches in accordance with Article 1.01(C),*** after being thoroughly consolidated in place, in accordance with the Contract Documents, unless indicated otherwise on the Contract Drawings.

- C. Concrete driveways, pads and related items shall be constructed, after being thoroughly consolidated in place, to the thickness indicated on the Contract Drawings.
- D. Concrete shall comply with the requirement of Division 3, "Concrete".

2.02 Welded Wire Fabric

- A. Welded wire fabric shall conform to the requirements of Section 03200, "Concrete Reinforcement".
- B. Welded wire fabric shall conform to ASTM Specification A-185, galvanized for Welded Steel Wire Fabric for Concrete Reinforcement.
- C. Welded wire fabric, where required, shall be furnished in flat sheets, rolled welded wire fabric **is not** permitted.

2.03 Driveways

- A. Heavy Duty Concrete Pavement Driveways for Commercial Vehicles and Trucks
 - 1. Use deformed bars conforming to ASTM A-615, Grade 60, free from loose rust and scale. No welding is permitted.
- B. Driveways for Passenger Vehicles and Light Trucks
 - 1. Use welded wire mesh in accordance with Article 2.02 above.

2.04 Forming

- A. Use forms of either wood or metal with a depth equal to the plan dimensions for the depth of concrete being deposited against them.
- B. **Forms shall be straight, free from warp, bends or defects, and of sufficient strength** when staked to resist the pressure of the concrete without deviation from line and grade.
- C. Clean the forms each time they are used, and oil or saturate with water prior to placing the concrete.

- D. **Provide stakes and bracing materials** to hold the forms securely in place.

2.05 Preformed Joint Filler

- A. Preformed Joint Filler shall be non-extruding, of the resilient bituminous type and shall conform to the requirements of ASTM Designation D-1751.
- B. Expansion joint filler shall be of the bituminous type, ½-inch thick, and shall conform to the requirements of ASTM Designation D-994 and AASHTO.

2.06 Membrane Curing Compound

- A. The Membrane Curing Compound used shall be a clear fugitive dye and shall conform to the requirements of AASHTO Designation M - 148, Type 1-D.
- B. Use only compounds that will not affect the bond of coatings or toppings that may be applied.

2.07 Gravel and Crushed Rock Base

- A. Where called for on the Contract Drawings, gravel or crushed rock shall meet the requirements of Section 02276, "Gravel and Crushed Rock Base for Structures".

3. EXECUTION

3.01 Foundation

- A. Excavation or backfill to the required depth.
- B. The finished subgrade shall be maintained in a smooth, compact condition and any areas which are disturbed prior to placing of the concrete shall be restored at the Contractor's expense. **The subgrade shall be moist at the time the concrete is placed.** Water shall be uniformly applied ahead of the pouring operations.
- C. Large boulders and other obstructions shall be removed to a minimum depth of six (6) inches below the finished subgrade elevation, and the space shall be backfilled with clean sand. Base course material or other suitable material shall be thoroughly compacted by rolling or tamping.

- D. The subgrade shall be accurately trimmed to the required elevation with a ¼-inch tolerance. High areas shall be trimmed to proper elevation. Low areas may be filled with suitable material and compacted to the specified density or filled with concrete integrally with the placing of the pavement.
- E. ***Compact the foundation material upon which the concrete is to be set to at least ninety-eight percent (98%) of the maximum density as determined by AASHTO T-180, with an even surface, true to line, grade and cross section.***

3.02 Forms

- A. Set the forms straight, free from warp or bends, true to line and grade, such that they rest firmly, throughout their entire length upon the compacted subgrade surface. Set forms with a $\frac{1}{16}$ -inch per foot cross slope or as existing.
- B. Forms shall be joined neatly and tightly and braced to resist the pressure of the concrete and the finished operations.
- C. All mortar or dirt shall be completely removed from forms that have been previously used.
- D. Construct all sidewalks four (4) inches thick, driveways six (6) inches thick, and heavy duty concrete pavement eight (8) inches thick, unless indicated otherwise on the Contract Drawings.
- E. The alignment and grade of all forms shall be approved before and immediately prior to the placing of concrete.
- F. All forms shall be oiled as specified in Section 03100, "Concrete Formwork" and Section 03300, "Cast-in-Place Concrete", before placing concrete.

3.03 Welded Wire Fabric

- A. All wire fabric shall be stored off the ground and shall be protected from moisture and be kept free from dirt, oil, or injurious coatings.
- B. Before being placed in position, wire fabric shall be thoroughly cleaned of loose mill and rust scale, dirt and other coatings, including ice, that reduce or destroy its bonding capability. Where there is delay in depositing concrete after reinforcement is in place, wire fabric shall be reinspected and cleaned when necessary.
- C. Set mesh in form and support so concrete will flow under it.

- D. Wire mesh shall be properly supported at regular intervals so mesh will not be displaced during concrete placement.
- E. Splices in welded wire fabric shall be lapped not less than 1½ courses or twelve (12) inches, whichever is greater. Wire fabric splices shall be tied together with galvanized or stainless steel wire ties, as approved by the Engineer, spaced no more than twenty-four (24) inches on center. Support, as approved by the Engineer, in the middle of slab.
- F. Welded wire fabric shall be in accordance with Section 03200, "Concrete Reinforcement".
- G. In no case shall wire fabric be covered with concrete until the amount and position of the fabric have been checked by the Engineer or RPR and his permission given to proceed with the concreting.

3.04 Heavy Duty Concrete Pavement

- A. Heavy duty concrete pavement, where shown on the Contract Drawings, shall be constructed as detailed in Figures 02720-1 through 02720-3.

3.05 Placing

- A. Concrete shall be mixed in accordance with the requirements of Section 03300, "Cast-in-place Concrete".
- B. The concrete shall be distributed on the subgrade to such depth that, when it is consolidated and finished, the thickness required by the Contract Drawings or Specifications will be obtained at all points and the surface will at no point be below the grade specified for the finished surface.
- C. The concrete shall be deposited on the subgrade in a manner which will require as little rehandling as possible.
- D. Placing of the concrete shall be continuous between transverse joints, without the use of intermediate bulkheads.
- E. Reinforcement shall be placed as shown on the Contract Drawings or as specified in the Contract Documents and shall be maintained at this location during the placing and finishing operations.
- F. Concrete shall be thoroughly consolidated against and along the faces of all forms by means of vibrators.

G. Vibrators

1. Vibrators are used, they shall not be permitted to come in contact with the subgrade or a side form. Vibration at any one location shall not continue so long as to produce puddling or the accumulation of excessive grout on the surface.
2. In no case shall the vibrator be operated longer than fifteen (15) seconds in any one location.

3.06 Finishing Concrete

A. ***Immediately after the placing, the concrete shall be struck off, consolidated and finished***, to produce a finished product conforming to the cross section, width and surface finish required by the Contract Drawings and Specifications. Strike off the concrete by means of a wood or metal screed used perpendicular to the forms in order to obtain the required grade, and remove surplus water and laitance.

B. Straightedging and Surface Corrections

1. After floating has been completed and the excess water removed, but while the concrete is still in a plastic state, the surface of the concrete shall be tested for trueness with an accurate ten (10) foot straightedge. The straightedge shall be furnished by the Contractor. The straightedge shall be held in successive positions parallel to the walk center line, in contact with the surface, and the whole area tested from one side of the slab to the other as necessary. The advance along the walk shall be in successive stages of not more than one-half the length of the straightedge.
2. ***Any depressions shall be immediately filled*** with freshly mixed concrete and struck-off, consolidated and refinished. High areas shall be cut down and refinished.
3. Straightedge testing and surface correction shall continue until the entire surface appears to conform to the required grade and cross section. All surface irregularities exceeding 1/4-inch in a ten foot straightedge span shall be corrected.

C. Preliminary Finish

1. Finishing operations shall be delayed until all bled water and water sheen have left the surface, and concrete has started to stiffen.
2. After the water sheen has disappeared, edging operations shall be completed. After edging and jointing operations, the surface shall be floated with an aluminum or magnesium float.

3. Immediately following floating, the surface shall be steel troweled. If necessary, tooled joints and edges shall be rerun before and after troweling to maintain uniformity.

D. Final Finish

1. As soon as the water sheen has disappeared and just before the concrete becomes non-plastic, the concrete shall be given a light broom finish perpendicular to the forms.
2. ***All edges, including expansion joint edges, shall be finished with an edging tool having a radius of 1/4-inch.***
3. Where a new sidewalk, driveway or concrete pavement section is replacing an existing sidewalk, driveway or concrete pavement section, the Contractor shall match the finish of the existing sidewalk, driveway or concrete pavement section.

3.07 Joints

- A. The Contractor shall provide control joints at right angles to the run of the sidewalk, driveway or concrete pavement section and at spacing equal to the width, unless otherwise noted on the Contract Drawings.

B. Transverse Construction Joints

1. Transverse construction joints shall be constructed at the end of all pours and at other locations where the pouring operations are stopped for as long as thirty (30) minutes.
2. Construction joints shall not be placed within five (5) feet of any other transverse joint or of either end of a section of walk.
3. If sufficient concrete has not been placed to form a slab at least five (5) feet long, the excess concrete, back to the last preceding joint, shall be removed.
4. The joints shall be formed by placing a wood or metal bulkhead accurately and securely in place, in a plane perpendicular to the profile and center line of the walk.
5. Construction joints shall have tooled edges with a 1/4-inch radius.

C. Transverse Contraction (Control) Joints

1. Transverse contraction joints shall be formed at five (5) foot intervals and shall consist of planes of weakness created by an edging tool.

2. Contraction joints shall be formed as soon as possible after the concrete has set.
3. The cut in the fresh concrete, a slot approximately $\frac{3}{16}$ -inch wide, shall be perpendicular to the surface of the walk, shall extend to a depth of $1\frac{1}{2}$ -inches below the top surface, and shall have $\frac{1}{4}$ -inch radius tooled edges.

D. Transverse Expansion Joints

1. One-half ($\frac{1}{2}$) inch expansion joints shall be formed by placing preformed joint filler around all structures, walls, curbs, other fixed objects or one another.
2. Locate expansion joints at intervals not exceeding forty (40) feet.
3. Place expansion joints where sidewalks and driveways intersect themselves.
4. Extend expansion joints the full width and depth of the joint, protecting the top edge which shall not be more than $\frac{1}{8}$ -inch below the finished surface.

3.08 Concrete Curing

- A. After the finishing operations have been completed and as soon as the concrete has hardened sufficiently that marring of the surface will not occur, the entire surface and the edges of the newly placed concrete shall be covered and cured with membrane curing compound.
- B. ***Apply clear membrane curing compound by a hand sprayer in a single coat continuous film at a uniform coverage in accordance with the manufacturers recommendation.*** Thoroughly agitate the curing compound prior to application and during application as necessary to prevent settlement. Recoat immediately any cracks, checks or other defects appearing in the coating.
- C. Curing compound ***shall not*** be applied during periods of rainfall. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of side forms the sides of the slabs exposed shall immediately be coated to provide a curing treatment equal to that provided for the surface.
- D. ***Continuously cure the concrete for a period of at least seventy-two (72) hours.*** Replace immediately any curing material removed or damaged during the seventy-two (72) hour period. Curing will be done by the membrane curing compound method.
- E. ***The concrete shall be protected from traffic and weather for at least three (3) days.***

3.09 Form Removal

- A. **After the concrete has sufficiently set a minimum of twelve (12) hours**, the Contractor shall remove the forms and shall backfill the space on each side.
- B. The earth shall be compacted and graded in a satisfactory manner without damage to the concrete work. Place and thoroughly compact suitable fill material to ninety-eight percent (98%) of the maximum density as determined by AASHTO T-180.
- C. Honeycombs shall be filled with sand cement mortar.
- D. Plastering will not be allowed on the face of the walk.

3.10 Testing

- A. Sample and cure the concrete in accordance with ASTM C-31, except take not less than two (2) 6-inch by 12-inch cylinders for each ten (10) cubic yards poured or each day's pour if less than five (5) cubic yards.
- B. Take slump tests as the concrete is discharged from the mixer/truck at the point of placing. Slump tests shall be made in accordance with ASTM C-143, and test cylinders in accordance with ASTM C-39 and the requirements of Division 3, "Concrete".

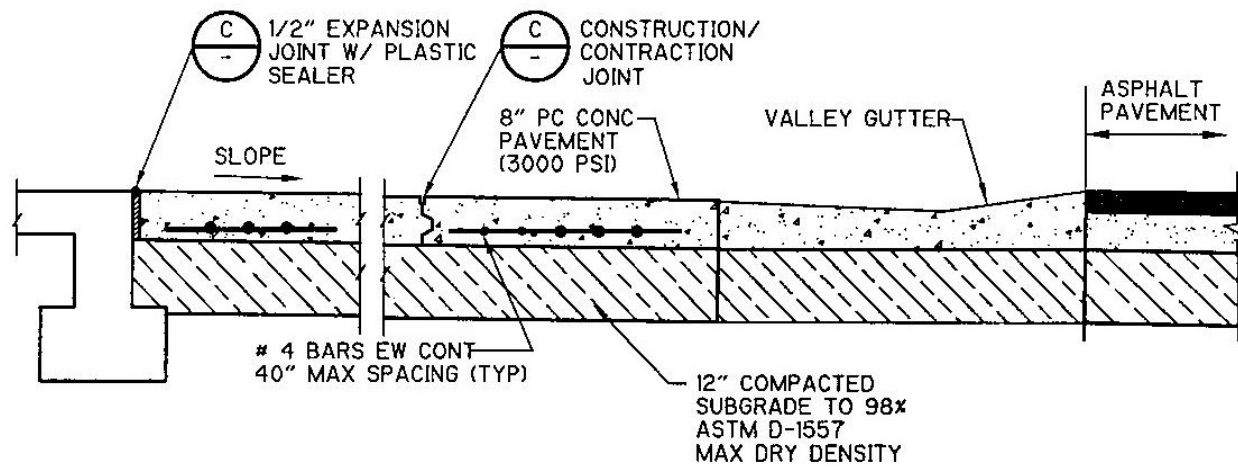
3.11 Concrete Rejection

- A. Finished sidewalks, walkways, driveways, pad and related items **shall be within ± 0.02 feet** of the elevations shown on the Contract Drawings, and no crack other than at contraction joints.
- B. Remove and replace all sidewalks, walkways, driveways, pad and related items that do not meet the above requirements.
- C. Rejected concrete sidewalks, walkways, driveways, pad and related items shall be removed and **replaced by the Contractor without additional compensation**.

3.12 Cleanup

- A. At the completion of the Work, the Contractor shall clean up all scraps, rubbish and surplus materials caused by this Work and haul them away from the site and legally dispose of them and leave the job site in a neat, clean and orderly condition.

END OF SECTION



HEAVY DUTY CONCRETE PAVEMENT

DETAIL

NTS

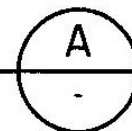


FIGURE 02720 - 1

HEAVY DUTY CONCRETE PAVEMENT - VALLEY GUTTER APPLICATION

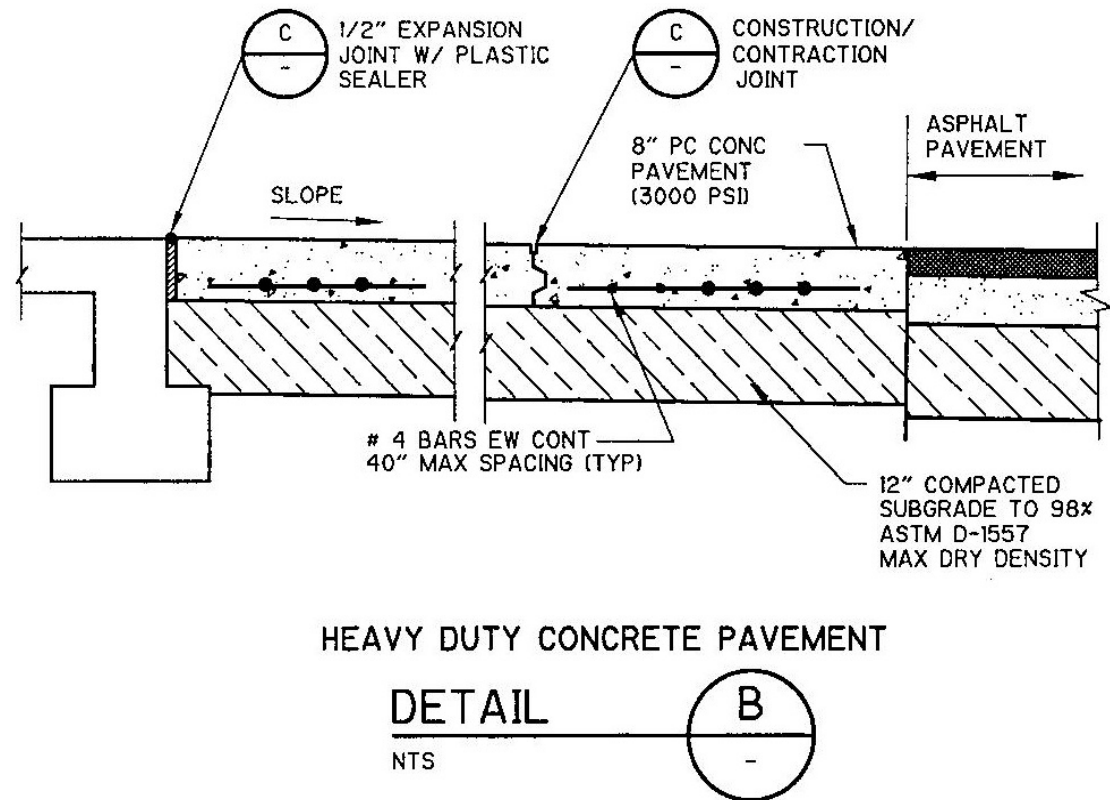


FIGURE 02720 - 2

HEAVY DUTY CONCRETE PAVEMENT - ASPHALTIC ROADWAY OPTION

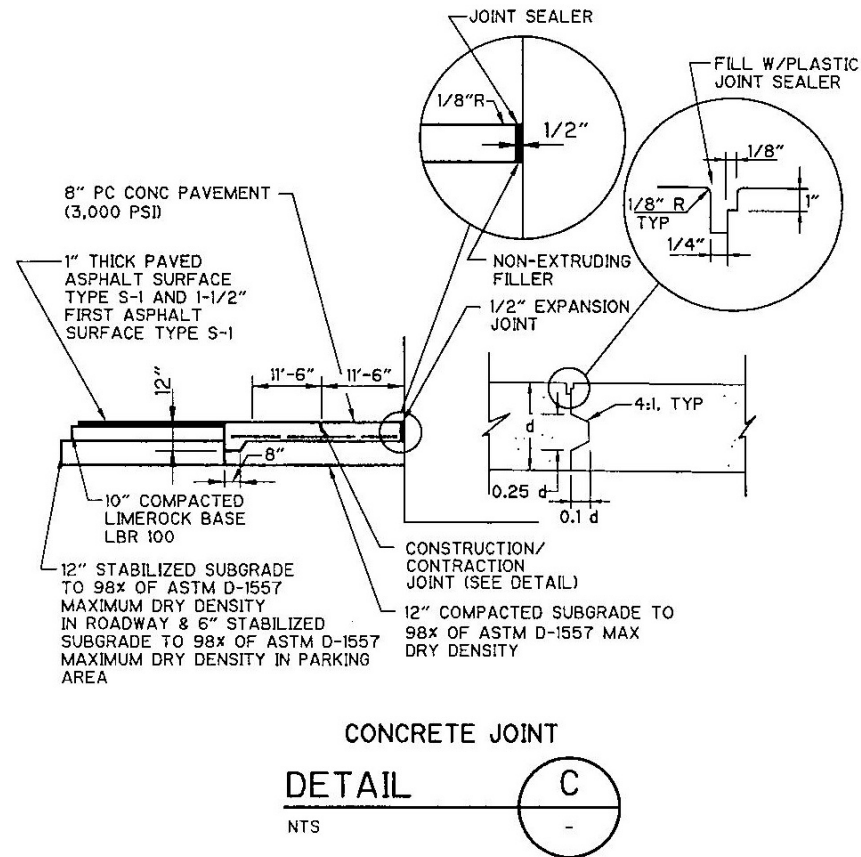


FIGURE 02720 - 3

HEAVY DUTY CONCRETE PAVEMENT - JOINT DETAILS

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SECTION 02815

SOLID SODDING

1. GENERAL

1.01 Description

- A. The Work specified in this Section consists of furnishing and placing sod and the furnishing and placing of fertilizer, water staples and stakes required for placing of sod within those areas specified on the Contract Drawings.
- B. The Work shall include, but is limited to, delivery, storage, protection to the public, inspections excavation, installation, grading, backfilling, fertilizing, sod installation, rolling, sanding, watering, mowing, cleanup, maintenance and guarantee.
- C. **The sod shall be Argentine Bahia or St. Augustine "Floritam"** where indicated on the Contract Drawings. The sod shall be well matted with grass roots and free of weeds and insects.
- D. Related Work Specified Elsewhere

Specification Section	Title
02100	Site Preparation
02200	Earthwork
02210	Site Grading
02215	Finish Grading
02220	Excavation, Backfilling and Compaction
02830	Fixed Head Irrigation System
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

- A. The Engineer's Landscape Architect shall have the right, during any phase of the Work operations, to reject any and all Work and materials which do not meet the requirements of the Contract Documents.

- B. Rejected Work and materials shall be immediately removed from the project area and replaced with acceptable work and material within seven (7) calendar days or as approved by the Engineer's Landscape Architect.
- C. Standards
 - 1. Botanical and common names for sod, including varieties, have been derived from accepted names of the landscape industry.
 - 2. Grade Standards
 - a. Sod shall be nursery grown and shall comply with required inspections, grading standards and plant regulations as set forth by the Florida Department of Agriculture.
 - b. Quality grade shall be based on the standards of sod quality grades of Premium, Standard or Commercial as established by the Turfgrass Producers Association of Florida, Inc.

1.03 Submittals

- A. Submit shop drawings in accordance with the General and Supplementary Conditions and Section 01300, "Shop Drawings, Submittals and Samples".
- B. ***The Contractor shall submit certificates from the sod producer stating that the sod meets the requirements for "Florida Standard Grade" as defined by the Turfgrass Producers Association of Florida, as set forth in the Article 2.01 of this specification. The certification of sod quality shall be delivered to the Engineer ten (10) days prior to use.***
- C. Fertilizer manufacturer's certificate of analysis including nitrogen, phosphorus, potash, and complete micro-nutrients in accordance with Article 2.02 of this specification.
- D. Submit a copy of the certificate(s) with each delivery.

1.04 Applicable Publications

- A. Portions of the publications listed below form a part of this specification only to the extent referenced:
 - 1. Florida Department of Transportation, "Standard Specification for Road and Bridge Construction", (FDOT Specification, "Grassing" (latest edition).

2. Florida Department of Transportation, "Utility Accommodation Guide", Section 5, Paragraphs K, L, and M, except delete "as directed by the Maintenance or Resident Engineer." and delete "or otherwise, to the satisfaction of the Maintenance or Resident Engineer.", latest version.
3. Turfgrass Producers Association of Florida, "Standards of Sod Quality".
4. Florida State Plant Board Specifications.

1.05 Records

- A. **Submit written weekly records** to the Engineer and Owner of all grassed areas for use in determining the beginning and ending of the maintenance period for each area.
- B. The records shall indicate the date of grassing, fertilization and mowing, the sod type, quantity (ft², yd², or acres) and location of grassing.

2. PRODUCTS

2.01 Solid Grass Sod

- A. Grass Sod shall be Argentine Bahia or St. Augustine "Floritam", where indicated on the Contract Drawings. The quality grade of the sod shall be "*Standard Grade*" for Argentine Bahia and "*Premium Grade*" for St. Augustine "Floritam" based on the standards of sod quality established by the Turfgrass Producers Association of Florida, Inc. The sod shall be well matted with grass roots and of firm, tough texture having a compact top growth and heavy root development. The allowable weed content shall be as follows based on the Standards for Premium and Commercial grades:
 1. Premium Grade: *No weeds or any other grasses allowed. Only the species of sod specified.*
 2. Standard Grade: *No casually visible broadleaf weeds, no obvious patches of weeds and no more than two percent (2%) of any other grass or weed in the total canopy.*
 3. Commercial Grade: *Any sod that does not meet the weed restrictions of Premium or Standard Grade sod.*

Sod sections shall be strong enough to support their own weight and retain their size (**12" x 24", minimum**) and shape when suspended vertically from a firm grasp on the upper ten percent (10%) of the section. Sod shall be moist and relatively free of thatch.

- The soil embedded in the sod shall be a clean earth, free of stones and debris. The sod shall be a ***minimum of 2-inches thick, live, fresh and uninjured at time of planting.***
- B. The sod shall be certified to meet the Florida State Plant Board specifications, absolutely true to varietal type and free from weeds or other objectionable vegetation, fungus, insects and disease of any kind.
- C. Mowing
1. ***The sod shall have been mowed three (3) times with a lawn mower with the final mowing not more than seven (7) calendar days prior to the sod being cut into uniform dimensions.***
- D. Cutting
1. Sod shall not be harvested when the moisture content (excessively dry or wet) may adversely affect its survival and shall be live, fresh and uninjured at the time of placement.
 2. After approval of the source, mow and rake as necessary to remove excessive top growth and debris.
 3. Cut the sod with mechanical sod cutters, retaining native soil mat of sufficient thickness to withstand handling. The sod shall be provided in commercial pad sizes measuring not less than 12-inches by 24-inches with a uniform thickness two (2) inches in thickness and shall be live, fresh and uninjured at the time of planting.
- E. ***The sod shall be harvested, delivered, and installed within a period of seventy-two (72) hours.*** Sod older than this shall not be delivered to the Project site and shall be deemed “*unacceptable*”.
- F. The sod shall be planted as soon as possible after being dug and shall be shaded and kept moist until it is planted.

2.02 Backfill/Planting Soil

- A. The topsoil shall be as described in Articles 2.02 and 3.02 of Section 02215, “Finish Grading”.

2.03 Water

- A. The water used in the grassing operations shall be supplied and paid for by the Contractor and obtained as provided for in Section 01500, "Temporary Facilities". The Contractor shall provide permanent or temporary piping and valves, and temporary trucks to convey water from the source to the point of use.

2.04 Fertilizer

- A. Commercial fertilizer shall comply with all State and Federal fertilizer laws.
- B. The fertilizer shall be of the granular type having an analysis of 12-6-8, derived from the following sources.

Element	Percentage	Derived From
Total Nitrogen	12%	Activated sludge urea-form, sulfur coated urea and potassium nitrate
a. Nitrate	75%	
b. Ammonia	0.0%	
c. Water Soluble	10.25%	
d. Water Insoluble	1.00%	
Phosphoric Acid	6.0%	Triple super phosphate
Water Soluble Potash	8%	Sulphate of potash magnesium, potassium nitrate, sulphate of potash, and activated sludge
Total Magnesium	2.41%	Sulphate of potash magnesium
a. Water Soluble	2.41%	
Total Manganese	0.77%	Manganese oxide
Total Boron	0.02%	Sodium borate
Total Copper	0.07%	Copper oxide
Total Zinc	0.08%	Zinc oxide
Total Iron	1.00%	Iron oxide and ferrous sulphate
Total Chlorine	2.00%	

- C. The fertilizer shall be granular, uniform in composition, dry and free flowing, suitable for application by equipment intended for the purpose. Deliver the fertilizer in unopened bags fully labeled with the manufacturer's analysis.

- D. Store all fertilizer in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.
- E. Comply with all State of Florida fertilizer laws.

2.05 Stakes and Staples

- A. Stakes shall be manufactured of softwood, 3/4-inch x 3/4-inch by 8 inches long and shall be unpainted and untreated.
- B. Staples shall be of manufactured of 11 gage metal type, approximately ten (10) inches long and one (1) inch wide.

2.06 Sod Transportation

- A. Comply with all current restrictions for transporting sod from or through quarantine areas for the white fringed beetle, witchweed, and West Indian sugar cane borer weevil, as issued by the Division of Plant Industry, Florida Department of Agriculture and the Animal and Plant Health Inspection Service, U.S. Department of Agriculture.

3. EXECUTION

3.01 General

- A. ***Solid sod grassing shall be provided on all non-traffic areas not covered by pavement or structures that are disturbed or damaged by the construction operation*** and/or as specified on the Contract Drawings.
- B. Inspect surfaces indicated to receive sod and verify that related preceding Work has been completed. Do not proceed with placement until conditions are satisfactory.
- C. Construct a good healthy stand of grass as specified, free of weeds and foreign growth. Unless otherwise shown on the Contract Drawings or specified, all disturbed areas are to be solid sodded.
- D. The Contractor shall be responsible to see that all planted areas receive sufficient water until ***Final Project Acceptance*** by the Owner.

3.02 Preparation

- A. Remove stones, sticks, rubbish and other extraneous matter from areas to be sodded. Eliminate voids and rough areas and produce a smooth, evenly graded surface.
- B. If weed growth is present in the area to be sodded, remove the top three (3) inches of existing material and weed growth.

3.03 Construction Methods for Grassing

A. General

- 1. ***Solid sodding shall only be applied when the soil is moist in proper condition to induce growth.*** Do not sod when the ground is unduly wet or otherwise not in a tillable condition.
- 2. When a suitable length of roadway slopes or adjacent areas has been graded and made ready, sodding in accordance with these specifications can commence. Incorporate solid sod grassing into the Project at the earliest possible time in the life of the Contract.

B. Sequence of Operations

- 1. The several operations involved in the work shall proceed in the following sequence: ***preparation and fertilizing of the ground, sodding, watering and maintaining.***

C. Preparation of Areas to be Sodded

- 1. ***Prepare by disk-harrowing the ground over which the grassing is to be done, and thoroughly pulverize the soil to a depth of at least eight (8) inches.*** The prepared soil shall be loose and reasonably smooth.
- 2. Where the soil is sufficiently loose and clean, the Engineer, at his discretion, may authorize the elimination of ground preparation.
- 3. ***Areas to be sodded shall be cleared of all rough grass, weeds, and debris and the ground brought to an even grade as shown on the Contract Drawings.***
- 4. ***Spread planting soil over the area to be sodded to a uniform depth of two (2) inches.***

5. ***The area shall be raked smooth, to the grades indicated on the Contract Drawings, and reasonably free of large clods, roots, debris, and other material*** which will interfere with the work or subsequent mowing and maintenance operations. Hand picking may be required.
6. No subsequent operations shall be commenced until the Engineer has approved the condition of the prepared areas.

D. Application of Fertilizer

1. ***Before applying fertilizer, the soil pH shall be brought to a range of 6.0 to 7.0. Soil samples shall be analyzed by a local certified laboratory to confirm that the soil pH is within the required range.***
 2. The fertilizer shall be spread uniformly over the area to be grassed at the rate of ***five hundred twenty-five (525) pounds per acre, or twelve (12) pounds per 1,000 ft², or as recommended by the manufacturer.*** The Contractor shall use a mechanical spreader capable of uniformly distributing the material at the specified site. Immediately after spreading, ***the fertilizer shall be mixed with the soil to a depth of approximately two (2) inches.***
 3. On steep slopes, or other areas where machine-spreading may not be practicable, the fertilizer shall be spread by hand and raked in and thoroughly mixed with the soil to a depth of approximately two (2) inches.
- E. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over one (1) inch in diameter or dimension. The surface shall conform to the finish grade identified on the Contract Documents, less the thickness of the sod, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.04 Placing Sod

- A. The areas designated on the Contract Drawings and those areas which have been disturbed and/or damaged as a part of this Project are to be sodded.
- B. Incorporate sodding into the Project at the earliest practical time in the life of the contract. ***Sod that has been cut for more than seventy-two (72) hours shall not be used. Sod that has not been planted within twenty-four (24) hours after cutting shall be stacked in an approved manner and maintained and properly moistened.*** The sod panels shall, at all times, be protected from excessive drying and unnecessary exposure of the roots to the sun. Any pieces of sod which, after placing, show an appearance of extreme dryness shall be removed and replaced by fresh, uninjured pieces.

- C. After completion of the soil conditioning as specified in Article 3.03 above, place the sod panels on the moistened, prepared surface and lay them tightly together (edges in close contact, firmly and smoothly imbedded by length) so as to make a solid sodded lawn area. On mounds or other slopes, the long dimension of the sod panel shall be laid perpendicular to the slope.
- D. Where sodding is used in drainage ditches, or on slopes of 4:1 or greater, the setting of the pieces shall be staggered such as to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offset of individual strips shall not exceed six (6) inches.
- E. ***The sod shall be immediately pressed firmly into contact with a 500 pound hand roller or other suitable equipment, approved by the Engineer, that will produce a 90 psi compression grading.*** The rolling operation shall provide a true and even surface and ensure knitting without displacement of sod or deformation of the surfaces of the sodded area. Hand tamp those areas inaccessible to the roller. ***The edges of the sodded area shall be staggered in a corresponding manner providing the offset along the edge does not exceed six (6) inches.*** All vertical edging adjacent to sodded area shall be tamped so as to produce a feathered edge.
- F. On areas where the sod may slide due to height and slope, and on slopes greater than 2:1, the Contractor shall peg the sod with wooden pegs driven through the sod blocks into firm earth at suitable intervals. Remove any pieces of sod which, after placing, show an appearance of extreme dryness.
- G. Sodding shall not be performed when weather and soil conditions are, in the Engineer's opinion, unsuitable for proper results.
- H. Bring the sod edge into a neat, clean manner to the edge of all paving, landscaping areas, sidewalks, roadways, concrete pads, valve and meter vault locations, etc.
- I. Sanding
 - 1. ***Top dressing with approved, clean, weed free sand shall be required to give the finished product a smooth finish.***
 - 2. The Contractor shall pay particular attention to the need for a light layer of sand along the edges of each piece of sod. ***There shall be no holes, ruts, depressions in the sodded lawn.***

3.05 Watering

- A. Water the sodded areas initially to develop uniform coverage and deep water penetration of at least six (6) inches.

- B. The Contractor shall provide continuous watering of the sod in order to achieve optimum growth conditions for establishment. ***A minimum of one (1) inch of water per week shall be applied to the sodded areas. The Contractor shall apply water to the sod on a regular basis until Final Project Acceptance by the Owner.***
- C. ***The Contractor shall be responsible for the costs related to watering the grassed areas.***

3.06 Cleanup

- A. Immediately clean spills from paved and finished surface areas.
- B. The Contractor shall remove fertilizer containers, sod pallets and sodding debris and excess materials from the Project Site and legally dispose of them.
- C. The Contractor shall sweep sod waste, soil and fertilizer from paved areas, curbs, driveways, sidewalks, pads and walks.
- D. Cleaning and cleanup shall be in accordance with Section 01800, "Miscellaneous Work and Cleanup".

3.07 Maintenance

- A. The Contractor shall, at his expense, maintain the planted areas immediately after the sod is installed and continue, in a satisfactory condition, until ***Final Project Acceptance*** by the Owner.
- B. Such maintenance shall include watering, mowing, and filling, leveling, repairing of any damaged areas where the establishment of the grass stand does not appear to be developing satisfactorily, or where erosion has washed away an area and filling and leveling are required.
- C. Replanting shall be performed at the Contractor's expense except when it is determined that such replacement was due to circumstances beyond the Contractor's control.
- D. The Engineer may require replanting or of any areas in which the establishment of the grass stand does not appear to be developing satisfactorily within sixty (60) days of planting or where necessary due to the Contractor's negligence, carelessness or failure to provide routine maintenance and shall be at the Contractor's expense.

E. Mowing and Edging

1. ***Mowing and edging shall be performed at least once every ten (10) days during the Project from the date of installation of the sod.***
2. ***Upon final Project Acceptance by the Owner, the Contractor shall provide a final mowing and edging of the grass.***

F. Insecticides

1. ***The Contractor shall apply all insecticides as needed, for complete control of pests and diseases.*** The materials and methods shall be in accordance with highest standard horticultural practices and as recommended by the County Agent, and approved by the Engineer, prior to implementation.
 2. When a chemical is being applied, the person using it shall have in their possession all labeling associated with the chemical. Also, the chemical shall be applied per the manufacturer's instructions and recommendations.
 3. The spraying of insecticides and other such chemicals are to be confined to the infected area. Spraying techniques, which may introduce the material being sprayed beyond the immediate area of the individual plant, are strictly prohibited.
 4. The implementation of control measures for pests and disease infestations shall be in strict compliance with all federal and local regulations. Upon request, the Contractor shall furnish documentation of such compliance.
 5. All insecticides shall be applied by a licensed/certified operator only. The operator shall have the license/certification in their possession when insecticides are being applied.
- G. After the sod has been laid, tamped and top dressed, areas which fail to show uniform growth and health, shall be re-sodded, as often as necessary, until all sodded areas are covered with a satisfactory lawn. Damage resulting from erosion, gullies, washouts, or other causes shall be repaired by filling with topsoil, tamping, re-fertilizing, and re-sodding by the Contractor at his expense.
- H. Sodded areas shall be protected against trespassing and damage. Sod that has been damaged or injured shall be treated or replaced as directed, in compliance with the Specifications, at no additional cost to the Owner.
- I. Keep sidewalks, curbs and gutters, drainage structures, driveways, parking areas, streets, terraces, decks and pavers free of grass cuttings.

- J. Material rejected during the course of construction shall be removed within ten (10) calendar days and replaced before an inspection for completion will be scheduled.
- K. ***The Contractor shall be responsible for the proper maintenance and the survival and condition of the sod from the time a landscape item is installed until Final Project Acceptance by the Owner.***
- L. Replacement of sod shall be the responsibility of the Contractor including the possible replacement of sod resulting from removal by theft or vandalism or acts of negligence on the part of others. Sod shall be alive and in good growing condition at the time of Final Project Acceptance by the Owner.

END OF SECTION

SECTION 02830

FIXED HEAD IRRIGATION SYSTEM

1. GENERAL

1.01 Description

- A. Furnish all labor, materials, equipment and incidentals required and install, test and operate a complete fixed head, “full-coverage”, irrigation system (for all grassed areas and the proposed landscaping) for the entire Sanford Main WTP site using reclaimed water.
- B. The Contractor shall hire a professional irrigation specialist/contractor, as part of this Project, to develop a Fixed Head Irrigation System Plan, complete with details, and install the “full-coverage” irrigation system. This specification section includes the general requirements of the system and is generic in nature. The Contractor shall provide, during the shop drawing review process, a complete and detailed layout of the “full-coverage” irrigation system including all piping, materials, controllers, valves and electrical work to ensure a completely functional and operational system to cover all grass and landscaping within and immediately outside the Sanford Main WTP site.
- C. The Work shall include, but not necessarily be limited to, excavation and backfilling, and furnishing and installing all piping, valves, sprinkler heads, controls, and electrical work required.
- D. It shall be the responsibility of the Contractor to install a “full-coverage” irrigation system for the entire site and ensure the performance and functionality of the irrigation system and all equipment.
- E. Re-routing of pipe over, under and around pavement, conduits, pipe, trees, or any other obstruction shall be at the expense of the Contractor.

1.02 Submittals

- A. Submit shop drawings in accordance with the Section 00700, “General Conditions”, Section 00800, “Supplementary Conditions” and Section 01300, “Shop Drawings, Submittals and Samples”.

- B. Submit copies of all materials required to establish compliance with the specifications. Submittals shall include, but are not limited to, the following:
 - 1. A series of drawing indicating the layout of the “*full coverage*”, fixed head, irrigation system showing all piping, piping sizes, fittings, valves, sprinkler heads and types, controls, control wires, etc.
 - 2. Descriptive literature, bulletins, and/or catalogues of all equipment to be furnished.
 - 3. Descriptive literature, illustrations, specifications, installation instructions and dimensioning for all piping, fittings and valves.
 - 4. Equipment data including principle dimensions, materials of construction, space requirements, piping, hydraulic and electrical connections and requirements and other pertinent information.
 - 5. A complete total bill of materials of all equipment.
 - 6. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item.

1.03 Examination and Verification of Contract Drawings and Site

- A. It shall be the Contractor's responsibility to report to the Engineer any conflicts or proposed deviations from the proposed irrigation system.
- B. Failure to do so prior to the installation of the “*full coverage*”, fixed head, irrigation system, which results in equipment, piping or appurtenances being replaced, and/or relocated, shall be done at the Contractor's expense.

1.04 Project Record Drawings

- A. The Contractor shall provide and keep up-to-date a complete set of As-built drawings which shall be collected daily to show changes in sprinkler locations, controller locations, piping locations, and other deviations from the original fixed head, “*full-coverage*” irrigation system design drawings. All valve locations shall be shown with actual measurements to fixed reference points so they may be easily located in the field.
- B. Upon completion of the work, the Contractor shall furnish the Engineer with a complete set of reproducible record drawings (AutoCAD drawings) showing the sprinkler system as installed.

- C. The Project Record Documents are the sole responsibility of the Contractor and shall not be construed to be the responsibility of any other party.
- D. Acceptance of the “full-coverage”, fixed head, irrigation system is based on the furnishing of “complete” Project Record Drawings that are acceptable to the Engineer.

1.05 Material Storage

- A. The Contractor shall be responsible for contacting the Owner to establish a specific area in which all materials to be used on the Project shall be stored when not in use and prior to installation.
- B. The Contractor shall keep this area neat and orderly at all times during construction. The Contractor shall also be fully responsible for protecting all equipment and materials from damage by the elements, theft, fire, or vandalism.
- C. Any equipment or materials which are stolen, damaged, found to be defective, or unsuitable for incorporation into the Work as a result of improper storage techniques shall be replaced by the Contractor at no additional cost to the Owner.

1.06 Warranty

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors in accordance with Section 01740, “Warranties and Bonds”.
- B. For all major pieces of equipment, submit a warranty from the equipment manufacturer. ***The manufacturer’s warranty period shall be concurrent with the Contractor’s warranty period for two (2) years, unless otherwise specified, commencing at the time of Final Project Acceptance by the Owner.***

1.07 Operating Instructions

- A. Operation and maintenance manuals shall be furnished in accordance with Section 01300, “Shop Drawings, Submittals and Samples”, and Section 01730, “Operation and Maintenance Data”.
- B. The O&M Manuals shall be prepared specifically for this installation and shall include all required cut sheets, drawings, equipment lists, descriptions, etc., that are required to instruct personnel in the operation and maintenance of such equipment as well as all of the information required in Section 01730, “Operation and Maintenance Data”.

- C. A factory representative of all major component manufacturers, who has complete knowledge of proper operation and maintenance, shall be provided to instruct representatives of the Owner and the Engineer on the proper operation and maintenance of the fixed head, full coverage, irrigation system.
- D. With the Owner's permission, this work may be conducted in conjunction with the inspection of the installation and test run of the system, as provided under Part 3 of this Specification Section. If there are difficulties in the operation of the irrigation system equipment due to the manufacturer's design or fabrication, additional service shall be provided at no additional cost to the Owner.

1.08 Qualifications

- A. The Contractor, as part of this Project, shall **employ a professional irrigation specialist/contractor to install the "full-coverage", fixed head irrigation system.**
- B. The "full coverage", fixed head, irrigation system equipment and controls shall be **installed by a professional irrigation contractor** specializing in the installation of commercial irrigation systems and fully familiar with the products and equipment specified. The irrigation Contractor shall have successfully installed at least five (5) similar irrigation systems which have been in operation a minimum of one (1) year using similar products and equipment as specified herein. The Contractor shall submit a list of installations which includes the size of the installation location, Owner, contact person and telephone number, and equipment manufacturer upon request from the Engineer to establish compliance with the experience requirements specified.
- C. To assure unity of responsibility, the irrigation equipment and controls shall be furnished and coordinated by a single irrigation equipment manufacturer. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire "full- coverage", fixed head, irrigation system.
- D. The fixed head irrigation system is intended to be standard equipment of proven ability as manufactured by a reputable manufacturer having a great deal of experience in the production of such equipment. The irrigation equipment and controls furnished shall be designed, constructed and installed with the best practices and methods, and shall operate satisfactorily when installed.
- E. All equipment furnished under this Specification shall be new and unused and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of five (5) years.
- F. Approved equipment manufacturers shall be Toro, Rainbird, Hunter or approved equal.

2. PRODUCTS

2.01 Piping, Fittings and Valves

A. Pipe sizes shall conform to those shown on the fixed head, "full-coverage, irrigation system plan/design and shall be of the size to sufficiently provide the volume and quantity of reclaimed water to irrigate the site. No substitutions of smaller pipe can be made, but substitution of larger pipe sizes can be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection and disposed of in a legal manner at no additional cost to the Owner.

B. Polyvinyl Chloride Pipe

1. All lines on the upstream and downstream side of the automatic control valves shall be polyvinyl chloride (PVC) pipe, Class 200, Type 1, SDR 21 domestic, extruded, unplasticized, rigid polyvinyl chloride pipe (color purple).

C. Polyvinyl Chloride Fittings and Connections

1. All plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld, slip joint ring tight seal, or screwed connections. No fittings made of other material shall be used except ductile iron (3-inch and larger) as hereinafter specified.
2. Slip fitting socket taper shall be so sized that a dry unsoftened pipe end, conforming to these special provisions, can be inserted no more than half way into the socket. Plastic saddle and flange fittings will not be permitted. Only Schedule 80 pipe may be threaded.
3. When connection is plastic to metal, male adapters shall be used. The male adapter shall be hand tightened, plug one turn, using a strap wrench. Joint compound shall be Permatex Type II, or equal.

4. Automatic Remote Control Valves, Electric Solenoid Type

- a. The automatic remote control valves shall be slow acting diaphragm type electric solenoid operated valves. The valves shall be solenoid activated, hydraulic operating valves. The solenoid shall be for a 24-volt, 60-cycle operation with a running current of 0.23 amps. The solenoid shall be complete epoxy encapsulated for positive waterproofing with stainless steel shunt bands. The valves shall be slow opening and closing by means of potential fluid resistor to avoid damage as a result of surge pressures. The opening and closing speed shall not be less than five (5) seconds. Spray zone valves shall be equipped with PRS-B pressure regulation modules, or equal.

- b. The valve body and bonnet shall be constructed of glass-filled nylon with threaded female connections. The inlet port of the diaphragm chamber shall have a self cleaning, nylon scrubber and removable stainless steel screen, for easy cleaning, and shall be accessible without removing bonnet from the valve body. The outlet port from the diaphragm chamber shall discharge into the downstream side of the valve. The solenoid plunger shall be spring loaded so that valve may be operated when installed in any position and shall be constructed of stainless steel with wear resistant neoprene seat and exclusive grit filter protection system against solenoid plunger "hang-up". The diaphragm shall be durable nylon reinforced neoprene. The valve bonnet shall be equipped with a slotted plug or a bleed screw for manual operation of the valve at any time. The valve bonnet shall be secured to the valve body by corrosion-resistant stainless steel bolts.
- c. All control valves shall be furnished with a separate manual shut-off gate valve.

2.02 Electric Wiring

- A. All AC wiring and electrical work shall be installed in accordance with the National Electrical Code (NEC) and local electric codes. All wire shall bear approval as UL type UF.
- B. All splices in wiring shall be made watertight, using approved methods.
- C. The Contractor shall be responsible for sizing, furnishing and installing the control wires between the irrigation controllers and the control valve for each zone. Wire shall be sized to minimize voltage drop and provide sufficient voltage for operation of the control valve solenoids as contained in the manufacturer's literature for the specified voltage and upstream pressure. The minimum wire size shall be #16. Wiring schematics shall be submitted to the Engineer, as part of the shop drawing process, for approval prior to installation.
- D. All controllers shall be provided with lightning protection with $\frac{5}{8}$ -inch x 10-foot copper clad grounding rods with less than five (5) ohms resistance required. If one rod will not give the five (5) ohms or less, one hundred fifty (150) feet or more of bare #6 wire will be installed into a the nearest wetted area. This wire will be connected to the ground rod by a brass, single piece clamp.
- E. Wire used to connect equipment to a grounding rod shall be one (1) size larger than largest wire used on the fixed head, full coverage, irrigation system (at same location), and connected with a brass, single piece clamp.
- F. All exposed wire shall be enclosed in PVC schedule 80 conduit.

- G. Power for the irrigation controllers shall be obtained from on-site sources. The Contractor shall be responsible for connection to the system, supplying suitably sized circuit breakers and mounting them within panels, labeling the breakers to clearly identify their function, and extending service to the individual irrigation control stations.
- H. Plans for connections to the power sources indicated and details of the electrical equipment and wiring to be supplied shall be submitted to the Engineer for approval prior to installation in accordance with Section 01300, "Shop Drawings, Submittals and Samples".

2.03 Sprinkler Heads

- A. Rotor and spray heads shall be manufactured by Rain Bird, Toro, Hunter or approved equal.
- B. Sprinkler heads shall carry a minimum two (2) year warranty on materials, workmanship and performance starting from the date of Final Project Acceptance by the Owner.

2.04 Automatic Irrigation Controllers

- A. The controllers shall be supplied in a weatherproof enclosure suitable for pedestal mounting inside a protective NEMA waterproof enclosure (contractor supplied). The irrigation controllers shall be as manufactured by Rain Bird, Toro, Hunter, or approved equal.
- B. Housing: Stainless steel or fiberglass, weatherproof construction
- C. Door: Lockable door access to controls
- D. Stations: Control stations shall be located as approved by the Engineer.
- E. Station Timing: Independent for each station with each infinitely adjustable from 0 to 99 minutes.
- F. Day Programming: To be based on a variable day cycle.
- G. Operation: Automatic, or manual, at discretion of operator.
- H. The irrigation controllers shall be equipped with automatic, swivel mounted, aluminum bracket rain sensors to interrupt power between the controllers and the solenoid control valves after rainfall quantities of $\frac{1}{8}$ -inch to 1-inch.

I. Power Requirements

1. Input: 120 volts A.C.
2. Output to valves: 24 volts A.C.

2.05 Electric Conduit and Fittings

- A. Plastic Conduit: Class III, FS W-C-1094

3. EXECUTION

3.01 Inspection

- A. The Engineer or his duly authorized representative shall be responsible for inspection of the Contractor's work while such work is in progress.
- B. The Engineer shall bring to the attention of the Contractor any work which does not meet the Contract requirements and the Contractor shall correct such work as brought to his attention.

3.02 Staking

- A. The Contractor shall keep a qualified man on the job for the purpose of staking the locations on the ground of all irrigation equipment to be installed. The agent of the Contractor shall first establish a base line, or lines from which his detailed staking shall originate. In staking the locations of sprinkler outlets, he shall adjust the staking as required to best irrigate the entire application area. All irregular spacings required, due to odd shapes in spray irrigation site shall be inspected and approved by the Engineer.
- B. Routing of the pipe shall be in accordance with the "*full-coverage*", fixed head, Irrigation Plan, submitted by the Contractor's professional irrigation specialist, except that the Engineer reserves the right to change the routing of the pipe from that shown on the Plan and to change the depth of trench and cover over the pipe in case of rock or other obstacles. In no event shall field changes of this nature affect the overall cost of the project, except where these changes may alter the quantity of materials to be provided according to the plan, or where the excess depth of trench and more backfill is required.

- C. Stakes shall be clearly marked and flagged to designate the type of equipment to be installed at that point. Stakes shall be placed accurately to allow particular equipment to be installed within one (1) foot from the indicated position. Where the stake is offset from the indicated position, it shall be clearly marked to indicate the base position. The Contractor's agent shall maintain this staking, replacing all stakes disturbed to the correct position, until all equipment is in place, and its position is properly indicated on the "Project Record Drawings" for the "full-coverage", fixed head, irrigation system.

3.03 Excavation

- A. All excavation shall be unclassified and shall include all materials encountered, except materials which cannot be excavated by normal mechanical excavation means. Such exceptions shall be brought to the attention of the Engineer and an adjustment in price shall be agreed upon before excavation of these areas proceed.
- B. The minimum depth of cover over piping 8-inch and smaller shall be eighteen (18) inches upstream of the control valve. All pipes downstream of the control valve shall have a minimum cover of approximately twelve (12) inches.
- C. All excavation, except as directed, shall be backfilled to the original grade, or such grade as shown on the Contract Drawings or as directed by the Engineer. Backfilling shall be carefully placed around the pipe in layers not over six (6) inches thick and thoroughly compacted by hand tampers weighing not less than twenty (20) pounds, or by approved mechanical tampers. Ponding will be permitted only with the written permission of the Engineer, providing sufficient water is used uniformly throughout the operation. No backfilling with bulldozers will be permitted adjacent to pipe lines. In no case will backfilling be permitted to be placed so as to damage the work. No rock will be permitted in the backfill within one (1) foot of any pipe. The backfilling shall be done so as to prevent after-settlement, and shall be left with a smooth surface. Should the work be suspended for any reason for any considerable time, the excavation shall be backfilled at the Contractor's expense when so ordered by the Engineer.
- D. Backfill around polyvinyl chloride pipe shall be carefully placed by experienced labor and thoroughly consolidated without shock to the pipe, and carried up uniformly on both sides of the pipe. After backfilling is complete, all excess materials shall be disposed of by the Contractor at no additional cost to the Owner.
- E. The Contractor shall exercise reasonable care to avoid causing damage to any and all underground utilities and structures.
- F. All excavation, backfilling and compaction shall be in accordance with Section 02220, "Excavation, Backfilling and Compaction".

3.04 Installation of Lateral Lines

- A. Lateral lines may be installed by standard trenching techniques or by "*pulling in*" pipe.
- B. If the "*pulling in*" method is used, the pipe "*plow*" shall be of the vibratory type and equipped with a turf roller device to prevent tearing of the turf. The "Mole" or "Bullet" which precedes the pipe and is used to form the opening for the pipe, shall be not less than one (1) inch larger in diameter than the outside diameter of the pipe.
- C. Lateral pipes and fittings shall be installed in accordance with the manufacturer's recommendations. All lateral lines shall be thoroughly flushed prior to the installation of automatic valves and/or sprinkler heads.

3.05 Sprinkler Heads

- A. All sprinkler heads shall be installed on glueable flex pipe.
- B. The sprinkler heads shall be installed so that the top of the head is at the finished grade level.

3.06 Control Wires

- A. All control lines shall be installed in a neat and orderly fashion and may be installed either in the main and lateral trenching or in their own separate trench.
- B. Control wire connections shall be as approved in a preceding section of these specifications.
- C. Control wire shall be installed in accordance with details on the approved wiring schematic.

3.07 Control Equipment

- A. All automatic valves and controllers shall be installed following the recommendations of the manufacturer of said equipment and, more specifically, in accordance with the detailed drawings submitted by the Contractor.
- B. The locations of all controllers shall be approved by the Engineer before the actual installation of said controllers.

3.08 Valve Boxes and Accessories

- A. Any valve boxes and/or other miscellaneous access boxes shall be installed so the top of said box is at finished grade.
- B. Valve boxes shall be 20-inch x 14-inch plastic "jumbo" size, purple in color, stating "Irrigation Control Valve".

3.09 Cleaning and Testing

- A. The Contractor is responsible for furnishing a completed, "full-coverage", fixed head, irrigation system ready to operate. All costs for testing the system and repairs of any leaks or deficiencies of any kind shall be borne by the Contractor.
- B. Prior to installing irrigation heads, the lines shall be thoroughly flushed with water to remove all stone and sand particles from the system. Threaded caps shall be installed on all risers, beginning with the one closest to the water source and working out to the end of all lateral lines. Backfilling of the trench may begin at this time, however, all pipe joints and riser connections shall be left exposed for leakage testing.
- C. At the direction of the Engineer, all heads within a representative portion of the system shall be capped off and the following hydrostatic leakage test shall be performed:
 - 1. The pressure required for hydrostatic leakage tests shall be 150 pounds per square inch (psi). The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation cocks with a diameter of at least $\frac{3}{4}$ -inch shall be provided at each pipe dead end in order to bleed air from the line.
 - 2. The hydrostatic pressure and leakage test shall conform with Section 13 of AWWA C-600 specification, latest revision, with the exception that the Contractor shall furnish all plugs, meters, pressure pumps and other equipment needed to test the line.
 - 3. Pipe lines shall be filled with water and all air removed and a pressure of 150 pounds per square inch (psi) shall be maintained in the pipe for the period of not less than two (2) hours by a means of a force pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.
 - 4. All visible leaks at exposed joints and all leaks evident at the surface where the pipe is covered shall be repaired and leakage minimized, regardless of the total leakage, as shown by test. The amount of allowable leakage shall not exceed that allowed in AWWA C-600.

5. Lines which fail to meet tests shall be repaired and retested, as necessary, until the test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced by the Contractor at no additional cost to the Owner. Additional pipe lines may be tested in other sections as directed by the Engineer, by shutting gates or installing temporary plugs as required.

3.10 Balancing and Adjustment

- A. The Contractor shall balance and adjust the various components of the “full- coverage”, fixed head, irrigation system so the overall operation of the system is most efficient.
- B. This includes a synchronization of the controllers, adjustments to pressure regulators, pressure relief valves, and individual station adjustments on the controllers.
- C. The Contractor shall have the right to call in the Engineer and Owner to aid in balancing and adjusting the system.

3.11 Notice of Completion

- A. When the Contractor is satisfied that the system is operating properly, that it is balanced and adjusted properly, and that all Work and cleanup is completed, he shall issue the Notice of Completion to the Owner and Engineer, in writing.
- B. The Notice of Completion shall include a request for final inspection.

3.12 Final Inspection and Acceptance

- A. The Engineer will respond within ten (10) calendar days after the Notice of Completion is received for the purpose of making a final inspection of the system, and if final acceptance is not given, a "Punch List" will be prepared which, upon completion by the Contractor, will signify final acceptance by the Engineer.
- B. After final inspection and acceptance of the system, the Contractor shall submit the irrigation system "Record Drawings" to the Engineer in conformance with Section 01300, "Shop Drawings, Submittals and Samples", and Section 01720, "Project Record Documents".

3.13 Guarantees

- A. All labor and materials shall be guaranteed by the Contractor against all defects and malfunctions due to faulty workmanship or defective material **for a period of two (2) years from the date of Final Project Acceptance by the Owner.**
- B. The Contractor shall deliver all warranties, guarantees and bonds to the Engineer in accordance with Section 01740, "Warranties and Bonds".
- C. Upon being informed by the Owner of any defects or malfunctions, the Contractor shall effect all necessary repairs and/or replacements in a reasonably expedient manner at no additional cost to the Owner.
- D. If the Contractor does not respond to the Owner's request for repair work within a period of three (3) days, the Owner may proceed with such necessary repairs and charge the Contractor for all expenses incurred in the repair work.
- E. Emergency repairs, when necessary, may be made by the Owner without relieving the Contractor of his guarantee obligation.
- F. The Contractor shall be obligated to repair any settling of backfilled trenches which may occur during the guarantee period. The Contractor is also obligated to restore any and all damaged landscaping, paving, or improvements within the period of guarantee.

3.14 Warranty and Guarantee Certificates

- A. The Contractor shall furnish a certificate of warranty registration and a guarantee of work and materials **for a period of two (2) years from date of Final Project Acceptance** of the system in accordance with Section 01740, "Warranties and Bonds".
- B. Final payment for the system shall not be made unless this certification is presented to the Engineer and Owner.

3.15 Owner's Responsibility for Maintenance

- A. It will be the Owners responsibility to maintain the system in working order during the guarantee of work and materials for a **period of two (2) years from the date of Final Project Acceptance by the Owner.**

END OF SECTION

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SECTION 02842

ALUMINUM ORNAMENTAL FENCE AND GATE SYSTEMS

1. GENERAL

1.01 Description

- A. Furnish all materials, equipment, transportation, tools and labor, unless otherwise specified, to construct a complete and fully-operational heavy industrial aluminum ornamental fence system (6-feet tall on top of split face block wall system) and ornamental cantilever gate systems, and other appurtenances, called for or that could reasonably be inferred from the Contract Documents. If any items for a complete heavy industrial aluminum ornamental fence system and ornamental cantilever gate system are omitted or not shown, the Contractor shall furnish and install the same without additional cost to the Owner.
- B. The heavy industrial aluminum ornamental fence system and entrance gate system to be supplied are to be constructed around the areas shown on the Contract Drawings for the Sanford Main WTP.
- C. The fencing system shall consist of a six (6) foot bronze mill finished, heavy industrial aluminum ornamental fence system installed on top of a perimeter wall, between perimeter wall columns, around the property line of the treatment facility.
- D. Two (2) industrial, ornamental cantilever gate systems, with a bronze mill finish, shall be installed at the locations indicated on the Contact Drawings
- E. The ***pickets on the ornamental fence and cantilever gate systems shall match.***
- F. The aluminum ornamental fencing and cantilever gates systems shall be installed according to the manufacturer's instructions unless otherwise indicated herein.
- G. The permanent fencing and gate systems shall be installed at a point during the construction schedule where damage to said systems will be minimized. All damage to the perimeter wall, and permanent fencing/gates system shall be repaired immediately by the Contractor at no additional cost to the Owner.
- H. Fence and gate systems shall be able to handle 150 mph wind loadings. The manufacturer shall provide any additional reinforcement required to meet the loading.

I. Related Work Specified Elsewhere

1. Site Preparation:	Section 02100
2. Finish Grading:	Section 02215
3. Concrete:	Division 3
4. Masonry:	Division 4
5. Miscellaneous Metals:	Division 5

1.02 **Quality Assurance**

A. The fencing erector shall be a firm experienced in the erection of fencing and accessories of the types specified. The erector must be approved by the manufacturer of the industrial ornamental fencing and gate systems and shall have a minimum of five (5) years experience in installing fencing under the current corporate/firm name.

B. Sole Quality Control

1. Provide each type of aluminum ornamental fence and gate system as complete units produced by the same manufacturer, including necessary erection accessories, fittings and fastenings.
2. The manufacturer shall be a company specializing in manufacturing the products specified herein with a minimum of five (5) years documented experience.

C. The heavy industrial aluminum ornamental fence system and ornamental cantilever gate systems shall be as manufactured by Ameristar Fence Products, or approved equal. The systems shall be of the following Ameristar models:

1. Aluminum Ornamental Fence System:	Echelon II - Classic
2. Aluminum Ornamental Cantilever Gate System:	Transport II - Classic

The ***pickets on the ornamental fence and cantilever gate systems shall match.***

D. Reference Standards

1. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM A653 / A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
ASTM B117	Practice for Operating Salt-Spray (Fog) Apparatus
ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
ASTM D523	Test Method for Specular Gloss
ASTM D714	Test Method for Evaluating Degree of Blistering in Paint.
ASTM D822	Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus
ASTM D1654	Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D2244	Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D2794	Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3359	Test Method for Measuring Adhesion by Tape Test

1.03 Submittals

- A. Submit shop drawings to the Engineer for review and approval in conformance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. Submit shop drawings for the heavy industrial aluminum ornamental fence system including plan layout and details illustrating fence height, location and sizes of posts, rails, tubular pickets, appurtenances, a hardware list and erection procedures.
- C. Submit shop drawings for the industrial ornamental cantilever gate systems including plan layout and details illustrating gate height, location and sizes of posts, rails, tubular pickets, brackets, bracing, appurtenances, a hardware list and erection procedures.
- D. Submit copies of the manufacturer's descriptive literature of materials, technical data, details of fabrication, and installation instructions and procedures for the industrial ornamental chain link fence and cantilever gate systems.
- E. Submit a manufacturer's certification that the materials meet the requirements of the specifications and the ASTM Standards.

- F. Submit two (2) samples of framework members, pickets and typical accessories with the finish bronze coatings.

1.04 Product Delivery, Storage and Handling

- A. Delivery of materials shall be in the manufacturer's original packaging with all tags and labels intact and legible. Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling.
- B. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.05 Project Record Documents

- A. Accurately record the actual location of the aluminum ornamental fencing and cantilever gates systems, relative to the property lines and submit to the Engineer in accordance with Section 01720, "Project Record Documents".

1.06 Operation and Maintenance Manuals

- A. O&M Manuals shall be furnished for this Project in accordance with Section 01730, "Operation and Maintenance Data" and shall be submitted in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. The O&M Manuals shall be prepared specifically for this installation and shall include all detailed operating instructions, maintenance procedures and instructions and specifications relative to the assembly, alignment, checking, lubrication, placing in operation, adjustment, and maintenance of equipment and auxiliaries furnished under this Contract, together with its complete parts lists therefore, and copies of shop drawings, certified dimensions drawings and design calculations, required cut sheets, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment.
- C. All such material shall be in addition to any instructions or parts lists packaged with or attached to the equipment when delivered.
- D. ***The "final" O&M Manuals shall contain plastic laminated pull-out lubrication and maintenance cards*** detailing all lubrication points, lubricant type, and frequency of lubrications and all additional required maintenance and frequency intervals.

- E. *In addition to standard O&M Manuals, all manufacturers supplying equipment and products specified herein shall also submit their operation and maintenance manuals and data to the SCADA System Integrator for this Project on CD/DVD/BD's in Corel WordPerfect (latest version), Microsoft Word (latest version), or text, ".txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats (integrators preference for the system shall be required). All O&M Manual files shall also be submitted electronically on CD/DVD/BD's to the Engineer in both PDF and JPEG formats, no exceptions.*
- F. *The SCADA System Integrator shall be responsible to configure and compile the O&M Manuals into "hypertext" window help files for use as computer "on-line" help screens for equipment operation and maintenance. The SCADA System Integrator shall return all hypertext files to the equipment and product manufacturer's for review and approval prior to introducing them into the SCADA System at the treatment facility.*

1.07 Warranty

- A. The Contractor shall furnish the Owner with a **two (2) year service/parts warranty** as specified in Section 01740, "Warranties and Bonds". The aluminum ornamental fence and cantilever gate systems shall be unconditionally **warranted by the manufacturer's for a period of five (5) years from the date of Final Project Acceptance by the Owner.**
- B. The equipment manufacturer shall guarantee that the equipment furnished is suitable for the purpose intended and free from defects of design, material and workmanship.
- C. In the event that any equipment fails to perform as specified herein, the equipment **manufacturer shall promptly repair or replace the defective equipment at no additional cost to the Owner.**
- D. This warranty is in addition to any other warranty required by the Contract Documents.

2. PRODUCTS

2.01 Heavy Industrial Aluminum Ornamental Fence System

A. Manufacturer

- 1. The industrial ornamental aluminum fence system shall conform to Ameristar Echelon II - Classic, 2-rail style as manufactured by Ameristar Fence Products, Inc., (Tulsa, OK), or approved equal.

2. The fencing system shall consist of a **six (6) foot, bronze mill finished, heavy industrial aluminum ornamental fence system** installed on top of a perimeter wall, between perimeter wall columns, around the property line of the treatment facility.

B. Material

1. Aluminum material for the heavy industrial aluminum ornamental fence system, including tubular pickets, rails and posts, shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T52. The aluminum extrusions for the fence pickets shall be Alloy and Temper Designation 6063-T52.
2. The manufactured framework shall be subjected to the fence system manufacturers thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat "bronze finish" with a minimum thickness of 2 mils (0.0508mm). The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in the table below:

Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 - Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117 and D1654	Corrosion Resistance over 1,000 hours (Scribed per D1654; failure mode is accumulation of 1/8-inch coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625-inch ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

3. Material for the aluminum ornamental fence pickets shall be 1-inch square x 0.062-inch thick extruded tubing. The cross-sectional shape of the rails shall conform to the manufacturer's ForeRunner™ design with outside cross-section dimensions of 1.75" square. The top wall and internal web of the rail shall be 0.070-inch thick; the sidewalls shall be 0.070-inch thick for superior vertical load strength. Picket holes in the ForeRunner™ rail shall be spaced 4.715-inches on-center. Picket retaining rods shall be 0.125-inch diameter galvanized steel. Fence posts and gate posts shall meet the minimum size requirements shown in the table below:

Minimum Size for Echelon II Post	
Fence Posts	Panel Height
2½-inch x 2½-inch x 0.080-inch Aluminum with reinforced web	Up to and including 6-foot heights

High quality PVC grommets shall be supplied to seal all picket-to-rail intersections.

4. Bracket to rail attachments shall be made using specially designed one-way tamperproof security nuts with carriage bolt. Bracket to post connections shall be made using self-drilling hex-head screws.
5. Aluminum castings shall be used for all rings, post caps, finials, and miscellaneous adornments.

C. Fabrication

1. Pickets, rails and posts shall be pre-cut to specified lengths. ForeRunner™ rails shall be pre-punched to accept pickets.
2. The rail inner slide shall be fully inserted into the rail outer channel to form the raceway for the internal retaining rod. Grommets shall be inserted into the pre-punched holes in the rails, and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal raceway of the two-part ForeRunner™ rails. Retaining rods shall be inserted into each ForeRunner™ rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.
3. Completed panels shall be capable of supporting a 300 lb. load (applied at midspan) without permanent deformation. Panels shall be biasable to a 25% change in grade.
4. Gates shall be fabricated using 1.75-inch square reinforced ForeRunner™ rail material, 2-inch square x 0.25-inch gate ends, and 1-inch square x 0.125-inch pickets. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall be joined by welding.

2.02 Ornamental Cantilever Gate System

A. Manufacturer

1. All industrial ornamental cantilever gates shall conform to the Ameristar TransPort II gate system, Classic design, manufactured by Ameristar Perimeter Security USA Inc. (Tulsa, OK), or approved equal.

2. Two (2) industrial, ornamental, bronze mill finished, cantilever gate systems shall be installed at the locations indicated on the Contact Drawings and are characterized as follows:

Gate Type	Gate Dimensions		Opening Direction	Description
	Length	Height		
Cantilever Gate	30 feet	7 feet - 1 inch	NE to SW	Ornamental Cantilever Gate System
Double Swing Gate	20 feet	7 feet - 1 inch	N to S	Ornamental Cantilever Gate System

B. Material

1. The materials used for cantilever gate framing, including uprights and diagonal bracing, shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with a yield strength of 25,000 psi, a tensile strength of 30,000 psi and a standard bronze mill finish. The TransPort™ enclosed tracks shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with a yield strength of 25,000 psi, a tensile strength of 30,000 psi and a standard bronze mill finish.
2. Material for the pickets shall be 1-inch square x 1/8-inch wall aluminum pickets on all gate systems. Picket spacing shall not exceed 5-inches, on-center. The pickets shall be securely fastened to the face of top and bottom enclosed track extrusions.
3. Material for gate uprights and diagonal bracing shall be 2-inch square x 1/4-inch wall aluminum. The cross-sectional shape of the enclosed-track shall conform to the manufacturers Fast-Trak™ design with as a single extrusion consisting of a 2" x 5" channeled support with integrated 2" x 2" enclosed-track raceway. Gates less than 24' openings shall be constructed as a single track system, gates greater than 24' openings shall be constructed as a dual track system.
4. Steel material for fence posts and pickets shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi. The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 oz/ft², Coating Designation G-90. Material for the gate support posts shall be 4-inch square x 11 gauge tubing.
5. Suspension Rollers for enclosed tracks shall be used at each support post to track connection. Each truck assembly shall be capable of being adjusted vertically via threaded rod for fine-tune adjustment. Truck assembly shall be constructed in a way so that the primary housing for the truck rollers shall pivot via ball-bearing connection to threaded rod.

6. The gate manufacturer shall provide properly sized, secured, motor systems to open and close the gate systems proposed for this Project. ***The motor systems shall be warrantied for a period of two (2) years from the date of final project acceptance by the Owner.***

C. Fabrication

1. Gate frame uprights and diagonal bracing shall be pre-fabricated and pre-punched to accept frame fasteners. The enclosed track shall be pre-punched to accept gate uprights. The pickets shall be pre-cut to specified length and pre-drilled to accept picket to track fasteners. Posts shall be pre-cut to specified lengths.
2. Top and bottom enclosed track extrusions shall be mechanically fastened to vertical gate uprights and intermediate supports, as required by assembly instructions. Diagonal bracing shall be mechanically fastened to vertical gate uprights and intermediate supports, as required by assembly instructions. Pickets shall be mechanically fastened to top and bottom enclosed track, as required by assembly instructions.
3. The manufactured gate components shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat bronze mill finish with a minimum thickness of two (2) mils. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in the table below:

Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 - Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D 714 and D1654	Corrosion Resistance over 1,000 hours (Scribed per D1654; failure mode is accumulation of 1/8-inch coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625-inch ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

2.03 Motorized Gate Equipment

- A. The North dual swing gate shall be furnished with two motorized gate operators (one for each side).
- B. The South slide gate shall be furnished with a third motorized gate operator.

C. Dual Swing Gate Operators

- 1. Provide two (2) operators, one for each swing gate. The operators shall be interconnected via a network with one configured as a Master and the other as a Slave.
- 2. All safety and monitoring components shall be connected to the Master operator. The Slave operator shall open and close synchronously as commanded by the Master operator over the network.
- 3. The operator shall meet the following requirements:
 - a. Power Supply: 120 VAC at a maximum of six (6) Amps.
 - b. Operating Temperature: -20 to 160°F.
 - c. Rated for up to twenty (20) feet in length and 1,200 lbs.
 - d. Operator Manufacturer/Model: Viking Model T-21 or approved equal.

D. Slide Gate Operator

- 1. The operator shall meet the following requirements:
 - a. Power Supply: 120 VAC at a maximum of six (6) Amps.
 - b. Operating Temperature: -20 to 160°F.
 - c. Rated for gates up to sixty (60) feet length and 1,600 lbs.
 - d. Operator Manufacturer/Model: Viking Model L-3 or approved equal.

E. Ancillary Equipment

- 1. Provide all sensing and safety equipment required to meet UL Standard 235, Section 35.1.1. As a minimum this shall include:
 - a. Underground vehicle loop detectors as shown on the Contract Drawings.

b. Entrapment zone safety monitors

- 1) These shall be provided for the opening and closing entrapment areas for the sliding gate and the closing entrapment area for the swing gates. They shall comprise a photo-electric sensor at the operator end with associated reflector at the other end of each entrapment area.
- 2) The sensor shall be rated for a minimum range of ten (10) meters and comply with UL standard 325 for this application.
- 3) Manufacturer/Model: Omron Model E3K-R10K4-NR-1 or approved equal.

c. All gates shall be provided with warning signs on the inside and outside.

3. EXECUTION

3.01 General

- A. Fence installation shall not be started before the split-face block perimeter wall and columns and final grading around the fenced areas are complete with finish elevations established, unless otherwise permitted.
- B. The gate systems shall not be started until the heavy duty concrete paving and split-face block perimeter wall and columns, adjacent to the entrance roads, are complete.
- C. Install the fencing and gate systems in accordance with the manufacturer's instructions.

3.02 Heavy Industrial Aluminum Ornamental Fence System - Installation

- A. Fence posts shall be evenly spaced between the perimeter wall columns and in accordance with the fence manufacturer's recommendations for this Project. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be mounted to the 2-inch cap block on top of the split-face CMU perimeter wall. Detailed installation instructions shall be provided by the manufacturer for installing the fence in this particular application.
- B. When cutting/drilling rails or posts, adhere to the following steps to seal the exposed surfaces:
 1. Remove all metal shavings from the cut area.

2. Apply custom finish paint matching fence color.
 3. Seal all exposed surfaces per steps 1 and 2. Ameristar spray cans or paint pens shall be used to prime and finish exposed the surfaces; it is recommended that paint pens be used to prevent overspray. The use of parts or components by the Contractor, not supplied by the fence manufacturer, is strictly prohibited.
- C. The Contractor shall clean the aluminum ornamental fencing system of excess materials immediately after installation is complete.

3.03 Ornamental Cantilever Gate Systems - Installation

- A. Cantilever support posts shall be set in concrete footers having a minimum depth of forty-eight (48) inches. Division 3, "Concrete", shall govern material requirements for the concrete footer.
- B. The gates shall be installed per manufacturers gate installation instructions. Gates shall also be installed in compliance with ASTM F2200 standards.
- C. When cutting/drilling posts, adhere to the following steps to seal the exposed steel surfaces:
 1. Remove all metal shavings from the cut area.
 2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
 3. Apply two (2) coats of custom finish paint matching fence color. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. The use of parts or components by the Contractor, not supplied by the fence manufacturer, is strictly prohibited.
- D. Gate posts shall be spaced according to the manufacturers' drawings, dependent on clear opening. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per the manufacturer's recommendations.
- E. The Contractor shall clean the aluminum ornamental cantilever gate systems of excess materials immediately after installation is complete.

END OF SECTION

SECTION 02850

PARKING BUMPERS

1. GENERAL

1.01 Description

- A. The Work included in this Section consists of furnishing all materials, equipment, transportation, tools, labor, and appurtenances for the furnishing and installation of parking bumpers (wheel stops) as shown on the Contract Drawings.

2. PRODUCTS

2.01 Parking Bumpers

- A. Parking bumpers shall be six (6) feet long standard precast concrete with two $\frac{3}{4}$ -inch diameter precast holes for anchor pins.
- B. Anchor pins shall be plain or deformed reinforcing steel bars that conform to the requirements of ASTM Designation A-615, Grade 40.

3. EXECUTION

3.01 Installation

- A. Parking stall bumpers shall be provided for each stall, and each unit shall be provided with two $\frac{5}{8}$ -inch diameter steel rods, eighteen (18) inches long, driven into the pavement and made "*flush*" with top of the precast unit.
- B. Units shall be set to line and spacing shown on Contract Drawings.
- C. Damaged bumpers will not be accepted and shall be removed by the Contractor and replaced with acceptable units at no additional cost to the Owner.

END OF SECTION

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SECTION 02870

SITE AND STREET FURNISHINGS

1. GENERAL

1.01 Scope of Work

A. Furnish all labor, materials, equipment and incidentals for the complete installation of all site furnishings and related items as shown on the Contract Drawings and specified herein.

B. Related Work Specified Elsewhere

1. Concrete Sidewalks, Driveways and Pads:	Section 02720
2. Cast-In-Place Concrete:	Section 03300

1.02 Submittals

A. Submit manufacturer's literature including specifications and catalog cuts and printed installation instructions for the same in accordance with Section 01300, "Shop Drawings, Submittals and Samples".

B. Submit color charts of the manufacturer's standard finishes for the Engineer's review and selection.

1.03 Quality Assurance

A. The manufacturer shall be one that produces site furnishings as standard product and has been engaged in the practice of producing site furnishings for a minimum of five (5) years under the current company name.

1.04 Delivery, Storage and Handling

- A. Deliver all materials necessary for the complete installation to the Project Site and store and protect them from damage until installation.
- B. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the work and material of all other trades.
- C. In the event of damage, immediately make all repairs and replacement necessary, to the approval of the Engineer, and at no additional cost to the Owner.

2. PRODUCTS

2.01 Litter Containers

- A. The Contractor shall provide and install two (2) Litter Containers at the locations to be identified by the Engineer and Owner.
- B. Materials
 - 1. Metal support legs shall be 1-inch x 1-inch square steel. Vertical metal straps shall be 1½-inch x 3/16-inch and shall be welded to metal bands.
 - 2. Tubular steel collar shall be 1¼-inch in diameter with a 0.12-inch wall thickness.
 - 3. The top shall be formed of spun metal and the pop-up rod shall be stainless steel.
 - 4. The litter containers shall be surface mounted units.
 - 5. Furnish litter containers with a factory standard **“brown” powder coat finish.**
 - 6. All hardware shall be Type 304 stainless steel.
- C. The litter container shall be Landscape Forms - Scarborough Litter Receptacle, side opening with sand/ash pan top, or approved equal.

2.02 Benches with Armrest

- A. The Contractor shall provide and install two (2) architectural benches with armrests, eight (8) feet in length, on the exterior concrete slab, east of the Training/Breakroom, in the orientation to be identified by the Engineer and Owner.

B. Materials

1. The benches shall be of the backed type with horizontal straps and each have a length of eight (8) feet.
 2. The support end frames shall be 1-inch x 1-inch solid steel, joined by 1½-inch diameter, 0.12-inch wall thickness tubular steel.
 3. Seating panels shall be constructed with horizontal steel straps, 1½-inch x 3/16-inch.
 4. The benches shall be constructed with no intermediate arms.
 5. The architectural benches shall be surface mounted units.
 6. Furnish litter containers with a factory standard **“brown” powder coat finish.**
 7. All hardware shall be Type 304 stainless steel.
- C. The architectural benches shall be Landscape Forms - Scarborough Bench, with back horizontal straps and no intermediate arms, or approved equal.

2.03 Table with Integral Chairs

- A. The Contractor shall provide two (2) Integral Tables each with four (4) backed chairs (dining backed) and install them on the exterior concrete slab, east of the Training/Breakroom, in the orientation to be identified by the Engineer and Owner.

B. Materials

1. The architectural tables shall be constructed of solid steel tubular steel.
 2. The architectural tables shall be a surface mounted unit.
 3. The architectural tables shall have a factory standard **“brown” powder coat finish.**
 4. The architectural tables shall have a 48-inch large wooden table top (exterior application) with a center hole and a matching colored umbrella.
 5. All hardware shall be Type 304 stainless steel.
- C. The architectural tables with integrated backed chairs, large square wooden table top and umbrella shall be Landscape Forms - 'Carousel Seating', or approved equal.

3. EXECUTION

3.01 Inspection

- A. Do not proceed with the Work of this Section until conditions detrimental to the proper and timely completion of the Work have been corrected in an acceptable manner.

3.02 Installation

- A. Install equipment in accordance with the manufacturer's instructions, approved shop drawings and the requirements of this Section.
- B. Secure all site and street furnishing to the concrete using Type 304 stainless steel hardware following the manufacturer's installation recommendations.

3.03 Cleaning and Protection

- A. Replace any damaged or defective site furnishings.
- B. Remove any deleterious materials from the site and protect all furnishings from damage after installation.
- C. Clean all site furnishings prior to Final Project completion.

END OF SECTION

SANFORD MAIN WTP IMPROVEMENTS

SANFORD, FLORIDA



DIVISION 3

CONCRETE

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DIVISION 3

CONCRETE

Specification Section	<u>Title</u>
03100	Concrete Formwork
03200	Concrete Reinforcement
03250	Concrete Accessories
03300	Cast-in-Place Concrete
03400	Precast Concrete Structures
03420	Prestressed Hollowcore Plank
03600	Grout
03700	Concrete Electrical Raceway Encasement

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SECTION 03100

CONCRETE FORMWORK

1. GENERAL

1.01 Description

A. The Work included in this Section consists of providing all labor, materials and equipment necessary for providing and installing formwork for concrete.

B. Work Specified Herein

1. General formwork.
2. Forms, form liners, and coatings.
3. Form ties and accessories.

C. Related Work Specified Elsewhere

Specification Section	Title
02200	Earthwork
03200	Concrete Reinforcement
03250	Concrete Accessories
03300	Cast-in-Place Concrete
Contract Drawings and General Provisions of the Contract	

1.02 General Design and Responsibility

A. All forms and shoring shall be designed at the Contractor's expense by a Professional Engineer registered in the State of Florida. 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.

- B. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete. The Contractor shall be responsible for safety in its construction, use and removal.
- C. Provide camber as necessary to compensate for anticipated deflection in the formwork and concrete due to weight and pressure of fresh concrete and other construction loads.

1.03 Quality Assurance

A. Qualifications

1. Formwork shall be constructed in accordance with the specified standards, as well as all pertinent codes and regulations.
2. Where provisions of pertinent codes conflict with the requirements of this Section of the Specifications, the more stringent provisions shall govern.

B. Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Concrete Institute (ACI)	
ACI 117	Specifications for Tolerances for Concrete Construction and Materials
ACI 301	Specifications for Structural Concrete
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 347	Guide to Formwork for Concrete
American Plywood Association (APA)	
	Material grades and designations as specified
Building Codes	
	Florida Building Code
	Local Codes and Regulations

C. Pre-Placement Checklist

1. ***The Contractor, as part of his Quality Control Plan, shall develop and submit for approval a Pre-Placement Checklist form to cover the following items:***
 - a. Reference Drawings covering the placement for all trades and disciplines.
 - b. Date and time scheduled for placement and the actual date and time of placement.
 - c. Foreman name, placement number, number of truckloads and number of cylinders.
 - d. Checklist items such as embeds (list each), subgrade, rebar, forms, alignment, plumbness, etc.
 - e. Signoff's for foreman, Contractor's Quality Control representative, each subcontractor foreman (major subs, mechanical, electrical, plumbing, etc.) and Engineer.

- D. ***No concrete may be placed until the checklist is properly and completely signed off.*** Failure to comply with this provision can be grounds for rejecting the work. The checklist shall be weather protected and located with the foreman or at the foreman's station.

1.04 Submittals

- A. Submit shop drawings and product data in accordance with Section 01300, "Shop Drawings, Submittals and Samples", showing materials of construction and details of installation for:
 1. Submit manufacturer's literature for form ties, form release agent, spreaders, corner formers, form coatings and bond breakers.
 2. Location and sequence of the concrete placements. Indicate locations of joints and panel sizes and patterns. Show location of form ties on architectural surfaces.
 3. Review of the pour sequence, form system, and panel layout shall be for appearance and strength of the completed structure only. Review by the Engineer of forming plans or procedures shall not relieve the Contractor of responsibility for the strength, safety or correctness of methods used, the adequacy of equipment, or from carrying out the work in full compliance with the requirements of the Contract Drawings and Specifications.

B. Samples

1. The Contractor shall demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated or otherwise furnished and will not affect the forming material.
- C. Submit the manufacturer's literature for form ties, spreaders, corner formers, form coatings, and bond breakers.

2. PRODUCTS**2.01 Form Construction and Design**

- A. Design forms according to the applicable portions of ACI 347, "Guide to Formwork for Concrete". Form all concrete, except as specified otherwise.
- B. Provide form windows or stage forms to allow visual observation at all times of the concrete being placed and vibrated. Provide a formwork design and placement schedule that will limit the free fall of concrete in walls as follows:

Wall Thickness	Maximum Free Fall of Concrete (feet)
8 inches or less	4.0
Greater than 8 inches	6.0

The total vertical lift made in a single pass shall not exceed two (2) feet in height.

- C. ***Notify the Engineer, a minimum of seventy-two (72) hours prior to the placement of concrete.***
- D. For multi-storied structures, the shoring and reshoring diagrams and procedures shall be signed and sealed by a registered Engineer in the State of Florida. These diagrams and procedures shall take into account the effect of the loads on the uncured concrete and the construction load on each floor.
- E. Steel forms shall be 24 gauge, tongue and groove joints, complete with steel stakes and splice plates.

2.02 Classes of Forms

A. Class I Forms

1. Use steel forms, ply form, or smooth surface plywood $\frac{3}{4}$ -inch minimum thickness for straight surfaces and $\frac{1}{2}$ -inch minimum thickness for curved surfaces.
2. Coat the face and edges of the forms with a two-coat system of one component polyurethane coating applied by roller at the rate of five hundred square feet (500 ft²) per gallon.

B. Class II Forms

1. Use plywood in good condition, metal, or smooth-planed boards free from large or loose knots with tongue and groove or ship lap joints.
2. The Forms shall be oiled.
3. Class II forms may be used for exterior concrete surfaces which are one (1) foot or more below finished grade. Use Class I forms for all other surfaces.

C. Coat all forms with a form-release agent.

2.03 Form Material

- A. Use plywood, lumber, steel or other approved materials as identified herein of sufficient strength and surface smoothness to produce the specified finish.
- B. Tape, gasket, plug, and/or caulk joints, gaps, and apertures in forms so that the joint will remain watertight and withstand placing pressures without bulging outward or creating surface irregularities.

C. Lumber

1. The Lumber used in form construction shall be either:
 - a. Douglas fir, No. 2 grade, S4S, Standard Grading and Dressing Rules No. 16, West Coast Lumber Inspection Bureau; or
 - b. Southern Yellow Pine, No. 2, S4S, Standard Grade Rules Southern Pine Inspection Bureau.

2. All boards shall be six (6) inches or more in width and seasoned on all sides.

D. Plywood

1. Plywood used in form construction shall be Grade B-B, Class I plyform, sanded on both sides in conformance with U.S. Product Standard PS-1, mill-oiled and edge sealed, and bearing the label of the American Plywood Association.
2. The minimum thickness of the plywood shall be $\frac{3}{4}$ -inch.

E. Medium Density Overlay (MDO) Plywood Forms

1. PS-1, B-B High Density Concrete Form Overlay, Class 1, unoiled.
2. Butt form panels, make contact surface fully flush and seal butting holes with sponge form tape. Chamfer edges of beams and ceilings.
3. Where medium density overlay (MDO) plywood is used to form beams, use no piece of MDO plywood that has been patched or damaged.

F. Drip Forms

1. Varnished ponderosa pine or equally rigid non-staining plastic, $\frac{1}{2}$ -inch wide on each leg.

G. Steel Forms

1. Uncoated steel, $\frac{3}{16}$ -inch minimum thickness, fabricated to close tolerances, protected only by the specified release agent, braced so as not to bend, dent or dimple under wet concrete loads, vibrator impact, and tool impact.
2. Maintain steel forms in a "rust-free" condition by use of steel wool and light grinding, followed by coats of specified release agent. Use forms that can be adjusted into true alignment without stops or ridges.

H. Glass Fiber Reinforced Plastic (FRP) Forms

1. Smooth coated forms, braced so as not to bend, dent or dimple under wet concrete loads, vibrator impact and tool impact, and at least 0.11-inch thick. Design forms for external bracing at piers and columns, without use of form ties.

I. Circular Column Forms

1. Fabricated of two pieces, clamped watertight using gaskets and without horizontal joints
2. Install horizontal construction joints only where indicated or as directed by the Engineer.

J. Beam Forms

1. Provide as one length without form joints and suitable for cambering up to $\frac{1}{60}$ of the span without distortion of profile or opening of seams.

K. Forms for Hammerhead Pier Caps

1. Provide in one length with adjustable soffits, bulkhead and screeds, as necessary, to accommodate different hammerhead beam configurations.
2. Provide no construction joints in hammerhead pier caps.
3. Where three or fewer identical hammerhead pier caps occur within a line section, steel braced High Density Overlay (HDO) plywood forms may be substituted for steel forms if:
 - a. Working drawings of the formwork are submitted.
 - b. Internal form ties are regularly spaced no less than forty-eight (48) inches each way, and are made watertight.
 - c. Form ties have removable cones, which are filled to match the concrete.
 - d. Joints in panels are fully watertight.
 - e. The resulting surface matches the appearance of steel formed hammerhead caps, with no visible discoloration due to form leakage.

L. Styrofoam Board

1. Expanded polystyrene extruded into board foam, closed cell, moisture resistant, and capable of maintaining the indicated clear space between concrete structures.

2.04 Form Ties

- A. Locate form ties on exposed surfaces in a uniform pattern or as indicated on the Contract Drawings. Construct form ties so that the ties remain embedded in the concrete except for a removable portion at each end and do not leave an open hole through the concrete. Form ties shall have conical or spherical type inserts with a maximum diameter of one (1) inch. Construct form ties so that no metal is within one (1) inch of the concrete surface when the forms, inserts, and tie ends are removed. Ties shall withstand all pressures and maintain forms within acceptable deflection limits.
- B. ***Wire ties and wood spreaders will not be permitted.***
- C. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of one (1) inch and sufficient dimensions to permit patching of the tie hole.
- D. Ties for water-holding structures or dry structures with access, such as basements or pipe galleries, that are below finish grade shall have an integral steel waterstop that is tightly and continuously welded to the tie. The waterstop shall be ***at least two times (2X) larger*** in area than the tie cross-sectional area and shall be oriented perpendicular to the tie and symmetrical about the center of the tie. Construct the ties to provide a positive means of preventing rotation or disturbance of the center portion of the tie during removal of the ends.
- E. Tapered form ties shall be tapered through-bolts at least one (1) inch in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of the same minimum size.

2.05 Control Joint Filler

- A. Use epoxy joint filler equal to Burke Epoxy Joint Filler to fill all voids left by saw cuts and to resist against spalling caused by vehicle traffic in concrete slabs.

2.06 Inserts

- A. Galvanized cast steel or galvanized welded steel, complete with anchors to concrete and fittings such as bolts, wedges and straps. Provide hanger inserts spaced to match the grid of suspended ceilings.

2.07 Shoring

- A. As designed and executed by the Contractor to support all loads.

2.08 Bond Breaker

- A. Bond breaker shall be a **non-staining** type which will provide a positive bond prevention, such as Tilt Seal, an manufactured by Hunt Process Co., Santa Fe Springs, CA; Silcoseal 77, as manufactured by Dayton Superior Corp., Miamisberg, Ohio; or approved equal.

2.09 Form Release Agent

- A. Coat all forming surfaces in contact with concrete using a form release agent that shall effectively prevent absorption of moisture by the form and prevent bond with the concrete. The form release agent shall be **non-staining, non-residual, water based**, free of taste and odor, leave concrete with a coatable surface, and be *non-toxic* after thirty (30) days.
- B. For steel forms, the form release agent shall prevent discoloration of the concrete due to rust.

2.10 Chamfer Strips and Moldings

- A. Chamfer strips shall be polyvinyl, metal or PVC strips or approved equal, designed to be nailed in the forms to provide a $\frac{3}{4}$ -inch chamfer at all exposed edges of concrete members, unless otherwise indicated on the Contract Drawings.
- B. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Contract Drawings. Sizes of moldings shall conform to the sealants manufacturer's recommendations.

3. EXECUTION

3.01 General

- A. Forms shall be sufficiently strong and watertight, in accordance with ACI 301 and 347, to withstand the pressure resulting from the placement and vibration of concrete and shall be sufficiently hard and rigid to resist indentation and scratching while maintaining specified tolerances, and with **maximum deflection between form supports of $\frac{1}{240}^{th}$ of the span length**.

- B. Design, erect, shore, brace and maintain formwork, according to ACI 301, to support vertical, lateral, static and dynamic loads, and construction loads that might be applied, until the structure can support such loads.
- C. Construct formwork so that concrete members and structures are of the size, shape, alignment, elevation and position indicated, within the tolerance limits of ACI 117.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt and gradual, as follows:
 - 1. Class A: 1/8-inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B: 1/4-inch (6 mm) for rough-formed finished surfaces.
- E. Construct forms tight enough to prevent loss of concrete mortar.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 (horizontal) to 1 (vertical).
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve the required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where the interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine the sizes and locations from trades providing such items.
- K. Coordinate with other trades and properly place and locate in position all necessary chases, dowels, bolts, anchors, anchor slots, inserts, sleeves, openings, hangers, metal ties and other fastening devices required for attachment and support of adjacent work. Securely anchor all embedded items.

- L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- M. Coat contact surfaces of the forms with a form-release agent, according to the manufacturer's written instructions, prior to placing reinforcing. Keep form coatings off steel reinforcing, items to be embedded and previously placed concrete.
- N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.02 Form Erection

- A. Use facing materials that produce a hard uniform texture on the concrete. Do not use facing materials with raised grain, torn surfaces, worn edges, patches, dents or other defects. Use facing materials with maximum deflection, as reflected in concrete surfaces, **not in excess of $\frac{1}{240}^{th}$ of the span** between the structural members.
- B. Provide means for holding adjacent edges and ends of form panels and sections tight and in accurate alignment to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Forms shall be tight and shall prevent the loss of mortar and fines during placing and vibration of concrete.
- C. Insure that the forms may be removed without injury to the surface of the finished concrete.
- D. Provide exterior corners in concrete members with bevels as specified.
- E. Provide a positive means of adjustment of shores and struts. Insure that all settlement is taken up during concrete placing.
- F. Do not embed any form-tying device or part thereof other than metal in the concrete.
- G. Locate the large end of a taper tie on the "wet" side of the wall.
- H. Use only form or form-tying methods which do not cause spalling of the concrete upon form stripping or tie removal.
- I. Form $\frac{3}{4}$ -inch x $\frac{3}{4}$ -inch chamfers at all exposed edges of concrete members unless otherwise noted on the Contract Drawings.
- J. Form surfaces of concrete members except where placement of the concrete against the ground is shown in the Contract Drawings or as indicated below. The dimensions of concrete members shown in the Contract Drawings apply to formed surfaces, except

where otherwise indicated. Add two (2) inches of concrete where concrete is placed against trimmed undisturbed ground in lieu of forms. Placement of concrete against the ground shall be limited to footings and other non-exposed concrete and only where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing.

- K. ***At construction joints, overlap the contact surfaces of the form sheathing over the hardened concrete by not more than one (1) inch.*** Hold forms against the hardened concrete to prevent offsets or loss of mortar.
- L. Provide temporary openings in wall forms to limit the free fall of concrete to a maximum of six (6) feet unless an elephant trunk is used. Locate such openings to facilitate placing and consolidation, and space no more than eight (8) feet apart. Provide temporary openings in the bottom of the wall and column forms and elsewhere as necessary to facilitate cleaning and observation immediately prior to cleaning.
- M. Runways
 - 1. Provide smooth and rigid runways, if needed, for moving equipment and concrete. Support runways directly on formwork or on grade and in no case on reinforcing steel or bar supports.

3.03 Form Surface Preparation

- A. ***After each use and prior to placing reinforcing, clean form surfaces to be in contact with concrete of any mortar, grout and other foreign material.***
- B. Coat form surfaces in contact with concrete with a form release agent prior to form installation. Do not allow the form release agent to stand in puddles in the forms, to come into contact with hardened concrete against which fresh concrete is to be placed, or with reinforcing steel and items to be embedded.

3.04 Formwork Reuse

- A. Reuse only forms which provide a hard uniform surface texture on exposed concrete surfaces. Do not use facing materials with raised grain, torn surfaces, worn edges, patches, dents or other defects.
- B. ***Clean and repair surfaces of forms to be reused in the Work.*** Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply light sanding or other surface treatment between uses to obtain such uniform texture. Apply new form-release agent.

- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces.
- D. Plug unused tie rod holes with corks, shave flush, and sandpaper the concrete surface side. Do not patch forms other than filling tie rod holes, except in the case of Class II forms.
- E. Do not use metal patching discs on Class I forms.
- F. Reuse of wooden forms for other than rough finish will be permitted only if a "*like new*" condition of the form is maintained.

3.05 Metal Forms

- A. Metal 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.
- B. All forms shall have the contact surfaces coated with a release agent.

3.06 Shores and Reshores

- A. Comply with ACI 318 (ACI 318M) and ACI 301 for the design, installation and removal of shoring and reshoring.
- B. Do not remove shoring or reshoring until the measurement of slab tolerances is complete.
- C. In multistory construction, extend the shoring and reshoring over a sufficient number of stories to distribute loads in such a manner that no floor member will be exclusively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- D. Plan the sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.07 Tolerances

A. Concrete Tolerances

1. Vertical, lateral, and level alignments and cross-sectional dimensions shall comply with ACI 117.
2. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

Description	Maximum Tolerance
Sleeves and Inserts	+ ¼-inch to - ¼-inch
Projected Ends of Anchors	+ ¼-inch to 0-inch
Anchor Bolt Setting	+ ¼-inch to - ¼-inch
Finished Concrete, all locations	+ ¼-inch to - ¼-inch in 10 feet

3. The planes and axes from which the above referenced tolerances are to be measured shall be as follows:

Description	Measurement Datum
Sleeves and Inserts	Centerline of Sleeve or Insert
Projected Ends of Anchors	Plane perpendicular to the end of the anchor as located on the Contract Drawings
Anchor Bolt Setting	Centerline of the anchor bolt
Finished Concrete, all locations	The concrete surface as located on the Contract Drawings

4. Where equipment is to be installed, comply with the manufacturer's tolerances if more severe than above.
5. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. ***Rejected work shall be repaired or replaced at no additional cost to the Owner.***

B. Form Tolerances

1. Forms shall be surfaced, designed, and constructed in accordance with the recommendations of ACI 347 and shall meet the following additional requirements for the specified finishes.
 2. Formed Surface Exposed to View
 - a. Edges of all form panels in contact with concrete shall be flush within $\frac{1}{32}$ -inch and forms for plane surfaces shall be such that the concrete will be plane within $\frac{1}{16}$ -inch in four (4) feet.
 - b. Forms shall be tight to prevent the passage of mortar, water and grout.
 - c. The maximum deviation of the finish wall surface at any point shall not exceed $\frac{1}{4}$ -inch from the intended surface as shown on the Drawings.
 - d. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number or seams.
 3. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.
 4. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement, and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be ± 1 -inch.
 5. Formed Concrete Surfaces to Receive Paint
 - a. Surface deflections shall be limited to $\frac{1}{32}$ -inch at any point and the variation in wall deflection shall not exceed $\frac{1}{16}$ -inch per four (4) feet.
 - b. The maximum, deviation of the finish wall surface at any point shall not exceed $\frac{1}{8}$ -inch from the intended surface as shown on the Contract Drawings.
- C. Formed Openings shall be of sufficient size to permit final alignment of the items within it without deflection or offsets of any kind and to allow space for packing where the items pass through the wall to ensure water tightness around openings so formed. Provide openings with continuous keyways with waterstops where required, and provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated and specified. Reinforcing steel shall be at least two (2) inches clear from the opening.

D. Embedded Items

1. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions and directions furnished with the items to be embedded.
2. Install anchor rods, accurately located, to the elevations required and complying with the tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges", and hold securely in position in the forms until the concrete is placed and set
3. Install reglets to receive waterproofing and to receive through-wall flashings in the outer face of the concrete frame at exterior walls, where flashing is shown at lintels, shelf angles and other conditions.
4. Install dovetail anchor slots in concrete structures as indicated.
5. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting.
6. Check all nailing, blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to concreting.
7. Coordinate with other trades for items to be embedded in the concrete and not shown on the Contract Drawings.

E. Pipes and Wall Spools Cast in Concrete

1. Install wall spools, wall flanges and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools to the reinforcing steel.
2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will be possible during construction.
3. Pipes or spools located below operating water level shall have waterstop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast. Pipes fitted with thrust rings shall be cast in place.

F. Beveled Edges (Chamfer)

1. ***Form ¾-inch beveled edges on exposed concrete edges and corners, beam soffit corners, and where indicated on the Contract Drawings.***

2. Reentrant corners in concrete members shall not have fillets, unless otherwise shown in the Drawings.
3. The top edges of slabs, walkways, beams, and walls may be beveled with an edging trowel in lieu of using chamfer strips.

3.08 Aluminum Surfaces in Contact with Concrete

- A. ***Coat all aluminum surfaces in contact with concrete in accordance with Section 09900, "Painting".***

3.09 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.
- B. Forms and shoring for elevated structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and reshore.
- C. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed. The time periods indicated in the table include all days except those in which the temperature falls below 40°F:

Description	Normal Strength Concrete	Normal High-Early Strength Concrete	Min. Compressive Strength for Form Removal (% Design Strength)
Cantilevers	12 days	7 days	90%
Over 20 ft between supports	12 days	7 days	90%
Stairways	10 days	5 days	80%
Floor slabs	10 days	5 days	80%
Free standing walls, columns and piers	10 days	5 days	80%
Walls, piers, columns, sides of beams, footings, slabs on grade, and vertical surfaces	2 days	1 day	80%
Front face form of curbs	1 day	0.5 day	70%

- D. Do not remove forms from concrete which has been placed with an outside air temperature below 50°F without first determining if the concrete has properly set without regard for time. Do not apply heavy loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

3.10 Inspection

- A. The Engineer shall be notified when the forms are complete and ready for inspection at least twenty-four (24) hours prior to the proposed placement of concrete.
- B. ***Failure of the forms to comply with the requirements specified herein, or to produce concrete complying with the requirements of these specifications, shall be grounds for rejection of that portion of the concrete work.***
- C. ***Rejected concrete shall be repaired or replaced as approved by the Engineer at no additional cost to the Owner.*** Such repair or replacement shall be subject to the requirements of these specifications and approval of the Engineer.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

1. GENERAL

1.01 Description

- A. The work in this Section consists of providing all labor, materials, equipment and incidentals required to install all steel bars, steel wire and wire fabric required for the reinforcement of concrete, as shown on the Contract Drawings, and as specified herein.
- B. Work Specified Herein: *Provisions of all reinforcement*
- C. Related Work Specified Elsewhere:

Specification Section	Title
00809	American Iron and Steel
03100	Concrete Formwork
03250	Concrete Accessories
03300	Cast-in-Place Concrete
03400	Precast Concrete Structures
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Concrete Institute (ACI)	
ACI 117	Standard Tolerance for Concrete Construction and Materials
ACI 301	Specifications for Structural Concrete for Buildings

STANDARD	DESCRIPTION
American Concrete Institute (ACI) - Cont'd	
ACI 315	Details and Detailing of Concrete Reinforcement Manual
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 350R	Environmental Engineering Concrete Structures
American Society for Testing and Materials (ASTM)	
ASTM A82	Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A184	Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A185	Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A496	Specification for Steel Wire Deformed, for Concrete Reinforcement
ASTM A497	Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A767	Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A775	Specification for Epoxy-Coated Reinforcing Steel Bars
ASTM A884	Specification for Epoxy-Coated Steel Wire & Welded Wire Fabric for Reinforcement
American Welding Society (AWS)	
AWS D1.4	Structural Welding Code - Reinforcing Steel
Concrete Reinforcing Steel Institute (CRSI)	
	CRSI Manual of Standard Practices
Building Codes	
	Florida Building Code
	Local Codes and Regulations

1.03 Submittals

- A. **Submit shop drawings** for review in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples".
- B. **Submit mill test certifications** identifying chemical and physical analyses for each load of reinforcing steel delivered.

- C. **Submit reinforcing bending lists and placing drawings for all reinforcing.** Placing drawings shall include wall elevations, plan views, and sections to clearly show the reinforcing placing procedures. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and reinforcement supports.
- D. **Placing drawings shall indicate all openings** (mechanical, electrical, equipment and architectural), **including additional reinforcing** at openings and intersecting wall, beam and footing arrangements as indicated on the structural drawings and specified herein. Placing drawings shall be coordinated with the concrete placing schedule.
- E. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, deck, floor, beams or roof slabs), including all dowels and other bars required. Furnishing such lists shall not be construed that the list will be reviewed for accuracy.
- F. **The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance** with the details shown on the plans and as specified herein.
- G. Coordinate placing drawings with concrete placing schedule.

1.04 Product Delivery, Storage and Handling

- A. Reinforcement shall be shipped to the Work with bars of the same size and shape fastened in bundles with metal identification tags with waterproof markings giving size and mark securely wired on.
- B. The identification tags shall be labeled with the same designation as shown on the submitted bar lists and shop drawings.
- C. All bars shall be stored off of the ground and shall be protected from moisture and be kept free from dirt, oil, or injurious contaminants.

2. PRODUCTS

2.01 Reinforcement

A. Reinforcement Bars

- 1. Concrete reinforcement in Sizes No. 3 ($\frac{3}{8}$ - inch) and larger shall be deformed steel bars of the same sizes and shapes indicated on the Contract Drawings. The steel

shall be newly rolled stock of domestic manufacture, substantially free from mill scale, rust, dirt, grease, or other foreign matter. Bars shall be of intermediate grade, deformed billet steel conforming to ASTM Specification A-615, Grade 60, deformed, including all supplementary requirements.

2. ***All reinforcing steel shall be manufactured by a firm in the USA (American Iron and Steel (AIS) Regulations apply on this construction project).***
3. Fabricate reinforcing steel in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute (CRSI).
4. Bend all reinforcing steel cold.
5. ***Rail-steel bars will not be allowed in the work.***
6. ***Reinforcement shall be accurately fabricated to the dimensions indicated on the Contract Drawings.*** Particular care shall be exercised not to have stirrups oversized in order to maintain proper coverage of concrete. Stirrups and tie bars shall be made around a pin having a diameter not less than two (2) times the maximum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than five (5) times the minimum thickness of the bar except for bars larger than one (1) inch, in which case the bends shall be made around a pin of eight (8) bar diameters. Bars reduced in section or with kinks or bends not shown on the Contract Drawings will not be accepted.
7. Deliver all reinforcing steel to the Project Site bundled and tagged with identifying tags.

2.02 Welded Wire Fabric (WWF)

- A. Welded wire fabric shall conform to ASTM Specification A-185, galvanized for Welded Steel Wire Fabric for Concrete Reinforcement.
- B. Welded wire fabric shall be furnished in flat sheets, rolled welded wire fabric is not permitted.
- C. Where welded wire fabric is shown but not sized on the Contract Drawing, the Contractor shall use 6 x 6 x W2.1 x W2.1 WWF.

2.03 Wire Tie

- A. Wire tie shall be 16-gauge minimum, zinc coated annealed, conforming to ASTM Specification A82.

2.04 Bar Supports

- A. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place shall be provided and used.
- B. Manufacture bar supports from steel wire, plastic or precast concrete according to CRSI's "Manual of Standard Practice", of greater compressive strength than the concrete as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-coated steel wire or CRSI Class 2 stainless steel bar supports.

2.05 Bar Couplers

- A. Reinforcing steel bar splicing couplers shall be a mechanical type as manufactured by Dayton Barsplice, DYWIDAG, Erico Products, Inc. or approved equal and where approved by the Engineer.
- B. Use couplers which develop 125% of the specified yield strength of the reinforcing bars.
- C. Make field demonstrations and sample splicing prior to splicing bars being included into the work.

2.06 Dowels

- A. Smooth dowels shall be ASTM A615, Grade 60 plain-steel bars.
- B. Cut bars true to length with the ends square and free of burrs.
- C. Threaded dowels shall be ASTM A36.

2.07 Reinforcing Steel Accessories

Bar Supports	CRSI Bar Support Specifications
Plastic Protected	Class 1 - Maximum Protection
Stainless Steel Protected	Class 2 - Maximum Protection
Precast Concrete Block	Precast Blocks

2.08 Fabrication

- A. Do not commence fabrication until receipt of the approved shop drawings from the Engineer.
- B. Fabricate reinforcing steel in accordance with all requirements of the specified standards and within CRSI tolerances, and unless otherwise indicated, with the following: (1) Provide standard books; (2) **Extend bottom bars a minimum of six (6) inches into supporting members**; (3) Provide cover indicated to the outermost stirrup, tie or bar; (4) Provide splices only where indicated on the Contract Drawings.

3. EXECUTION

3.01 Installation

A. General

- 1. On porous subgrade or beddings, provide a vapor barrier as specified in Section 03300, "Cast-in-Place Concrete" and Section 07050, "Vapor Barrier". **Do not cut or puncture the vapor barrier.** Repair any damage and reseal the vapor barrier prior to placing concrete.
- 2. Comply with CRSI's "Manual of Standard Practice" and ACI 315 for placing concrete reinforcement.

- B. Securely tie and support reinforcement to prevent displacement during concrete placement.

C. Fastening Devices for Other Work

- 1. Coordinate with other trades and properly place and locate in position all necessary reinforcement, dowels, bolts, anchors, anchor slots, inserts, hangers, metal ties, and other fastening devices required for attachment and support to adjacent work.
- 2. Securely anchor all fixtures and embedded items.

- D. Surface condition, bending, spacing, and tolerances of placement of reinforcement shall comply with the Concrete Reinforcing Steel Institute (CRSI). The Contractor shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Contract Drawings.

- E. Place reinforcing in accordance with the following, unless otherwise indicated on the Contract Drawings:

1. **Reinforcement indicated on the Contract Drawings is continuous throughout the structure(s) to the farthest extent possible.**
2. Unless otherwise shown, **install reinforcement with the following clearances for concrete coverage:**

Description	Minimum Clearance
Beams and Girders	Two (2) inches outside of ties
Solid Slabs and Joists	Two (2) inches top and side; Three (3) inches cover placed against earth
Columns	Two (2) inches outside of ties
Walls	Two (2) inches top and sides
Grade Beams and Footings	Three (3) inches outside of steel, side and bottom, when cast against earth two (2) inches top and sides

3. Reinforcing steel, before being positioned and just prior to placing concrete, shall be free from loose mill and rust scale, earth, ice, foreign materials and from any coatings that may destroy or reduce the bond. Clean reinforcing steel by sandblasting or wire brushing and remove mortar, oil, paint, or dirt to remove materials that may reduce the bond.
4. 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.
5. **Do not straighten or rebend reinforcing steel in the field.** Do not use reinforcing with bends not shown on the Contract Drawings.
6. **Place reinforcement a minimum of two (2) inches clear of any metal pipe or fitting, unless noted otherwise on drawings.**
7. Position reinforcing steel in accordance with the Contract Drawings and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms to provide the specified concrete coverage. Bars additional to those shown on the Contract Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position, shall be provided by the Contractor at no additional cost to the Owner.
8. **Set wire ties with ends directed into the concrete**, not towards exposed concrete surfaces.

9. **Securely support and tie reinforcing steel to prevent movement during concrete placement** by using zinc coated wire ties of not less than No. 16 gauge or suitable clips at intersections. Secure dowels in place before placing concrete.
 10. **Place reinforcement a minimum of two (2) inches clear of any metal pipe or fittings**, unless noted otherwise on drawings.
 11. **Secure reinforcing dowels in place prior to placing concrete.** Do not press dowels into the concrete after the concrete has been placed.
- F. Support and tie wire mesh to prevent movement during concrete placement.
- G. Wire dowels in position prior to placing concrete. Position dowels for masonry walls to occur at reinforced block cells.
- H. **No reinforcing steel bars shall be welded** either during fabrication or erection unless specifically shown on the Contract Drawings or specified, 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.
- I. 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.
- J. Placement of flat sheet welded wire mesh
1. Install welded wire mesh reinforcement in the longest practicable lengths on supports spaced to minimize sagging.
 2. Support and tie mesh to prevent movement during concrete placement.
 3. Support welded wire fabric by high chairs or bolster with baseplates, all plastic supports, and concrete blocks.
 4. It is not permissible to place the WWF on the subbase and pull it up or lay the WWF on top of the concrete and walk it into the concrete.
 5. Extend fabric to within two (2) inches of the edges of the slab and lap splices at least in accordance with ACI 318 but not less than twelve (12) inches. Tie laps and splices securely at ends and at least every twenty-four (24) inches with 16 gauge annealed steel wire.

6. Do not extend fabric through expansion joints or construction joints in slabs on grade except as otherwise indicated.
- K. **Reinforcing steel bars shall not be field bent except where shown on the Contract 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 approved by the Engineer. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Contract Drawings.

3.02 Additional Reinforcement around Openings

- A. Unless specific additional reinforcement around openings is shown on the Contract 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.
- B. The bars shall have sufficient length to develop a 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 thirty (30) bar diameters, but not less than twelve (12) inches.** The lap splice length for column vertical bars shall be based on the bar size in the column above. Splice horizontal bars in circular structures forty (40) bar diameters. Provide splices and laps in columns, piers and struts in a manner sufficient to transfer full stress bond. When splicing bars of different diameters, the length of lap is based on the larger bar. Stagger splices in adjacent bars.
- B. **Tension lap splices shall be provided at all laps in compliance with the applicable tables in ACI 315.** Splices in adjacent bars shall be staggered. Class A splices shall be used when 50 percent (50%) or less of the bars are splices within the required lap length. Class B splices shall be used at all other locations.
- C. Except as otherwise indicated on the Contract Drawings, splices in circumferential reinforcement in circular walls shall be Class B tension splices and shall be staggered. Adjacent bars shall not be spliced within the required lap length.
- D. **Install wire fabric in as long lengths as practicable.** Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI-318 but not less than twelve

(12) inches. The spliced fabrics shall be tied together with wire ties spaced not more than twenty-four (24) inches on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.

3.04 Accessories

- A. ***The Contractor shall be solely responsible for determining, providing and installing accessories such as chairs, chair bars, and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.***
- B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.
- C. ***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 Contract Drawings or specified.
- 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.***
- B. ***The Engineer shall be given at least twenty-four (24) hours advance notice of the readiness of placed reinforcement for observation.***
- C. The forms shall be kept open until the Engineer has finished his observations of the reinforcing steel.

END OF SECTION

SECTION 03250

CONCRETE ACCESSORIES

1. GENERAL

1.01 Description

A. The Work included in this Section consists of all labor, materials and equipment necessary to install expansion joints, construction joints, and waterstops.

B. Work Specified Herein

1. Construction and Expansion joints
2. Anchors and inserts
3. Waterstops

C. Related Work Specified Elsewhere

Specification Section	Title
00809	American Iron and Steel
03100	Concrete Formwork
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete
03800	Leakage Testing of Hydraulic Structures
07900	Joint Sealants
Contract Drawings and General Provisions of the Contract	

1.02 Submittals

A. Materials

1. Submit manufacturer's literature, materials and samples of waterstops and supports for reinforcing bars in accordance with the Section 00700, "General Conditions",

Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples", including a statement of compliance with ASTM and U.S. Federal Specifications.

2. The manufacturer shall demonstrate a minimum of five (5) years of continuous, successful experience in their product line.
 3. Provide product data including catalog cut sheets, technical data, storage requirements, splicing methods, installation and application requirements, location of use, product life, and conformance to ASTM standards for the following items:
 - a. Waterstops.
 - b. Premolded Joint Fillers.
 - c. Bond Breaker and Bonding Agents.
 - d. Expansion Joint Dowels (include, in addition to the above, complete assembly including dowels, coatings, lubricants, spacers, sleeves, expansion caps).
 - e. Compressible Joint Filler.
 - f. Tongue and Groove Joint Forms.
- B. ***The Contractor shall provide certifications from the manufacturers that all materials used within the joint system are compatible with each other.***
- C. Provide technical data sheets for the Contractor's personnel, Engineer and the Owner covering joint preparation, priming, and sealant materials application.
- D. Submit layouts for construction joints as noted on the Contract Drawings.

1.03 Reference Standards

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM) - Cont'd	
ASTM C1059	Latex Agents for Bonding Fresh to Hardened Concrete
ASTM D1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D1752	Preformed sponge rubber and cork expansion joint fillers for concrete paving and structural construction
U.S. Army Corps of Engineers (CRD)	
CRD C572	Specification for Polyvinylchloride Waterstops

1.04 Delivery, Storage and Handling

- A. Store all products in accordance with the manufacturer's recommendations.
- B. Waterstops shall be protected from moisture, oil, dirt, sunlight and other contaminants.

1.05 Manufacturer's Services

- A. Prior to joint preparation for joints receiving sealant materials, the Contractor shall require that the joint manufacturer's technical representative demonstrate, at the Project Site, joint preparation, priming, and sealant materials application for the Contractor's personnel performing joint work.

2. PRODUCTS

2.01 PVC Waterstop

- A. Provide ribbed, dumbbell-type waterstops at construction joints exposed to water pressure, including groundwater pressure, and other joints as indicated on the Contract Drawings.
- B. **All waterstop shall be embedded in concrete** to prevent the passage of fluids through joints and shall be resistant to oils, solvents and chemicals.
- C. Waterstops shall comply with U.S. Army Corps of Engineers Specification CRD-C-572.
- D. Waterstops shall be such that any cross section will be dense, homogeneous, free from porosity and other imperfections, and shall be symmetrical in shape.

- E. Waterstops shall be extruded from a PVC compound and shall be 9 inches x ½-inch, non-tapered, ribbed profile for wall thicknesses of 12-inches and greater, and 6 inches x ¾-inch for wall thicknesses less than 12 inches. **Provide a 6-inch split-ribbed waterstop with center bulb at all connections of new concrete structures with existing concrete.**
- F. All waterstop material shall be extruded from virgin elastomeric PVC compound, resistant to chemical action-with portland cement, alkalies, acids, and not affected by mildew or fungi. It shall show no effect when immersed for ten (10) days in a 10% solution of sulfuric or hydrochloric acid, saturated lime solution or salt water.
- G. Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the Work include, but are not limited to, the following:
1. The Burke Company
 2. Greenstreak Plastic Products Company
 3. Meadows, Inc.
 4. Progress Unlimited, Inc.
 5. Schlegel Corporation
 6. Vinylex Corporation
 7. Or approved equal
- H. When tested in accordance with Federal Standard No. 601, the material shall meet the following minimum requirements:

Requirement	ASTM Specification
Tensile strength (2,000 psi)	D 638
Hardness, Shore Durometer (65 - 80)	D 2240
Elongation, ultimate (280%)	D 638
Water absorption, dry wt, maximum (48 hours) - 0.32%	D 570
Specific gravity, 1.3	D 792
Stiffness in flexure, 920 psi	D 747
Cold brittleness, -35°F	D 746
Tear resistance, 290 lbs/inch	D 624

- I. **The use of reworked PVC or other substitute material will not be permitted.**

2.02 Joint Sealant for Concrete Structures

- A. Joint sealant for continuous immersion shall be a multi-part, gray, non-staining non-sagging, polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant rubber.
- B. The joint sealant shall meet U.S. Federal Specification TT-S-00227E(3) Type I, Class A self-leveling for horizontal joints and Type II, Class A, non-sag for vertical joints.
- C. In addition, the joint sealant must be recommended by the manufacturer for continuous immersion in water and said certification submitted to the Engineer along with the shop drawing submittal.
- D. Provide sealants as manufactured by Products Research and Chemical Corporation, Mameco International, The Burke Company, W.R. Meadows, or approved equal.
- E. Technical Requirements

Parameter	Requirement
Consistency	Gun grade
Tack free time	24 hours at 75°F and 50% R.H.
Pot life	1 - 3 hours
Hardness	35 Shore A, ±15
Elongation	500%
Tensile strength, ASTM D 412	300 psi
Peel strength on concrete	No loss of bond after 24 hours at 150% elongation
Temperature service range	-40°F to +155°F
Immersion in water	Continuous

2.03 Backing Rod for Expansion Joints

- A. Backing rod shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware, or approved equal.
- B. The rod shall be ¼-inch larger in diameter than the joint width. Where possible, provide full length sections for the joint and minimize splices. Apply backup rod and bond breaker tape in expansion joints.

2.04 Bond Breaker Tape

- A. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler material or concrete surface as required.
- B. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.
- C. Bond breaker for concrete other than where tape is specifically called for shall be either bond breaker tape or a *non-staining* type bond prevention coating.

2.05 Preformed Control Joint

- A. Preformed control joint shall be a one-piece, flexible, PVC joint former, such as Kold-Seal Zip-Per Strip KSF-150-50-50, manufactured by Vinylex. Corp., Knoxville, TN, or equal.
- B. Provide the preformed control joint material in full length *unspliced* pieces.

2.06 Premolded Joint Filler

A. Structures

- 1. Joint filler shall be preformed, non-extruded type constructed of closed-cell neoprene conforming to ASTM D 1752, Type I, as manufactured by W. R. Grace Company of Cambridge, MA; W. R. Meadows, Inc., Elgin, IL; or approved equal.
- 2. ***The thickness shall be ¾-inch, minimum.***

B. Sidewalk and Roadway Concrete Pavements

- 1. Joints where fiber is specifically noted on the Contract Drawings, shall be asphalt-impregnated fiber board. Joint filler shall conform to ASTM D 1751.
- 2. Thickness shall be ¾-inch unless otherwise shown on the Contract Drawings.

- C. Bituminous type, if approved, shall conform to the requirements of ASTM D 994.

2.07 Expansion Joint Dowels

- A. Steel expansion joint dowels shall conform to one of following:
 - 1. Epoxy coated steel bar dowels with a 12-mil coating thickness. Steel bar dowels shall conform ASTM A-615, Grade 60. The epoxy coating shall be in conformance with ASTM A 775; or
 - 2. Stainless-steel bar dowels conforming to ASTM A Type 302.
- B. Dowels shall be straight and clean, free of loose flaky rust and loose scale.
- C. Expansion joint shall be thoroughly greased prior placing adjoining wall or slab concrete.
- D. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end.

2.08 Epoxy Adhesive

- A. Epoxy adhesive shall be a two-component, solvent-free, moisture insensitive, epoxy resin material for use on dry or damp surfaces, conforming to ASTM C881. Provide the material type, grade and class to suit Project requirements.
- B. Subject to compliance with requirements, products that may be incorporated in the Work, include, but are not limited to, the following:
 - 1. Burke-Epoxy M.V., The Burke Company
 - 2. Spec-Bond 100, Conspec Marketing and Manufacturing Company
 - 3. Resi-Bond (J-58), Dayton Superior
 - 4. Euco Epoxy System #452 or #620, Euclid Chemical Company
 - 5. Epoxite Binder 2390, A.C. Horn, Inc.
 - 6. Concessive Standard Liquid, Master Builders, Inc.
 - 7. Rezi-Weld 1000, W.R. Meadows, Inc.
 - 8. Sikadur 32 Hi-Mod, Sika Corporation
 - 9. Metco Hi-Mod Epoxy, Metalcrete Industries

2.09 Bonding Agent

- A. Bonding agent shall be a non-reemulsifiable, acrylic emulsion or styrene butadiene conforming to ASTM C1059. Provide the material type, grade and class to suit Project requirements.

- B. Subject to compliance with requirements, products that may be incorporated in the Work, include, but are not limited to, the following:
1. Acrylic Bondcrete, The Burke Company
 2. Strongbond, Conspec Marketing and Manufacturing Company
 3. Day-Chem Ad Bond, Dayton Superior
 4. SBR Latex, Euclid Chemical Company
 5. Hornweld, A.C. Horn, Inc.
 6. Acryl-Set, Master Builders, Inc.
 7. Intralok, W.R. Meadows, Inc.
 8. Daraweld, W.R. Grace & Company
 9. Acrylpave, Metalcrete Industries

2.10 Compressible Joint Filler

- A. The joint filler shall be a non-extruded watertight strip material used to fill expansion joints between structures. The material shall be capable of being compressed at least forty (40) percent for seventy (70) hours at 68°F and subsequently recovering at least twenty (20) percent of its original thickness in the first one-half hour after unloading.
- B. Compressible Joint Filler shall be Evasote 380 E.S.P., by E-Poxy, Ravena, NY, or equal.

2.11 Fuel Resistant Joint Sealant

- A. Sealant shall conform to Federal Specification SS-S-1614.

2.12 Styrofoam Filler Block

- A. Styrofoam filler blocks for future construction and expansion joints shall be Styrofoam SM brand as manufactured by Dow Chemical Company, or equal.

2.13 Precast Concrete Block Supports for Reinforcing Bars

- A. Comply with the requirements of ACI 318.
- B. Provide blocks with No. 4 dowels bent 90° to support top bars.

2.14 Vapor Barrier

- A. The vapor barrier for the Project Work is specified in Section 07050, "Vapor Barrier".

2.15 Tongue and Groove Joint Forms

- A. Twenty-four (24) gauge steel forms complete with steel stakes and splice plates, designed for joints not to receive a poured seal, and equal to Burke Keyed Kold Joint as manufactured by The Burke Company.

2.16 Inserts

- A. Galvanized steel to fit the proposed hanger and support

3. EXECUTION

3.01 Vapor Barrier

- A. Examine the substrate and the conditions under which the vapor barrier work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Proceed with installation of the vapor barrier only after substrate construction and penetrating work have been completed.
- C. ***The vapor barrier shall be applied parallel with the direction of the concrete pour, lapping adjacent sides and ends a minimum of twelve (12) inches.*** Do not puncture the vapor barrier. The Contractor shall refer to Section 07050, "Vapor Barrier".
- D. ***Seal all joints with continuous approved 2-inch wide plastic tape.***

3.02 Precast Concrete Block Supports for Reinforcing Bars

- A. Provide in sufficient quantity to support reinforcing bars in slabs formed on earth at a ***spacing not to exceed four (4) feet on centers in both directions.***

- B. **Provide blocks with dowels to support top bars.** Block supports are not required in slabs formed on tremie concrete, but may be used at the Contractor's option.
- C. Blocks are not required for reinforcing bars properly supported from formwork.
- D. At other locations, the Contractor shall refer to ACI 315 and CRSI MSP-1.

3.03 PVC Waterstops

- A. Waterstops shall be of the shapes, dimensions, and profiles presented herein.
- B. **Waterstops shall be properly heat spliced at ends and intersections to ensure continuity.** Construct forms for construction joints in such a manner as to prevent injury to waterstops. Install waterstops in construction and expansion joints in hydraulic structures which will contain liquid or resist the entry of groundwater.
- C. **Make field splices with a thermostatically controlled heating iron** in conformance with the manufacturer's current recommendations. Allow at least ten (10) minutes before pulling or straining the new splice in any way. The finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80% of the unspliced materials.
- D. **Center waterstop in the construction joint and secure water in the correct position** using hog rings or grommets spaced at twelve inches (12") on center along the length of the waterstop and wire tie to the adjacent reinforcing steel.
- E. Provide factory made waterstop fabrications for all **changes of direction, intersections, and transitions** leaving only straight butt joint splices for the field.
- F. Protect waterstops from dirt, oil, foreign materials and concrete spatter.

3.04 Joints

A. General

- 1. Construct joints true to line and faces perpendicular to the surface plane of the concrete.

B. Construction Joints

- 1. Locate and install construction joints so that they **do not impair the strength or appearance of the concrete and/or structure**, as acceptable to the Engineer.

Place joints perpendicular to the main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through the sides of strip placements of floors and slabs.

2. Form keyed joints as indicated. Form keyways by beveled strips or boards placed at right angles to the direction of shear. Embed keys at least three (3) inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the **middle third of spans**. Offset joints in girders a minimum distance of twice the beam width from a beam girder intersection.
4. Locate horizontal joints in walls and columns at the underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. **Use a bonding agent** at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
6. Provide construction joints where shown on the Contract Drawings, or as recommended by the Contractor and approved by the Engineer. In the event of an emergency, place additional construction joints. An interval of forty-five (45) minutes between two (2) consecutive batches of concrete shall constitute cause for an emergency construction joint.
7. After the pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material, and expose clean aggregate by sandblasting the surface of construction joints before placing the new concrete. At least two (2) hours before and again shortly before the new concrete is deposited, the joints shall be saturated with water. After the glistening water disappears, the joints shall be given a thorough coating of neat cement slurry mixed to a consistency of very heavy paste. The surface shall receive a coating of at least 1/8-inch thick, well scrubbed-in by means of stiff bristle brushes where possible. New concrete shall be deposited before the neat cement dries.
8. Layout of construction joints shall be in accordance with the following guidelines:
 - a. Provide horizontal construction joints at the top of foundation members and slabs on grade and at the soffit of supported slabs and beams.
 - b. **Space the corner vertical construction joints between 4 - 8 feet from the corner of walls or intersections**, unless noted otherwise on the Drawings.
 - c. **Space the construction joints at a maximum horizontal distance of twenty-five (25) feet and a maximum vertical distance of sixteen (16) feet**, unless noted otherwise on the Contract Drawings.

- d. **Space horizontal construction joints at least eight (8) inches below the bottom of slabs**, unless noted otherwise on the Contract Drawings.

C. Waterstops

1. Provide waterstops in construction joints as indicated. **Install waterstops to form a continuous diaphragm in each joint.** Support and protect exposed waterstops during the progress of the Work.

D. Contraction Joints in Slabs-on-Grade

1. Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth ($\frac{1}{4}$) of concrete thickness as follows:
 - a. Sawed Joints
 - 1) Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades.
 - 2) Cut $\frac{1}{8}$ -inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

E. Isolation Joint in Slabs-on-Grade

1. After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
2. Extend joint-filler strips full-width and the depth of the joint, terminating flush with finished concrete surface, unless otherwise indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

F. Doweled Joints

1. Install dowel bars and support assemblies at joints where indicated.
2. Lubricate or asphalt coat one-half ($\frac{1}{2}$) of the dowel length to prevent concrete bonding to one side of the joint.

- G. For control joints of nonstructural slabs, provide partial depth plastic strips set flush with finished surface or $\frac{1}{8}$ -inch-wide joints cut with a diamond saw. Use control joints one-quarter to one-third the depth of the slab unless otherwise indicated.
- H. For slabs-on-grade that are not subject to hydraulic loading, use formed construction joints. Maximum size of pour shall be fifteen (15) feet each way for slabs with wire mesh reinforcement and thirty (30) feet each way for slabs with bar reinforcement. Allow 24 hours between pours of adjacent slabs. Provide joints as specified or shown. Set continuous expansion joint strips between slabs and abutting vertical surfaces.
- I. When it is necessary to make a joint because of an emergency, furnish and place reinforcing dowels across the joint. Embed dowels 48 bar diameters each side of the joint. The size and number of dowels shall match the reinforcing in the member. Furnishing and placing such reinforcing steel shall be at the Contractor's expense.

3.05 Bonding at Construction Joints

- A. ***Before depositing new concrete on or against concrete that has set, thoroughly clean the surfaces of the set concrete so as to expose the coarse aggregate and remove laitance coatings, foreign matter and loose particles.***
- B. Retighten the forms.
- C. Dampen, but do not saturate the hardened concrete of joints and then thoroughly cover with a coat of cement grout of similar proportions to the mortar in the concrete.
- D. Place the fresh concrete before the grout has attained its initial set.

3.06 Expansion Joints

- A. Construct joints true to line and faces perpendicular to the surface plane of the concrete.
- B. Provide expansion joints with continuous edge reservoirs, which shall be filled with a joint sealant. Leave the material used for forming the reservoirs in place until immediately before the grooves are cleaned and filled with joint sealant.
- C. After removing edge forms from the reservoir, remove grout, loose concrete, and fins; then sandblast the slots. Allow the reservoirs to become thoroughly dry; then blow out the reservoirs and immediately prime and fill with the expansion joint sealant and backup materials. The primer used shall be supplied by the same manufacturer supplying the joint sealant.

3.07 Time Between Pours

- A. ***At least two (2) hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon.***
- B. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system.

3.08 Installation of Premolded Joint Filler

- A. Install in joint accurately as indicated in the manufacturer's instructions.
- B. Attach the premolded joint filler to the concrete with a bonding agent recommended by the joint sealant and joint filler manufacturer for compatibility.

3.09 Installation of Joint Sealants

- A. Immediately before installing the joint sealant, clean the joint cavity by sandblasting or power wire brushing. Install bond breaker tape per manufacturer's instructions.
- B. After the joints have been prepared as described above, apply the joint sealant. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer.
- C. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.
- D. Apply masking tape along the edges of the exposed surface of the exposed joints. Trowel the joints smooth with a tuck pointing tool wiped with a solvent recommended by the sealant manufacturer.
- E. After the sealant has been applied, remove the masking tape and any sealant spillage.

3.10 Cracking

- A. ***Saw joints in slabs before the formation of uncontrolled cracking*** (i.e., cracking that occurs at locations other than construction, control, or contraction joints) and as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing. Saw joints both during the day and night as required.

- B. *If concrete cracks at locations other than construction, control, or contraction joints, the Contractor may be required to remove and replace the defective work (cracked concrete) in accordance with the provisions of this section, all at no additional cost to the Owner.***

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE

1. GENERAL

1.01 Description

- A. The Contractor shall furnish all labor and materials required and install cast-in-place concrete complete as shown on the Contract Drawings and as specified herein. The Work specified herein includes, but is not limited to, concrete mixtures, mixing, transporting, placement schedule, depositing, consolidating, slab finishing, curing, and formed surface finishing.
- B. All concrete to be used in the construction of the Sanford Main WTP Improvements project shall be **Class A concrete (see Table 3300-A)** and shall have a 28-day compressive strength of **4,000 psi** (unless otherwise noted on the Contract Drawings).
- C. Related Work Specified Elsewhere

Specification Section	Title
02200	Earthwork
02720	Concrete Sidewalks, Driveways and Pads
03100	Concrete Formwork
03200	Concrete Reinforcement
03250	Concrete Accessories
03400	Precast Concrete Structures
03800	Leakage Testing of Hydraulic Structures
07900	Joint Sealants
09900	Painting
Contract Drawings and General Provisions of the Contract	

- D. Cementitious Materials shall be defined as Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.02 Quality Assurance

A. Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the latest revision of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

STANDARD	DESCRIPTION
American Concrete Institute (ACI)	
ACI-211	Proportions for Normal, Heavyweight and Mass Concrete
ACI-212	Guide for Use of Admixtures in Concrete
ACI-301	Specifications for Structural Concrete for Buildings
ACI-304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI-305	Hot Weather Concreting
ACI-306	Cold Weather Concreting
ACI-308	Standard Practice for Curing Concrete
ACI-309	Recommended Practice for Consolidation of Concrete
ACI-318	Building Code Requirements for Reinforced Concrete
ACI-347	Guide for Concrete Formwork
ACI-350	Environmental Engineering Concrete Structures
American Society for Testing and Materials (ASTM)	
ASTM-C31	Making and Curing Concrete Test Specimens in the Field
ASTM-C33	Concrete Aggregates
ASTM-C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM-C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM-C94	Standard Specification for Ready-Mix Concrete
ASTM-C143	Slump for Portland Cement Concrete
ASTM-C150	Standard Specification for Portland Cement
ASTM-C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM-C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM-C173	Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM-C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM-C260	Air Entraining Admixtures for Concrete

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM) - Cont'd	
ASTM-C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM-C494	Chemical Admixtures for Concrete
ASTM-C618	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
Other Standards and Codes	
	Florida Building Code
	Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice"

B. Manufacturer's Qualification

1. A firm experienced in the manufacturing of ready-mixed concrete products and that complies with ASTM C-94/C-94M requirements for production facilities and equipment.
2. The manufacturer shall be certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" and ASTM C-94.

C. Installer Qualifications

1. A qualified installer who employs project personnel qualified as ACI-certified Flatwork Technicians and Finishers and a supervisor who is an ACI-certified Concrete Flatwork Technician.
2. The Concrete Installation Firm shall have at least five (5) years of experience, under the current corporate name, in performing concrete work of high quality, including forming, color, texture and finishing and of the size and complexity of this Project.

D. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of concrete will be in accordance with ACI-318.
2. ***All structures that will contain either water or wastewater shall be watertight and shall be free from any perceptible leakage, as determined by the Engineer.***

E. Testing Agency Qualifications

1. An independent agency, qualified according to ASTM C-1077 and ASTM E-329 for the testing indicated, as documented according to ASTM E-548.

2. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01, or an equivalent certification program.
3. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. The Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
4. Provide testing in accordance with Section 01410, "Testing and Testing Laboratory Services" and Article 3.11 of this Section. The Contractor shall keep the testing laboratory informed of the testing schedule.
5. The Contractor shall engage a qualified testing agency to perform evaluation tests and to design concrete mixtures.

F. Source Limitations

1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

1.03 Submittals

A. Shop Drawings, Samples and Certifications

1. Samples and certifications shall be submitted in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples", and as directed by the Engineer. Unless otherwise indicated, submit certifications for all products and samples as may be specifically requested by the Engineer.

B. Plant Qualification

1. Submit certification from the National Ready Mixed Concrete Association indicating compliance with the specified qualification requirements and ASTM C-94.

C. Materials

1. Satisfactory evidence shall be submitted indicating that the materials to be used, including cement, aggregates, admixtures, etc., meet the specified requirements.

2. Provide catalog data, chemical and mechanical analyses, and conformance with ASTM requirements for the following:
 - a. Sources of cement, pozzolan and aggregates.
 - b. Air-entraining admixture.
 - c. Water reducing admixture.
 - d. High range water-reducing admixture (plasticizer).
 - e. Sheet curing material.
 - f. Liquid curing compound.
3. ***Provide certificates that aggregates comply with ASTM C33 and contain no asbestos.*** State weathering region limits of coarse aggregates (severe, moderate, or negligible). State the basis of determining that potential reactivity is negligible. Identify certifications and tests actual materials to be used in the Work. Provide additional tests and certifications for each change in material source. Provide an alternate material source of aggregate if test indicate that aggregates are reactive or possess severe weathering potential. ***Submit a gradation analysis with the concrete design mixes.***
4. Design Mix
 - a. ***Prepare mix designs in accordance with ACI 318-95, Chapter 4, except as modified herein.*** The design mix(es) to be used shall be prepared by qualified persons and submitted for approval at least fifteen (15) days before placing any concrete. The design of the mix is the responsibility of the Contractor subject to the limitations of the Specifications.
 - b. Approval of this submission will be required only in that the minimum requirements of the specifications have been met. Such approval will in no way alter the responsibility of the Contractor to furnish concrete meeting the requirements of the specifications relative to strength and slump.
 - c. ***Provide a certificate*** that the cement used complies with ASTM C-150 and these specifications.
 - d. Submit alternate design mixtures when the characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
 - e. Indicate amounts of mixing water to be withheld for later addition at the Project Site.

D. Delivery Tickets

1. **Provide delivery tickets for ready-mix concrete**, per ASTM C-94, indicating the following:
 - a. Date and time leaving the plant.
 - b. Truck number
 - c. Type of cement and weight
 - d. Weight of each size aggregate
 - e. Quantity of water and time added
 - f. Water/cement Ratio
 - g. Admixtures and weight
 - h. Class of Concrete
 - i. Site arrival time
 - j. Site leaving time
 - k. Type of fly ash and weight.

E. Epoxy Bonding Compound

1. Provide epoxy bonding compound manufacturer's specific instructions for use.
2. Provide manufacturer's certifications as to the suitability of the product to meet the job requirements with regard to surface, pot life, set time, vertical and horizontal application, and forming restrictions.

F. Non-Shrink Grout

1. Provide non-shrink grout manufacturer's certificate of compliance with these specifications.
2. Provide non-shrink grout manufacturer's specific instructions for use.

- G. **Submit a report from a testing laboratory, in a PDF format**, verifying that aggregate and gravel material contains no asbestos and conforms to the specified gradations and characteristics.

H. Placement Schedule Certification

1. **Submit at least twenty-four (24) hours before placing concrete, a signed certification providing the following:**
 - a. Exact location and portion of the structure to be placed.
 - b. Date and time that the concrete is to be placed.

- c. The type of concrete to be used (mix) and the method to be used in placing the concrete.
 - d. The estimated quantity of concrete to be placed.
 - e. That the line and grade have been checked and grade properly compacted.
 - f. That location, type, size and spacing of reinforcement has been checked and conform to the Contract Drawings.
 - g. That any waterstops, construction joints, contraction and expansion joints, or seals have been placed and conform to the Contract Documents.
 - h. That any embedded pipes have been placed, are the correct size and type and conform to the Contract Documents.
 - i. That any embedded conduits, grounding wires or receptacles have been placed, are the correct size and type and conform to the Contract Documents.
 - j. That any embedded anchor bolts, bearing plates, dowels, etc., are in place, are of the correct size and are located as indicated on the Contract Documents.
 - k. That all forms are properly located and adequately braced.
- I. Hot and Cold Weather concreting plans shall be submitted in accordance with Article 1.05 of this specification section.
- J. ***A pouring plan shall be submitted by the Contractor to the Engineer for approval showing the location of all construction joints.***

1.04 Sample Pattern Concrete Wall Panel - NOT USED

1.05 Hot, Cold and Adverse Weather Conditions

- A. Hot and cold weather concreting plans shall include the curing method and specific curing plan, ready-mixed supplier plan, contingency plans, and materials list as a minimum.
- B. All hot weather plans shall meet the requirements of ACI 305.
- C. All cold weather plans shall meet the requirements of ACI 306.

- D. Do not mix salt, chemicals, or other foreign materials with the concrete to prevent freezing without approval of the Engineer. Maintain the temperature of concrete above 50°F for five (5) days after placement. When high early strength portland cement concrete is used, the temperature shall not be less than 70°F for two (2) days or 50° F for three (3) days. Transition the concrete to the outside temperature at a rate of 1°F each hour for the first twenty-four (24) hours and 2°F each hour thereafter.
- C. ***In no case shall the temperature of the concrete exceed 90°F at the time of placement.*** If insulated forms are used, the temperature of the concrete mixture shall not exceed 80° F at time of placement.
- D. If the Engineer determines that heat of hydration may cause excessive concrete temperatures and subsequent detrimental effects, the concrete mixture shall not exceed 60°F at time of placement for critical pours.

2. PRODUCTS

2.01 Cementitious Material

- A. Cement for all concrete shall be domestic Portland cement that conforms to the requirements of ASTM Designation C-150 Type I, Type II, or Type III, gray.
- B. Type I cement may be used for buildings, pipe encasements and tremie concrete. All manholes, wet wells, valve/meter vaults, pumping stations, and structures exposed to water or wastewater shall be constructed with Type II cement. Type III cement for high early strength concrete shall be used only for special locations and only with the approval of the Engineer.
- C. ***Only one (1) brand of cement shall be used in any individual structure unless approved by the Engineer.*** Cement which has become damaged, partially set, lumpy or caked shall not be used and the entire contents of the sack or container which contains such cement will be rejected. No salvaged or reclaimed cement shall be used.
- D. ***The maximum tricalcium aluminate content shall not exceed eight (8) percent. The maximum percent alkalies shall not exceed 0.6%.***

2.02 Fly Ash

- A. ***Fly ash shall be Class F conforming to the requirements of ASTM C-618, including the requirements of Table 1 except the loss of ignition, LOI, shall be limited to three percent (3%), maximum.***

- B. ***Fly ash shall not exceed twenty percent (20%)*** of the cementitious content of the mix.
- C. Use one brand of cement and fly ash throughout the Project unless otherwise acceptable to the Engineer.

2.03 Aggregates

- A. ***Aggregates shall comply with ASTM C-33 and shall contain no asbestos and be free from any substances that will react with the cement alkalies.***
- B. Coarse aggregates shall be Size No. 67 ($\frac{3}{4}$ -inch). Use Size No. 8 for filling of the cells of masonry units.
- C. Fine aggregate shall be free of materials with deleterious reactivity to alkali in cement.
- D. In addition to requirements of ASTM C-33 for structures exposed to wastewater the following shall apply:

Description	Maximum Content
Soft particles	< 2.0 %
Chert as a soft impurity (defined in Table 3 of ASTM C-33)	< 1.0 %
Total of soft particles and chert as a soft impurity	< 2.0 %
Flat and elongated particles (Long dimension greater than 5 times short dimension)	< 15.0 %

- E. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

2.04 Water and Ice

- A. ***Use water and ice that is of potable water quality***, clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities that might reduce the strength, durability, or otherwise adversely affect the quality of the concrete.
- B. Water shall be in compliance with the requirements of ASTM C-94 / C-94M.

2.05 Air Entraining Admixture

- A. **The concrete shall contain an air entraining admixture.** The admixture shall conform to ASTM C-260, except it shall be **non-toxic** after thirty (30) days and shall **contain no chlorides**, and shall be certified by the manufacturer to be compatible with other required admixtures.
- B. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Monex Air or Monex NVR, Monex Resources, Inc.
 2. Air-Tite, Cormix Construction Chemicals
 3. Air-Mix or Perma-Air, Euclid Chemical Company
 4. Darex AEA or Daravair, W.R. Grace & Company
 5. MB-VR or Micro-Air, Master Builders, Inc.
 6. Sealtight AEA, W.R. Meadows, Inc.
 7. Sika AER, Sika Corporation
 8. Or Equal

2.06 Water Reducing and Retarding Admixtures

A. Water-Reducing Admixture

1. **Water Reducing Admixtures shall conform to ASTM C-494, Type A or D.**
2. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Monex Resources, Inc.
 - b. Chemtard, ChemMasters Corporation
 - c. PSI N, Cormix Construction Chemicals
 - d. Eucon WR-75, Euclid Chemical Company
 - e. WRDA, W.R. Grace & Company
 - f. Pozzolith Normal or Polyheed, Master Builders, Inc.
 - g. Metco W.R., Metalcrete Industries
 - h. Prokrete-N, Prokrete Industries
 - i. Plastocrete 161, Sika Corporation
 - j. Or Equal
3. The admixtures shall be **non-toxic** after thirty (30) days and **contain no calcium chloride**.

B. High-Range Water Reducing Admixture

1. ***Water Reducing Admixtures shall conform to ASTM C-494, Type F or G.***
2. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Monex SP or Mighty RD, Monex Resources, Inc.
 - b. Super P, Anti-Hydro Company, Inc.
 - c. Eucon 37, Euclid Chemical Company
 - d. WRDA 19 or Daracem, W.R. Grace & Company
 - e. Rheobuild or Polyheed, Master Builders, Inc.
 - f. Superslump, Metalcrete Industries
 - g. Sikament 300, Sika Corporation
 - h. Or Equal
3. The admixtures shall be non-toxic after thirty (30) days contain no calcium chloride.

C. Manufacturers Job Site Representation

1. Provide services of a competent field service representative from the manufacturer of each of the admixtures selected for use to provide at the job site advice and consultation on the use of the admixture materials.
2. The manufacturer's representative will be responsible to recommend the maximum discharge time for the superplasticizer and to recommend the method and procedure to induce the superplasticizer into the mixer, and the effect on the concrete in place.
3. The manufacturer's representative will be responsible to recommend quantities of admixtures to be used if variations are required because of temperature, humidity, wind, or other environmental considerations.
4. The manufacturer's representative shall be available on call at any time requested by the Owner, Engineer, Contractor, or concrete producer.

2.07 Curing Materials**A. Evaporation Retarder**

1. Waterborne, mono-molecular film forming, manufactured for application to fresh concrete.

2. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Spray-Film, ChemMasters
 - b. Confilm, MBT Protection and Repair, Division of ChemRex
 - c. SikaFilm, Sika Corporation, Inc.
 - d. Or equal.
- B. Absorptive Cover
1. Burlap cloth made from jute or kenaf, weighing approximately 9 oz./yd³ when dry, complying with AASHTO M - 182, Class 2.
- C. Moisture Retaining Cover
1. The moisture retaining cover shall comply with ASTM C-171 and shall be one of the following:
 - a. Polyethylene film
 - b. Polyethylene coated burlap
 - c. Waterproof paper
- D. The curing agent shall be a colorless, odorless, non-toxic, non-combustible, non-flammable, free of VOC's material such as Ashford Formula as manufactured by Curecrete Distribution, Inc. or approved equal.

2.08 Repair Materials

A. Repair Underlayment

1. A cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
2. Cement Binder: *ASTM C-150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C-219.*
3. Primer: *Product of the underlayment manufacturer recommended for substrate, conditions, and application.*

4. Aggregate: *Well-graded, washed gravel, 1/8-inch to 1/4-inch or coarse sand as recommended by the underlayment manufacturer.*
5. Compressive Strength: *Not less than 5,000 psi at 28 days when tested according to ASTM C-109/C-109M.*

B. Repair Overlayment

1. A cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.
2. Cement Binder: *ASTM C-150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C-219.*
3. Primer: *Product of the underlayment manufacturer recommended for substrate, conditions, and application.*
4. Aggregate: *Well-graded, washed gravel, 1/8-inch to 1/4-inch or coarse sand as recommended by the underlayment manufacturer.*
5. Compressive Strength: *Not less than 5,000 psi at 28 days when tested according to ASTM C-109/C-109M.*

C. The quantity of mixing water shall be no more than necessary for handling and placing.

2.09 Miscellaneous Materials

A. Vapor Barrier

1. Vapor barrier shall be polyethylene film, **ten (10) mils thick**, and shall conform to Product Standard PS-17 and the requirements of Section 07050, "Vapor Barrier".

B. Non-Slip Aggregate

1. Aggregate for non-slip finish shall be well graded between 1/32-inch to 1/4-inch size and composed of a minimum of sixty percent (60%) aluminum oxide or silicon carbide abrasive bonded by a vitreous ceramic material.

2. Aggregate shall be hard, homogeneous, non-glazing, rust-proof, and shall not be affected by freezing, moisture, or cleaning compounds.

C. Floor Hardener and Sealer

1. Floor hardener and sealer shall be a colorless liquid acrylic or chlorinated rubber formulated to comply with Federal Specifications TT-C-800A for Magnesium and Zinc Fluorosilicate Floor Hardeners and with Corps of Engineers Specification CE204.

D. Epoxy Resin Floor Leveler

1. Epoxy resin floor leveler shall be Sikadur Lo-Mod by Sika Chemical Corp., Epoxitite 2390 by W. R. Grace and Co., Euco Epoxy 460 by Euclid Chemical Co., or approved equal.

E. Silicon Water Repellent

1. Silicon water repellent shall be a 5% Silicon Solution complying with Fed. Spec. SS-W-110 and manufactured by W. R. Grace, W. R. Meadows, Euclid Chemical Co., or approved equal.

F. Granular Fill

1. Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D-448, Size 57, with one hundred percent (100%) passing a 1½-inch (37.5 mm) sieve and 0 - 5% passing a No. 8 (2.36 mm) sieve.

G. Fine-Graded Granular Material

1. Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D-448, Size 10, with one hundred percent (100%) passing a ¾-inch (9.5 mm) sieve, 10 - 30% passing a No. 10 (0.15mm) sieve, and at least 5% passing a No. 200 (0.075 mm) sieve; complying with deleterious substance limits of ASTM C-33 for fine aggregates.

H. Burlap Mats shall conform to AASHTO Specification M-182.

2.10 Bonding Compounds

- A. Bonding Compounds and Epoxy Adhesives are specified in Articles 2.08 and 2.09 of Section 03250, "Concrete Accessories".

2.11 Powdered Epoxy Coating for Anchor Bolts

- A. Powdered epoxy resin as manufactured by the 3M Company, Scotchkote No. 213, Armstrong No. R349, or approved equal.

2.12 Concrete Mixtures

A. General

1. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both as specified in ACI 301, ACI 211 and ACI 350. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Concrete mix design shall comply with the Florida Building Code requirements.
3. Concrete not indicated otherwise shall be Class A concrete.
4. Conform to ASTM C-94, except as modified by these specifications.
5. Limit water-soluble, chloride content in hardened concrete to 0.1 percent (0.1%) by weight of cement.
6. Air content as determined by ASTM C-231 and shall be $4\% \pm 1\%$.
7. Limit the use of fly ash to not exceed twenty percent (20%) of the total cementitious content by weight. Fly ash shall be used as an admixture and will not be allowed to replace cement. Fly ash shall be used in all structural concrete.
8. Submit written reports to the Engineer of each proposed mix for each class of concrete at least fifteen (15) days prior to the start of the Work, in a PDF format. Do not begin concrete production until proposed mix designs have been reviewed by the Engineer.
9. Mix Design
 - a. Provide concrete with compressive strengths at 28 days as presented in Table 03300 - A.

- b. Measure slump in accordance with ASTM C-143. The maximum allowable slump of the concrete, without superplasticizer, shall be as presented in Table 03300 - B.

Table 03300 - A Compressive Strengths for Various Class Concretes			
Class	Type of Work	28-day Compressive Strength (psi)	Minimum cement content (lb/yd ³)
A	Concrete for all structures and concrete not otherwise specified. Mat foundations, footings, tanks, ditches, pumping stations, tremie concrete, precast structures, structural, water retaining structures, and other structures in contact with treated waters.	4,000	564
B	Slab on grade, masonry filled cell, grout, encasements, thrust blocks, pipe supports, concrete curbs, fills and sidewalks, etc., not in contact with treated waters.	3,000	500
C	Floor grout, miscellaneous non-reinforced concrete	2,500	376
D	Prestressed concrete	5,000	630
E	Precast Concrete	5,000	630

Table 03300 - B Allowable Concrete Slump (without Superplasticizer)	
Description	Maximum Allowable Slump
Slab on Grade or heavy sections wider than 3 feet	3 inches (max)
Footings, walls, suspended slabs, beams, columns	4 inches (max)
Pavement	2 inches (max)
Floor Grout	4 inches (max)

c. Slump

- 1) Proportion and produce the concrete to have a maximum slump as presented in Table 03300 - B. Slump shall be measured prior to the addition of the superplasticizer.
- 2) A tolerance of up to one (1) inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent ten (10) batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

d. Variations to the maximum allowable slump are as follows:

Concrete Type	Allowable Slump
Class A and B concrete with superplasticizer	7 inches ± 1 inch
For Tremie concrete	6 inches ± 1 inch

10. Aggregate Size

- a. Aggregate size shall be $\frac{3}{4}$ -inch maximum for slabs and sections eight (8) inches thick and less.
- b. Aggregate size shall be one (1) inch maximum for slabs and sections greater than eight (8) inches thick and smaller than seventeen (17) inches.
- c. Aggregate size shall be 1- $\frac{1}{2}$ inches maximum for all larger slabs and sections. Aggregate size for floor grout shall be a maximum of $\frac{3}{8}$ -inch. Coarse aggregate shall be limited to prevent harshness and honeycombing.

11. Combined aggregate grading shall be as shown in the following table:

Description	Maximum Aggregate Size			
	1½"	1"	¾"	⅜"
Aggregate Grade per ASTM C-33	467	57	67	8

12. Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void content of the coarse aggregate.

13. Water-to-Cement Ratio

Concrete Type	Water-to-Cement Ratio
Concrete with superplasticizer	0.37
Class A concrete without superplasticizer	0.45
Class B concrete without superplasticizer	0.55
Class C concrete without superplasticizer	0.65

B. Admixtures1. General

- a. Use admixtures in accordance with the manufacturer's written instructions.

2. Air Entraining Admixture

- a. Use air entraining admixtures in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete, at the point of placement, having a total air content of $4\% \pm 1\%$.

3. Water Reducing and Retarding Admixture

- a. Use water-reducing and retarding or plasticizing admixture in concrete, as required, for placement and workability.
- b. Use water reducing admixtures in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
- c. The addition of the water reducing and retarding admixture shall be separate from the air entraining mixture.
- d. Admixtures shall be stored, handled and batched in accordance with the recommendations of ACI 212 and ASTM C-94.

- C. In addition to the information required by ASTM C-94, delivery tickets shall indicate the parameters identified in Article 1.03(D) of this specification section. Furnish the delivery ticket for each batch of ready-mixed concrete delivered to the site.

D. Temperatures

1. The temperature of the concrete upon delivery from the truck ***shall not exceed 90°F***, otherwise ice, or another approved method, shall be used to reduce the temperature of the concrete as recommended by ACI.

E. Modifications to the Mix

1. No modifications to the mix shall be made in the plant or on the job that will decrease the cement content or increase the water/cement ratio beyond that specified.
2. Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by the Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Engineer before using in the Project Work.
3. Addition of water must be approved by the Engineer. Added water shall be incorporated by additional mixing of at least fifty (50) revolutions. All water added shall be metered and the amount of water added shall be shown on the delivery ticket. Addition of water shall be in accordance with the procedures of ASTM C-94 for slump adjustment.

2.13 Concrete Workability

- A. ***The concrete shall be of such consistency and composition that it can be worked readily into the forms and around the reinforcement*** without excessive vibrating and without permitting the materials to segregate or free water to collect on the surface.
- B. ***The proportions shall be adjusted to secure a plastic, cohesive mixture, and one that is within the specified slump range.***
- C. To avoid unnecessary changes in consistency, obtain the aggregate from a source with uniform quality, moisture content, and grading. Handle materials to minimize variations in moisture content that would interfere with production of concrete of the established degree of uniformity and slump.

2.14 Fabricating Reinforcement

- A. Fabricate steel reinforcement according to CRSI's Manual of Standard Practice" and the requirements of Section 03200, "Concrete Reinforcement".

2.15 Ready-Mixed Concrete

- A. Ready-Mixed Concrete shall be measured, batched, mixed and delivered according to ASTM C-94/C-94M, and batch ticket information shall be furnished.
- B. ***When the air temperature is between 85°F and 90°F, reduce mixing and delivery time from 1½ hours to 75 minutes.***
- C. When the air temperature is above 90°F, reduce mixing and delivery time to sixty (60) minutes.

3. EXECUTION

3.01 Preparations

- A. ***No concrete shall be placed until the approval of the Engineer has been received.***
Approval will not be granted until the forms are thoroughly clean, and reinforcing and all other items required to be set in the concrete have been placed and thoroughly secured.
- B. The Engineer shall be notified a minimum of twenty-four (24) hours before the concrete is to be placed.
- C. Subgrade Preparation
 - 1. Compact the subgrade and/or bedding in accordance with Section 02220, "Excavation, Backfilling and Compaction" and the requirements of the specifications.
 - 2. The subgrade free of frost. If placement is allowed at temperatures below freezing, provide temporary heat and protection as required to remove all frost.
 - 3. ***Saturate the subgrade approximately eight (8) hours before placement and sprinkle ahead of the placement of concrete in areas where vapor barrier is not used.***
 - 4. Remove all standing water, ice, mud, and foreign matter before the concrete is deposited.
- D. Granular Base
 - 1. Where indicated on the Contract Drawings or Documents, install a granular base beneath the slab on grade or a structural foundation (See Spec. Section 02276).

2. Place the granular material on a compacted subgrade and compact the granular base to the same density as the subgrade.

E. Vapor Barrier

1. Place under structural slabs and buildings, or where indicated on the Contract Drawings or Documents.
2. **Lay vapor barrier sheets with twelve (12) inch edge laps and tape or seal with mastic** in accordance with Section 07900, "Vapor Barrier".
3. Stretch and weight edges and laps to maintain their positions until concrete is placed. Coordinate with placement of reinforcement specified in Section 03200, "Concrete Reinforcement".

3.02 Site-Mixed Concrete

- A. Site-mixed concrete shall conform to ACI-304 as modified by these specifications.
- B. Use a batch-type mixer capable of combining the aggregates, cement, and water within the specified time into a thoroughly mixed and uniform mass and capable of discharging the mixture without segregation.
- C. Use equipment that can accurately proportion cement, coarse and fine aggregates, admixtures, and water. Proportion cement and aggregate by weight.
- D. Discharge each entire batch before recharging. Do not allow any batch to exceed the manufacturer's rated capacity of the mixer.
- E. Mixing time shall be as follows:
 1. For mixer of a capacity of one (1) cubic yard or less, one and one-half minutes after batching is completed.
 2. For mixers of capacities larger than one (1) cubic yard, one and one-half minutes plus one-half minute for each additional one-half cubic yard capacity or fraction thereof in excess of one (1) cubic yard.
 3. The mixer shall revolve at a uniform rate as specified by the manufacturer for the mixing equipment.

3.03 Ready-Mixed Concrete

- A. ***Provide central-mixed concrete conforming to ASTM C-94/C-94M as modified by these specifications.***
- B. Convey concrete from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete.
- C. ***Place no concrete more than ninety (90) minutes after mixing has begun for that particular batch.***
- D. ***If it is necessary to add water to obtain the specified slump, add water per ASTM C-94, but do not exceed the water content of the reviewed design mix.***
- E. Use dry-batched concrete or jobsite mix only when the haul time is excessive. Do not retemper partially hardened concrete.
- F. Keep a record showing time and place of each pour of concrete, together with transit-mix delivery tickets certifying the contents of the pour.

3.04 Conveying

A. Buckets and Hoppers

- 1. Buckets and hoppers shall be provided that have discharge gates with a clear opening equal to no less than one-third of the maximum interior horizontal area, or five (5) times the maximum aggregate size being used.
- 2. ***Side slopes shall be no less than sixty degrees (60°).***
- 3. Controls on gates shall be provided to permit opening and closing during the discharge cycle. It is suggested that the Contractor provide one (1) standby bucket and hopper for use in case of equipment failure.

B. Runways

- 1. Provide runways as specified in Section 03100, "Concrete Formwork".
- 2. Extreme care shall be exercised to avoid displacement of reinforcing during the placing of concrete.

C. Elephant Trunks

1. Hoppers, elephant trunks or drop chutes shall be used to **prevent the free fall of concrete for more than six (6) feet.**

D. Chutes

1. Chutes shall be metal or metal lined, and shall have a slope not exceeding one (1) vertical to two (2) horizontal, and not less than one (1) vertical to three (3) horizontal.
2. Chutes more than twenty (20) feet long and chutes not meeting the slope requirements, may be used only if they discharge into a hopper before distribution.

E. Pumping Equipment

1. Pumping equipment and procedures, if used, shall conform to the recommendations contained in the report of ACI Committee 304 on "Placing Concrete by Pumping Methods", ACI 304.2R.
2. The specified slump shall be measured at the point of discharge. **The loss of slump in pumping shall not exceed 1½ inches.**

F. Conveying Equipment Construction

1. Do not use aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer.

G. Cleaning

1. Conveying equipment shall be cleaned at the end of each concrete operation.

3.05 Placing of Concrete

A. General

1. Before placing concrete, verify that installation of formwork, reinforcement and embedded items is complete and that all required inspections have been performed.
2. Placement of concrete shall conform to ACI 304, "Measuring, Mixing, Transporting and Placing Concrete", as modified by these specifications.

3. **Concrete shall be placed in accordance with the requirements of ACI 318 and as nearly practicable to its final position.** Place concrete only during normal working hours unless the Engineer is notified at least forty-eight (48) hours in advance. Concrete shall not be placed until the Engineer has approved the formwork, reinforcement, and embedded items and debris has been removed.
4. **Coordinate in advance of concrete placement the sequence of placement to assure that construction joints will occur only as designed.** Provide the Engineer with a copy of the sequence of placement at least seven (7) calendar days prior to placement. Alternate sections of concrete walls and slabs may be cast simultaneously. Do not place adjacent sections of walls and slabs until seven (7) calendar days after placement of the first placed concrete.
5. Notify the Engineer of the readiness, not just intention, to place concrete in any portion of the Work. This notification shall be at least twenty-four (24) hours in advance of the placement of the concrete such that the Engineer can observe and inspect the Work at the location of the proposed concrete placing. Failure of sufficient advance notification will be cause for a delay in the placing of the concrete until the observation and inspection of the Work can be completed. Forms, steel, screeds, anchors, ties, inserts, waterstop, and other embedded items shall be in place before the Contractor's notification of readiness is given. Any delay of concrete placing due to improper Contractor notification or incomplete preparation/work will not be grounds for the addition of time to the Contract Construction period.
6. **The Contractor shall schedule sufficient equipment for continuous concrete placing.** Provide for backup equipment and procedures to be taken in case of an interruption in placing. Provide for backup concrete vibrators at the Project Site. Test all concrete vibrators the day before placing concrete.
7. **Do not place concrete until all free water has been removed or has been diverted** by pipes or other means and carried out of the forms, clear of the work. Do not deposit concrete underwater, and do not allow free water to rise on any concrete until the concrete has attained its initial set. Do not permit free or stormwater to flow over the surface of the concrete so as to injure the quality or surface finish.
8. When a vapor (moisture) barrier is installed, do not puncture the moisture barrier by stakes or any other concrete accessory.
9. **Do not place concrete during rainstorms.** Protect concrete placed immediately before rainstorms to prevent rainwater from coming into contact with freshly placed or uncured concrete. Keep sufficient protective covering ready at all times for this purpose.

B. Placement of Concrete

1. Deposit concrete continuously in one layer or in horizontal layers of such thickness such that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness, or cold joints. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
 - a. ***Deposit concrete in horizontal layers of a depth not to exceed formwork design pressures (no deeper than 24 inches)*** and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while the preceding layer is still plastic to avoid cold joints.
 - b. ***Consolidate placed concrete by mechanical vibrating equipment*** supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - c. ***Do not use vibrators to transport concrete inside forms.*** Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least six (6) inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit the duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing the mixture constituents to segregate. A spare vibrator shall be “on-site” for emergency use at all times.
2. ***Deposit and consolidate concrete for floors and slabs in a continuous operation***, within the limits of construction joints or expansion joints, until placement of a panel or section is complete.
 - a. Consolidate concrete during placement operations so concrete is thoroughly worked around the reinforcement and other embedded items and into corners.
 - b. Maintain reinforcement in position on chairs during concrete placement.
 - c. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - d. Slope surfaces uniformly to drains where required.
 - e. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane (free of humps and hollows), before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

C. Hot Weather Placement of Concrete

1. During hot weather, give proper attention to the ingredients, production methods, handling, placing, protection and curing to prevent excessive concrete temperatures or water evaporation in accordance with the provisions of ACI 301 and ACI 305 and the provisions herein. ***As much as possible, concrete should be placed during cooler hours of the day.***
2. ***Maintain concrete temperature below 90° F (32° C) at the time of placement to eliminate early setting of the concrete.*** Chilled mixing water or chopped ice may be used to control temperature, provided the water equivalent of the ice is calculated into the total amount of mixing water. Using liquid nitrogen to cool the concrete is the Contractor's option.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedding concrete.
4. Fog-spray forms, steel reinforcement and subgrade just before placing the concrete. Keep the subgrade uniformly moist without standing water, soft spots or dry areas.
5. ***Use water-reducing retarding admixtures when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to the Engineer.***
6. ***There will be no additional reimbursement to the Contractor for costs incurred for placing concrete in hot weather.***

D. Cold Weather Placement of Concrete

1. The Contractor shall provide adequate equipment for heating concrete materials and protecting the concrete work from physical damage or reduced strength that could be caused by frost, freezing action or low temperatures and shall comply with the provisions of ACI-301 and ACI-306.
2. When the air temperature has fallen to or is expected to fall below 40°F, uniformly heat water (< 140°F) and aggregates before mixing to obtain a concrete mixture temperature of not less than 55°F and not more than 80°F, at the point of placement. Do not allow the heated water to come in contact with the cement before the cement is added to the batch.
3. Do not use frozen materials or materials containing ice. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

4. Do not use salt, or other materials containing anti-freeze agents or chemical accelerators unless otherwise accepted in mix designs. Calcium chloride will not be allowed.
5. Maintain the air and the forms in contact with the concrete at temperatures above 40°F for the first five (5) days after placing, and above 35°F for the remainder of the curing period. The Contractor shall provide thermometers to indicate the ambient temperature and the temperature two (2) inches inside the concrete surface.
6. ***There will be no additional reimbursement to the Contractor for costs incurred for placing concrete in cold weather.***

E. Supported Elements

1. ***At least two (2) hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.***

F. Concrete Fill and Tank Bottom Slab

1. Concrete fill for the tank bottoms, where shown on Contract Drawings, shall be placed within the tolerances described in this Section and as per the equipment manufacturer's recommendations for the clearance required by the mechanical equipment.
2. Do not operate the mechanical equipment of the tanks as a primary screed for moving the concrete fill, except in the final screeding operation, provided any damage to the equipment is repaired at no additional cost to the Owner.

G. Seals and Tremie Concrete

1. General

- a. Wherever practicable, all foundation excavations shall be dewatered and the concrete deposited in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, a concrete foundation seal shall be placed. The foundation shall then be dewatered, and the balance of the concrete placed in the dry.
- b. When seal concrete is required to be placed, the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete shall be the responsibility of the Contractor. Seal concrete placed by the Contractor, which subsequently fails to perform properly, shall be repaired as necessary to perform its required function, at the expense of the Contractor.

2. Method of Placing

- a. Concrete deposited under water shall be carefully placed in the space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than one (1) cubic yard capacity, or other approved method, and shall not be disturbed after it is deposited.
- b. All seal concrete shall be deposited in one (1) continuous pour.
- c. No concrete shall be placed in running water.
- d. **All form work designed to retain concrete under water shall be watertight**, and the design of the form work and excavation sheeting shall be by a Professional Engineer, registered in the State of Florida.

3. Use of Tremie

- a. **The tremie shall consist of a tube having a inside diameter of ten (10) inches**, and shall be constructed in sections having tight joints. No aluminum parts which have contact with the concrete will be permitted.
- b. The discharge end shall be entirely seated at all times and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper the tremie shall be slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper, after which the flow shall be stopped by lowering the tremie.
- c. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over the entire top surface of the work, and shall permit it being lowered rapidly when necessary to choke off or retard the flow. The flow shall preferably be continuous and in no case shall be interrupted until the work is completed. Special care shall be exercised to maintain still water at the point of deposit.

4. Use of Bottom-dump Bucket

- a. When the concrete is placed by means of a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the concrete already placed.
- b. The bucket shall then be raised very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.

5. Time of Beginning Pumping

- a. Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than seventy-two (72) hours after placement of the concrete.

H. Consolidating Concrete

1. General

- a. Concrete, with the exception of slabs less than eight (8) inches thick, shall be consolidated by means of internal vibrators operated by competent workmen.
- b. Concrete for slabs less than eight (8) inches shall be consolidated with vibrating screeds. Slabs eight (8) inches to twelve (12) inches 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.

2. Vibrators

- a. ***Vibrators shall have a minimum head diameter of at least two (2) inches, a minimum centrifugal force of seven hundred (700) pounds and a minimum frequency of 8,000 vibrations per minute (vpm).***

3. Vibrators for Confined Areas

- a. In confined areas, the specified vibrators shall be supplemented by others having a minimum head diameter of 1½ inches, a ***minimum centrifugal force of three hundred (300) pounds and a minimum frequency of 9,000 vibrations per minute.***

4. Spare Vibrator

- a. One (1) spare vibrator for each-three (3) in use shall be kept on the site during all concrete placing operations. ***There shall be a minimum of at least one (1) spare vibrator on-site during all concrete placing operations.***

5. Use of Vibrators

- a. ***Vibrators shall be inserted and withdrawn at points approximately eighteen (18) inches apart. The duration of each insertion shall be from 5 - 15 seconds.***

- b. Concrete shall not be transported in the forms by means of vibrators.
- c. Consolidation of concrete shall be in conformance with ACI 309.

I. Protection

- 1. ***Rainwater shall not be allowed to increase the mixing water, nor to damage the surface finish.***
- 2. Concrete shall be protected from construction overloads. Design loads shall not be applied until the specified strength has been attained.

J. Construction Joints

- 1. Except as otherwise indicated on the Contract Drawings, ***horizontal construction joints shall be provided*** at top of foundation members and slabs on grade and at the soffit of supported slabs and beams.
- 2. Other horizontal and vertical construction joints shall be located as indicated on the Contract Drawings. Joints will not be permitted except in the locations shown, unless recommended by the Contractor and approved by the Engineer.

K. Bonding

- 1. Before depositing new concrete on or against concrete that has set, the surfaces of the set concrete shall be thoroughly cleaned so as to expose the coarse aggregate and be free of laitance, coating, foreign matter and loose particles.
- 2. Forms shall be retightened.
- 3. The hardened concrete of joints shall be dampened, but not saturated, and then thoroughly covered with a coat of cement grout of similar proportions to the mortar in the concrete.
- 4. The grout shall be as thick as possible on vertical surfaces and at least 1/2-inch thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained its initial set.

L. Embedded Items

- 1. In addition to steel reinforcement, pipes, inserts and other metal objects as shown, specified or ordered shall be built into, set in or attached to the concrete. All necessary precautions shall be taken to prevent these objects from being displaced,

broken or deformed. Before the concrete is placed, care shall be taken to determine that all embedded parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter.

2. Pressure test embedded pipes for leakage, as specified elsewhere, before the concrete is placed.
3. Wrap metal rainwater leaders, firelines and other such piping with at least two (2) thicknesses of thirty (30) pound roofing felt before placing the concrete.
4. No wood shall be embedded in the concrete.
5. The concrete shall be packed tightly around pipes and other metal work to prevent leakage and to secure proper adhesion. Drains shall be adequately protected from intrusion of concrete.

M. Bonding to Existing Surfaces

1. Clean existing concrete surfaces that are to have new concrete bonded thereto of all grease, oil, dust, dirt and loose particles and coat with an epoxy bonding agent just prior to placing of the new concrete.
2. Apply the bonding agent as recommended by the manufacturer and allow the agent to become "tacky" before the new concrete is placed.
3. Do not allow the bonding agent to overlap or be spilled on the surfaces to be exposed after the work is completed.

3.06 Concrete Finishing

- A. ***As soon as the forms can safely be removed, all irregular projections shall be chipped off flush with the concrete surfaces. All voids produced by spacers or any honeycombing shall be pointed up with grout and troweled flush, with the concrete surface immediately after removal of the forms and water cured to prevent shrinkage.*** Honeycombing shall be cut out to expose a sound concrete surface prior to pointing. The use of mortar pointing or patching shall be confined to the repair of small defects in relatively green concrete. Where in the opinion of the Engineer substantial repairs are required, the defective concrete shall be cut out to sound concrete and repaired with gunite or the concrete shall be removed and reconstructed as directed.

B. Finishing Formed Surfaces

1. Smooth-Formed Finish

- a. **Provide a smooth-formed finish on all formed concrete surfaces or to be covered with a coating material applied directly to concrete**, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system.
- b. This is an “as-cast” concrete surface texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. **Remove fins and other projections completely, and leave a smooth finish.**
- c. The finish shall be a Class A in accordance with ACI-347.

2. Related Unformed Surfaces

- a. At the tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

C. Finishing Floors and Slabs

1. Comply with ACI-302.1R recommendations for screeding, restraightening and finishing operations for concrete surfaces. Do not wet concrete surfaces.

2. Scratch Finish

- a. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of ¼-inch (6 mm) in one direction.
- b. Apply a scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

3. Float Finish

- a. **Apply a float finish to monolithic slab surfaces to receive a trowel finish and other finishes as specified**; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

- b. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both.
- c. Restraighten, cut down high spots and fill low spots.
- d. Consolidate the surface with power-driven floats or by hand-floating if the area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 25 (floor flatness) and F(L) 20 (floor levelness) measured according to ASTM E-1155/E-1155M.
- e. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- f. The class of surface shall be a Class C surface in accordance with ACI 347-R.

4. Trowel Finish

- a. After applying a float finish, apply the first troweling and consolidate the concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until the surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1) Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, paint or another thin-film finish coating system.
 - 2) Finish and measure the surface so that a gap at any point between the concrete surface and an unlevelled, freestanding, 10-foot (3.05 m) long straightedge resting on two (2) high spots and placed anywhere on the surface does not exceed $\frac{3}{16}$ -inch (4.8 mm)

5. Trowel and Fine-Broom Finish

- a. Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either the thick-set or thin-set method. While the concrete is still plastic, slightly scarify the surface with a fine broom.
- b. Comply with the flatness and levelness tolerances for trowel finished floor surfaces.

6. Non-slip Broom Finish

- a. Apply a non-slip, light broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated, before the surface sets.

- b. Immediately after float finishing, yielding a smooth surface (relatively free of defects), slightly roughen the concrete surface by brooming with a fiber-bristle broom perpendicular to the main traffic route. Coordinate the required final finish with the Engineer before application.

D. Finishing Tolerance

1. ***All surfaces shall be uniform in texture and appearance and plane to a tolerance of $\frac{1}{8}$ -inch in ten (10) feet as determined by a ten (10) foot straightedge placed anywhere on the slab in any direction.***

E. Saw Cut Joints

1. ***Joints that are to be saw cut shall be cut not sooner than two (2) hours after the concrete is poured and not later than eight (8) hours after the pour.***

3.07 Miscellaneous Concrete Items

A. Filling In

1. Fill in all holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place.
2. Mix, place, and cure concrete as specified to blend with “*in-place*” construction.
3. Provide all other miscellaneous concrete filling indicated or required to complete the Work.
4. ***All grout shall be of the “non-shrink” type.***

B. Curbs

1. Provide a monolithic finish to interior curbs by stripping forms while the concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations

1. Provide machine and equipment bases and foundations as shown on the Contract Drawings.

2. **Set anchor bolts for machines and equipment at the correct elevations**, complying with diagrams or templates from the manufacturer furnishing the machines and equipment.
 3. Grouting Machinery Foundations
 - a. Block out the original concrete or finish off a sufficient distance below the bottom of the machinery base to provide for the thickness of grout shown on the Contract Drawings or required by the equipment manufacturer.
 - b. After the machinery has been set in position and placed at the proper elevation by steel wedges, the space between the bottom of the machinery base and the original pour of concrete shall be filled with a pourable non-shrink grout.
 - c. The grout and grouting procedure shall be in accordance with AAPI 686, Chapter 4, paragraphs 3.6 and 3.7, and Chapter 5.
- D. Steel Pan Stairs
1. Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on Contract Drawings. Screed, tamp, and trowel finish concrete surfaces.
- E. Backfill Against Walls
1. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified **28-day compressive strength**. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.
 2. Do not backfill the walls of structures laterally restrained or supported by suspended slabs on grade until the slab is poured and the has reached the specified compressive strength.

3.08 Curing and Protection

A. General

1. **Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.** In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation control material. Apply according to manufacturers instructions after screeding and bull floating, but before power floating and troweling. Comply with ACI 305 and 306 for protecting and curing concrete in hot and cold weather.

2. ***Fresh concrete shall be protected from rain*** in accordance with this specification section.
- B. ***Start initial curing as soon as the free water has disappeared from concrete surfaces after placing and finishing.*** Keep continuously moist for not less than fourteen (14) days as required due to weather.
- C. Where the concrete surface is scheduled to receive a sealed concrete finish, the curing is to be accomplished using an application of the Ashford Formula in strict accordance with the manufacturers recommendations.
- D. Moisture Curing
1. Cure concrete according to ACI-308, "Standard Practice for Curing Concrete".
 2. Provide moisture curing by the following methods:
 - a. Keep concrete continuously wet by covering with water for not less than fourteen (14) days with one of the following materials:
 - 1) A continuous water-fog spray.
 - 2) An absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place the absorptive cover to provide coverage of concrete surfaces and edges, with a twelve (12) inch lap over adjacent absorptive covers.
 3. Provide moisture-retaining cover curing as follows:
 - a. Cover concrete surfaces with a moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least four (4) inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- E. Evaporation Retarder
1. Apply evaporation retarder to unformed concrete surfaces if hot, dry or windy conditions cause moisture loss approaching $0.2 \text{ lb/ft}^2 \times \text{h}$ ($1.0 \text{ kg/m}^2 \times \text{h}$) before and during finishing operations.
 2. Apply according to the manufacturer's written instructions after placing, screeding and bull floating or darbying concrete, but before float finishing.

F. Formed Surfaces

1. Cure formed concrete surfaces, including the underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until the forms are removed.
2. As soon as initial set has occurred, place a soil soaker hose along the tops of all walls to keep concrete forms wet during the curing period.
3. If forms are removed, continue curing by methods specified above, as applicable, for the remainder of the curing period. If forms are removed before the end of the curing period, then the concrete shall be continuously moist for the remainder of the curing period by fog spraying or covering with water-saturated absorptive covers or moist burlap.

G. Unformed Surfaces

1. Begin curing unformed surfaces including floors and slabs, concrete floor toppings and other flat surfaces, immediately after finishing the concrete by applying the appropriate curing method.
- H. Final cure concrete surfaces to receive finish flooring with a moisture retaining cover, unless otherwise directed.
- I. ***Water cure cast-in-place concrete for hydraulic walls, slabs, channels, and footings by for a minimum period of fourteen (14) days prior to applying other curing methods.*** Do not submerge concrete placed in the dry until it has attained sufficient strength to adequately sustain the stress involved nor subject it to flowing water across its surface until it has cured. Start the curing of concrete as soon as possible without damaging the surface and not later than two (2) hours after placing.
- J. Cure concrete surfaces in accordance with the methods specified herein for the different parts of the work. These methods are considered to be the “minimum” for curing. The conditions that exist in the field during placement and curing may require additional curing procedures and efforts to ensure proper protection and curing of the concrete. The Contractor shall be responsible for selecting and implementing the appropriate curing method commensurate with climatic conditions and the nature of the concrete structure being constructed (exposed surface, water bearing surface, submerged surface, coatings being applied to the surface, etc.) and shall take the appropriate measures for curing as described in ACI 305 and 306 for protecting and curing concrete during hot and cold weather.
- K. Where wooden forms are used, wet forms immediately before concreting and keep moist by sprinkling until removed. Keep exposed surfaces of formed concrete moist until the appropriate curing method is applied.

- L. Use proper concrete placing and curing methods at all times to limit the amount of hazing and cracking of the structures during initial setting and shrinking of the concrete. Repair all shrinkage cracks.

3.09 Removal of Forms

- A. Removal of forms shall be in accordance with Section 03100, "Concrete Formwork, Article 3.08, "Removal of Forms", of these specifications.

3.10 Concrete Surface Repairs

A. Defective Concrete

- 1. Repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to the Engineer's approval.

B. Patching Mortar

- 1. Mix dry-pack patching mortar, consisting of one part Portland cement to two and one half (2½) parts fine aggregate passing a No. 16 (1.18 mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces

- 1. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - a. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½-inch (13 mm) in any dimension in solid concrete, but not less than one (1) inch (25 mm) in depth. Make edges of cuts perpendicular to the concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - b. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match the surrounding color. Patch a test area at inconspicuous locations to verify the mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

- c. Repair defects on concealed formed surfaces that affect the concrete's durability and structural performance as determined by the Engineer. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces

1. Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
 - a. Repair finished surfaces containing defects that affect the concrete's durability. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets and other objectionable conditions.
 - b. ***After the concrete has cured at least fourteen (14) days, correct "all" high areas by grinding.***
 - c. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to the Engineer.
 - d. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4-inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to the manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
- E. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of the same materials and mixture as the original concrete except without the coarse aggregate. Place, compact, and finish to blend with the adjacent finished concrete. Cure in the same manner as the adjacent concrete.
- F. Repair random cracks and single holes one (1) inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply a bonding agent. Place patching mortar before the bonding agent has dried. Compact patching mortar and finish to match the adjacent concrete. Keep patched area continuously moist for at least seventy-two (72) hours.

- G. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- H. Repair materials and installation, not specified above may be used, subject to Engineer's approval.

3.11 Quality Control Testing During Construction

A. Testing

- 1. The Contractor will engage a qualified testing agency to perform field testing of the concrete and prepare test reports. These costs shall be borne by the Contractor.
- 2. Tests shall be in accordance with this Section and Section 01410, "Testing and Testing Laboratory Services" and as specified herein.
- 3. ***The testing agency shall be approved by the Engineer and Owner.***
- 4. Any retesting due to unacceptable work or materials shall be at the Contractor's expense.

B. Inspections

- 1. Steel reinforcement placement.
- 2. Steel reinforcement welding.
- 3. Headed bolts and studs.
- 4. Verification of use of required design mixture.
- 5. Concrete placement, including conveying and depositing.
- 6. Curing procedures and maintenance of curing temperature.

C. Concrete Tests

- 1. Testing of composite samples of fresh concrete shall be performed according to the following requirements:
 - a. Sampling of Fresh Concrete
 - 1) Sampling of fresh concrete shall be in accordance with ASTM C-172, except as modified for slump to comply with ASTM C-94.

b. Testing Frequency

- 1) Standard laboratory **compressive test cylinders** will be obtained by the laboratory when concrete is discharged at the point placing (i.e., discharge end of pumping equipment), and cylinders will be made and cured.
- 2) **Obtain one (1) composite sample for each day's pour of each concrete mixture exceeding five (5) yd³, but less than twenty-five (25) yd³, plus one (1) set for each additional fifty 50 yd³ or fraction thereof.**
- 3) Sampling and curing of concrete cylinders shall be in accordance with ASTM C-31.

c. Air Content

- 1) Air content of the concrete mixture will be tested on **every** truck in accordance one of the following methods, **prior to depositing in the forms**:
 - a) Pressure Method: Per ASTM C-231
 - b) Volumetric Method: Per ASTM C-173

d. Slump

- 1) Slump tests shall be in accordance with ASTM C-143.
- 2) One (1) test shall be performed on each delivery truck of ready-mix concrete at the point of discharge, **prior to depositing in the forms**.
- 3) The Contractor shall perform additional tests when the concrete consistency seems to have changed or as directed by the Engineer.

e. Concrete Temperature

- 1) The concrete temperature shall be taken in accordance with ASTM C-1064, "Standard Test Method For Temperature of Freshly Mixed Concrete".
- 2) The temperature of the concrete mixture will be tested on **"every"** truck and one test for each set of compressive strength specimens. The temperature shall be tested **prior to depositing the concrete in the forms**.

f. Compression Test Specimens

- 1) Tests shall be in conformance with ASTM C-31/C-31M.
- 2) Cast and laboratory cure two (2) sets of two (2) standard cylinder specimens for each composite sample.
- 3) Cast and field cure two (2) sets of two (2) standard cylinder specimens for each composite sample.

g. Compressive Strength Tests

- 1) Compressive Strength Tests shall comply with ASTM C-39/C-39M.
- 2) Test one set of two laboratory cured specimens at seven (7) days and one set of two specimens at twenty-eight (28) days.
- 3) Test one set of two field-cured specimens at seven (7) days and one set of two specimens at twenty-eight (28) days.
- 4) A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

h. ***When the strength of field-cured cylinders is less than eighty-five percent (85%) of companion laboratory-cured cylinders***, the Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

i. The strength of each concrete mixture will be satisfactory if every average of any three (3) consecutive compressive-strength test results equal or exceed the specified compressive strength and no individual compressive-strength test result falls below the specified compressive strength by more than 500 psi (3.4 MPa).

j. ***Test results shall be reported, in writing, to the Engineer, ready-mix producer, and Contractor within twenty-four (24) hours of testing.*** Reports of compressive-strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in the Work, design compressive strength at twenty-eight (28) days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both seven (7) and twenty-eight (28) day tests.

k. Nondestructive Testing

- 1) Impact hammer, sonoscope, or other nondestructive device may be permitted by the Engineer but will not be used as sole basis for approval or rejection of concrete.

l. Additional Tests

- 1) The testing agency shall make additional tests of concrete when test results indicate that specified concrete strengths and other characteristics have not been attained in the structure/work, as directed by Engineer.
 - 2) The testing agency may conduct tests to determine the adequacy of concrete by cored cylinders complying with ASTM C-42/C-42M or by other methods as directed by the Engineer. These additional tests shall be at the Contractor's expense.
- m. Additional testing and inspecting shall be at the Contractor's expense and shall be performed to determine compliance of replaced or additional work with the specified requirements.
- n. The Contractor shall correct all deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents, at no additional cost to the Owner.

3.12 Field Control

- A. ***The Contractor shall advise the Engineer of his readiness to proceed at least twenty four (24) working hours prior to each concrete placement.*** The Engineer will inspect the preparations for placement of the concrete including the preparation of previously placed concrete, the reinforcing, embedded items, waterstop and the alignment and tightness of formwork. No placement shall be made without the prior approval of the Engineer.
- B. ***The Contractor's Superintendent shall submit a certification that indicates his preparedness to place concrete and is in accord with the Contract Drawings and Specifications.***
- C. 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 the test(s) on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work. The coring tests shall be incidental to the Contract.

- D. The Contractor shall cooperate in obtaining cores by allowing free access to the Work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. The Contractor shall repair all core holes at no additional cost to the Owner.

3.13 Failure to Meet the Requirements

- A. Should the strengths shown by the test specimens made and testing in compliance with the previous provisions fall below the values given in Section 2.12(A)(9), the Engineer shall have the right to require changes in proportions outlined to apply on 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 cases of failure to meet strength requirements the Contractor shall adjust the concrete mix to meet contract requirements.
- B. When the tests on control specimens of concrete fall below the required 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 C-42 and C-39. In case of failure of the core, 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. ***The tests need not be made until the concrete has aged sixty (60) days.***

3.14 Miscellaneous Work

- A. ***All bolts, anchors, miscellaneous metals or other sleeves and steel work required to be set in the concrete forms for attachment of masonry, structural, and mechanical equipment shall be set or installed under this Section.*** The Contractor shall be fully responsible for the setting of such materials in the forms and shaft correct all such not installed in a proper location or manner at his own expense. The Contractor shall coordinate the activities of other trades for installation of these item.
- B. Electric, instrumentation and controls conduits shall be installed in the concrete as required by the Contract Drawings and specified elsewhere in these Specifications. Outlet boxes and fixtures shall be located in reference to the final floor, wall or ceiling finish and shall be as secured that they will not be displaced by concrete placing.

- C. Pipes or conduits, for embedment, other than those merely passing through shall not be larger in outside diameter than one-third the thickness of the slab, wall, or beam in which they are embedded, unless indicated on the Contract Drawings, nor shall they be spaced closer than three (3) diameters on center, nor so located as to unduly impair the strength of the construction. The Engineer shall approve the location of all conduits and fixtures.
- D. Concrete foundations, supports and bases for all equipment and machinery shall be built to the equipment manufacturer's requirements, as approved by the Engineer, with anchor bolts installed.
- E. Sealed Finish
 - 1. Where indicated, apply three (3) coats of floor hardener and sealer in accordance with manufacturer's printed directions. Use the quantity recommended by the manufacturer.
 - 2. The surface shall be clean and dry before hardener and sealer is applied. Upon completion, leave concrete surfaces clean and without discoloration or traces of excess sealer.
- F. Watertightness of Concrete Structures - NOT USED

3.15 Clean-Up

- A. ***All concrete floor construction shall have the surfaces thoroughly scrubbed and cleaned with clear water.*** Cleaning shall be done immediately before application of finish flooring or coating. After cleaning, the slabs shall be protected until they are accepted for floor finishing work.
- B. ***Clean all surfaces affected by the Concrete Work.*** No extraneous concrete or discoloration shall be left on any construction.

END OF SECTION

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SECTION 03400

PRECAST CONCRETE STRUCTURES

1. GENERAL

1.01 Description

- A. The work under this Section includes the design, casting, delivery and erection of precast concrete structures/manholes as indicated on the Contract Drawings.
- B. Related Work Specified Elsewhere

Specification Section	Title
02075	Dewatering and Drainage
02220	Excavation, Backfilling and Compaction
03200	Concrete Reinforcement
03300	Cast-in-Place Concrete
07100	Waterproofing
09900	Painting
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM C-33	Standard Specification for Concrete Aggregates

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM) - Cont'd	
ASTM C-91	Standard Specification for Masonry Cement
ASTM C-150	Standard Specification for Portland Cement
ASTM C-230	Standard Specification for Grout and Mortar
ASTM C-330	Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C-478	Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C-857	Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C-858	Standard Specification for Underground Precast Concrete Utility Structures
ASTM C-890	Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
ASTM C-891	Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C-913	Standard Specification for Precast Concrete Water and Wastewater Structures
ASTM C-923	Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes
ASTM C-1037	Standard Practice for Inspection of Underground Precast Concrete Utility Structures
American Concrete Institute (ACI)	
ACI 318	Building Code Requirements for Reinforced Concrete
Other Applicable Standards	
PCI MNL 116	Manual for Quality Control for Plants and Production of Precast Concrete Products
Building Codes	
	Florida Building Code

2. Plant Inspection

- a. ***Notify the Engineer seven (7) calendar days before the units are cast and seven (7) calendar days before shipment*** is made to the Project Site to provide for an inspection of the plant, if the Engineer so directs.

1.03 Submittals

- A. Submit the following information to the Engineer for approval in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. The Contractor shall not begin fabrication of any precast concrete structures/manholes until the shop drawing submittal for each structure is approved by the Engineer.

- C. Submit satisfactory evidence shall be submitted that plant and production methods of the precasting company meet the requirements of PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products".

D. Design Submittal

1. Submit the following:
 - a. Manufacturer's catalog data and design data on each precast concrete item.
 - b. Dimensions of structures, thicknesses of walls, floors and top slabs
 - c. Indicate all reinforcing steel and wire.
 - d. Show materials of construction by ASTM reference and grade.
 - e. ***Manufacturer's design calculations (including shear, moment, buoyancy, camber calculations, etc.) and certification signed and sealed by a professional structural engineer registered in the state of Florida*** that the structure design and construction comply with the specified design load conditions and the referenced specifications.
 - 1) ***The design water table shall be assumed to be at the finished grade.***

E. ***Submit tabulated drawings and schedule showing the following:***

1. Plan and profile views of structure sections.
2. Plan showing locations and sizes of equipment access hatches, cover plates, grating, handrails and ladders and stairs, as appropriate to the Project.
3. Foundation plan, showing location and sizes of sumps, floor drains, pipe penetrations, pipe hangers and equipment anchors.
4. Sections or elevations showing locations and sizes of wall penetrations for pipes. Pipe penetrations shall meet the requirements of these specifications (Division 15).
5. Order of installation and closures.
6. Transportation handling and installation instructions.

- F. ***Submit erection drawings and diagrams for each structure.*** Submit calculations verifying the base anchor/foundation assemblies indicated in the drawings are adequate

- to accommodate the project-specific structure reactions. Show column base anchor details and anchor bolt sizes. Show all wall bracing.
- G. Submit the manufacturer's product data showing successful projects within the State of Florida over the past five (5) years of similar size.
- H. Manufacturer's data sheets shall be submitted on the following:
1. Joint mastic and gaskets.
 2. Pipe connections.
 3. Grout material.
 4. Protective coatings.
 5. Hatches, access frames and covers.

1.04 Delivery, Storage and Handling

- A. Use only qualified personnel, using proper equipment for transportation, handling and storage of the units.
- B. Lifting and supporting shall be done only at points indicated on the shop drawings.
- C. Before shipment, inspect precast components/units to make certain that materials and workmanship conform to the requirements of these specifications and the manufacturer's recommendations.
- D. Transport precast components to the Project site so as to prevent damage to the structures/units.
- E. **Any damaged structures/units shall be shipped back** to the precast manufacturer and new structures/units fabricated **at no additional cost to the Owner**. Any lost time due to refabrication shall be at the Contractor's expense.

1.05 Qualified Manufacturer's

- A. Qualified precast concrete structure manufacturer's shall include, but are not limited to, the following:
1. Oldcastle Precast, Inc.
 2. Mack Concrete Industries
 3. Or approved equal

2. PRODUCTS

2.01 Materials and Fabrication

A. Precast Concrete Structures

1. Precast concrete structures (manholes, wet wells, valve vaults, meter vaults, etc.) shall consist of precast reinforced concrete sections with flat top sections and base sections conforming, in general, to the details shown on the Contract Drawings. Design loads shall consist of dead load, live load, impact, soil loads and loads due to water table, as well as other loads that may be imposed under the structure. The precast concrete structures shall be designed and manufactured in accordance with ASTM C-478, C-858, C-890, C-891 and C-913. The concrete thickness for the precast structures shall be determined by the precast manufacturer based on the requirements of this specification section, the referenced standards, the depth and size of structure required as shown on the Contract Drawings, soil loads, and the location of the groundwater table as identified in Article 1.03(D)(1)(e)(1). **However, in no instance shall the minimum wall thicknesses shall be less than eight (8) inches.**
2. **Provide a minimum wall thickness of eight (8) inches for manholes, pump stations and wetwells with an internal diameter up to seven (7) feet, a minimum of ten (10) inches for internal diameters of eight (8) to ten (10) feet and a minimum of twelve (12) inches for internal diameters greater than ten (10) feet.**
3. **Hydrostatic calculations, structure base thickness design and flotation calculations shall be generated** using a design high groundwater table elevation at the finished grade for each structure and assuming that structure is both void of water and any associated equipment and appurtenances.
4. **All precast concrete structure shall be “watertight”.**
5. All precast concrete structures shall be **designed to withstand an HS-20 live load in addition to the maximum soil and hydraulic pressure for the conditions of installation.**
6. Top slabs for pumping station wet wells may be precast or cast-in-place with flat top slabs. Steel reinforcing shall be as required to meet the requirements of this section and the referenced standards. **Concrete for top slabs shall have a compressive strength of 5,000 psi at 28 days. The thickness and reinforcement of concrete for the top slabs of wetwells and valve vaults shall be designed to withstand an HS-20 loading and shall be a minimum of twelve (12) inches thick.**

7. ***Cast the bottom slab of pumping stations monolithically with the lower wall section and extend the longitudinal reinforcement into the slab.***
8. Forms used for precast concrete shall be of metal and sufficiently designed and braced to maintain their alignment under pressures of the concrete during placing. The base and first section of the precast structure shall be an integral cast.
9. Aggregates
 - a. All aggregates, fine and coarse, other than lightweight aggregate, shall conform to ASTM C-33.
 - b. Lightweight aggregates, fine and coarse, shall conform to ASTM C-330.
 - c. Aggregates shall be free of deleterious substances causing reactivity with oxidized hydrogen sulfide.
 - d. Both types of aggregate shall be graded in a manner so as to produce a homogenous concrete mix.
 - e. All materials are to be accurately weighed at a central batching facility for mixing.
10. Concrete
 - a. The concrete for precast concrete structures shall be in conformance with ASTM C-150, Type II cement for structures exposed to water and Type I for all other structures.
 - b. ***The minimum compressive strength of concrete used for precast concrete structures shall be 5,000 psi at 28 days*** (Class E, per Section 03300, "Cast-in-Place Concrete").
 - c. ***The maximum allowable absorption of the concrete shall not exceed eight percent (8%) of the dry weight.***
 - d. Coat concrete and steel in contact with aluminum fabrications, aluminum grating, or other aluminum items with two (2) coats of a bituminous epoxy coating (12 mil minimum, each coat).
 - e. The precast manufacturer may provide air entraining and water reducing concrete admixtures as specified in Section 03300, "Cast-in-Place Concrete".

11. Reinforcement

- a. Design reinforcement with a ***minimum protective cover of two (2) inches***.
- b. Reinforcing steel shall be sufficiently tied to withstand any displacement during the pouring operation.
- c. Reinforcing steel shall be ASTM A-615 Grade 60 deformed bar, ASTM A-82 wire, or ASTM A-185 welded wire fabric.

12. Castings

- a. Wall pipes, access hatches, grating, frames and other miscellaneous items required shall be cast into the precast concrete structure at the appropriate elevation as indicated on the Contract Drawings.
- b. ***Aluminum access hatches shall be provided for wet wells and valve vaults*** as indicated on the Contract Drawings. Aluminum access doors shall be as specified in these Contract Documents.
- c. Covers and frames shall be machined to provide plane, smooth surfaces for uniform seating and interchangeability. Rings and covers that provide imperfect seating will be rejected.
- d. Steps and ladders, if specified for installation on the Contract Drawings, shall be manufactured of non-corrosive materials and shall be provided and cast in place by the precast manufacturer.

13. Placing

- a. All concrete shall be handled from the mixer or transport vehicle to the place of final deposit in a continuous manner, as rapidly as practicable, and with segregation or loss of ingredients, until the approved unit is completed.
- b. ***The maximum elapsed time from batching to placement shall be two (2) hours***.
- c. ***Concrete shall be placed in layers not over two (2) feet deep***. Each layer shall be compacted by mechanical internal or external vibrating equipment.
- d. The duration of the vibration cycle shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation.

14. Curing

- a. For purposes of early reuse of forms, precast concrete may be steam cured after an initial set has taken place. The steam temperature shall not exceed 160°F, and the temperature shall be raised from normal ambient temperatures at a rate not to exceed 40°F per hour.
- b. The steam cured unit shall not be removed from the forms until sufficient strength is obtained for the unit to withstand any structural strain. To which it may be subjected during the form stripping operation. After the stripping of the forms, further curing by means of water spraying or a membrane curing compound may be used, and shall be of a clear or white type, conforming to ASTM C-309.

15. Joints

- a. Joints shall be tongue and groove pipe ends sealed one (1) inch butyl rubber gaskets conforming to Federal Specifications No. SS-5-00210-A and AASHTO-198 and shall be compounded of 100% solids, or by a flexible preformed bitumastic sealing materials equal to Ram-Nek as manufactured by R.K. Snyder and Co., Houston, TX.
- b. If rubber joint ring gaskets are used, interior and exterior voids in the pipe joints shall be sealed with the flexible sealing material specified above and installed in strict accordance with the manufacturer's printed instructions.
- c. If sections are sealed with a flexible preformed bitumastic sealing material, adequate material shall be applied so that "squeeze out" occurs at the interior and exterior of the joint.
- d. Rubber joint ring gaskets and flexible preformed bitumastic sealing material shall be provided by the wetwell manufacturer.
- e. ***All precast concrete structures shall be watertight.***

16. Sealing Compound and Grout

- a. Butyl rubber sealing compound shall comply with ASTM C-990.
- b. Plastic sealing compound shall comply with Federal Specification SS-S-00210.
- c. Mortar shall comply with ASTM C-387, Type S, or use grout complying with Section 3600, "Grout".

17. Crushed Rock for Precast Concrete Structure Base

- a. Crushed Rock for precast concrete structure bases shall comply with Section 02276, "Gravel and Crushed Rock Based for Structures". The rock for concrete structure bases shall be $\frac{3}{4}$ -inch.
18. Eccentric precast concrete cone sections shall be manufactured of precast concrete with reinforcing and joints as specified above for straight riser sections.
19. ***Lifting holes through the structures are not permitted.*** Equally spaced lifting lugs, rings or non-penetrating inserts shall be provided.
20. Inverts for pipelines shall be precast into the concrete structure or manhole base section by the manufacturer unless prior approval is obtained from the Engineer to construct inverts in the field. The drop from inlet to outlet shall be a minimum of one (1) inch unless approved by the Engineer. The channel height of the manhole invert shall match the crown of the exit sewer. Manhole benches shall be sloped a minimum of one (1) inch per foot from the outside periphery of the manhole to the edge of the invert channel.
21. Sump pumps, *where required in precast concrete structures*, shall be provided by the Contractor as part of the Project and shall be included in his Bid.

B. Pipe Connections

1. ***Pipe connections for wet wells and manholes shall be resilient, waterproof connections*** designed in accordance with ASTM C-923, "Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes".
2. Resilient pipe connectors shall be either cast into the manhole wall or installed following casting in a cored section of the manhole wall. Resilient connectors shall either be a gasket type connector equal to the A-Lok pipe to manhole seal, a flexible neoprene boot with stainless steel clamps equal to the KOR-N-SEAL system as manufactured by the Dukor Corporation, or approved equal. All connectors shall be "chemically" resistant to the material entering the concrete structure.
3. When the pipe is installed in the resilient structure connector, ***the pipe shall be capable of a 2° minimum deflection in any direction.***
4. ***Pipe connections for wall penetrations for meter and valve vaults shall be provided with wall sleeves and link seals.***
5. ***All locking rings or clamps used shall be Type 304 stainless steel.***

C. Standard Concrete Structure Frames and Covers

1. Cast iron frames and covers shall be provided for all concrete structures as indicated on the Contract Drawings.
2. Standard frames and covers shall be gray cast iron castings conforming to ASTM A48, Class 30B for Gray Iron Castings and shall be smooth, true to pattern, free from blow holes, sand holes, projections and other harmful defects.
3. ***Frames and covers shall be designed and manufactured for H20 (heavy truck traffic) live load.***
4. The seating surfaces of both the frame and cover shall be machined so that the cover will not rock after it has been seated. The cover shall be provided with a precisely machined dovetail groove with a neoprene O-ring gasket to provide a self sealing cover. The gasket shall be glued in-place at the foundry.
5. The structure cover shall be solid with two non-penetrating pick holes. Frames and covers shall be coated on all non-machined surfaces with three (3) coats of a protective bituminous. Manhole frames and covers shall be U.S. Foundry and Manufacturing Corp., No. 170-E.
6. ***Covers shall be embossed with Owner information to be approved by the Engineer prior to foundry casting.***
7. Anchor Bolts
 - a. Anchor bolts for bolting the frame to the precast concrete structure or manhole shall be $\frac{3}{4}$ -inch diameter galvanized all thread steel rods with a five (5) inch hook for embedment in the precast manhole top.
 - b. The bolts shall be of sufficient length to provide a minimum 2-inch thread projection through the flange of the structure or manhole frame. Two (2) anchor bolts shall be cast into the precast concrete structure or manhole top section or slab, positioned at 180°, at the time of manufacture.
 - c. Frames shall be drilled to match the bolt setting prior to coating.

D. Coatings

1. Exterior surfaces of precast structures shall be coated with a primer coat and three (3) finish coats of a protective bituminous epoxy for a ***finished minimum dry film thickness of thirty (30) mils.***

2. Interior surfaces of the precast structures shall be coated with a primer coat and three (3) finish coats of protective bituminous epoxy coating, using alternating colors for each coat, for a ***finished minimum dry film thickness of thirty (30) mils***.
- E. Before leaving the foundry, clean all castings and subject them to a hammer inspection.
- F. Wetwell Liner - NOT USED
- G. Parking Bumpers
1. Provide and install six (6) foot long x nine (9) inch wide x six (6) inch high parking blocks as indicated on the Contract Drawings. The Contractor is referred to the parking bumper requirements of Section 02850, "Parking Bumpers".
 2. Parking blocks shall be reinforced lengthwise with four reinforcement bars, shall be securely anchored in place and shall be manufactured of Class A concrete as specified in Article 2.12(A), Section 03300, "Cast-in-Place Concrete", of these specifications.
- H. Splash Pads
1. Provide splash pads for each downspout discharge unless otherwise noted on the Contract Drawings.
 2. Splash pads shall be 12-inch by 18-inch reinforced concrete and shall be manufactured of Class A concrete as specified in Article 2.12(A), Section 03300, "Cast-in-Place Concrete", of these specifications.
 3. Form 2-inch by 2-inch curbs at longest edges, and top surface shall be sloped and coved to drain.
- I. Concrete Sills and Copings
1. All masonry materials shall conform to the requirements specified in Division 4, "Masonry". Concrete sills and copings shall be manufactured of Class A concrete per Article 2.12(A) Section 03300, "Cast-in-Place Concrete", of these specifications.
 2. Exposed finishes shall be smooth and dense, without imperfections.
 3. Produce sills and copings accurately to the required shape and dimensions with joints and bonding as indicated. Provide exposed faces in the pattern and configuration indicated on the Contract Drawings with straight, true and sharp lines and arises. Beds and joints shall be straight and at right angles to the face. Provide reglet grooves for flashing where indicated.

4. Exterior sills and copings with exposed top surfaces shall have a wash on the top surface. Where sills and copings project beyond the wall line, the sides of cross joints in overhang shall be roughened to provide a bond for the mortar or mastic pointing.
5. Provide holes and sinkages for all anchors, clamps, and dowels as necessary. Provide sinkages for clamps on the bed side of each coping joint unless dowels or bolts are used to secure coping. Include all cutting and drilling necessary for installation of work of other trades as indicated on the Contract Drawings and specified under other Specification Sections.

3. EXECUTION

3.01 Inspection and Tolerances of Individual Elements

A. Fabrication

1. ***Warped, cracked or broken precast concrete units shall not be used.*** Use precast components with size and dimensions within the following tolerances at the time they are placed:
 - a. Overall length of members: $\pm \frac{1}{8}$ -inch per ten (10) feet.
 - b. Cross-Sectional Thickness Dimensions
 - 1) Sections less than 3 inches: $\pm \frac{1}{16}$ - inch
 - 2) 3 inches < Section $\leq$ 18 inches: $\pm \frac{1}{8}$ - inch
 - 3) Sections > 18-inches: $\pm \frac{1}{4}$ - inch
 - c. Deviations from straight-line in Long Member: $\pm \frac{1}{4}$ -inch or less in 20 feet

B. Erection

1. The alignment of the precast concrete units shall be $\pm \frac{1}{8}$ -inch per ten (10) feet, vertical and horizontal.

- C. The following imperfections shall be considered injurious and cause for rejection:

1. Cracked Unit: A single crack in the wall of a precast unit, extending through the entire thickness, regardless of the length of such crack; a single crack which extends through one-fifth ($\frac{1}{5}$) of the wall thickness and is over three (3) inches long.
 2. Surface Imperfections: Surface imperfections such as lumps, blisters, pits, or flakes on the interior surface.
 3. Broken Unit: A precast concrete unit section with a piece broken from it.
- D. ***Any damaged structures/units shall be shipped back*** to the precast manufacturer and new structures/units fabricated ***at no additional cost to the Owner. Any lost time due to refabrication shall be at the Contractor's expense.***

3.02 Installation

- A. The Contractor shall prepare an excavation large enough to accommodate the structure and permit sealing of openings, waterproofing, and backfilling operations. The earthwork shall conform to the applicable sections of Division 2, "Earthwork".
- B. Precast concrete structures shall be constructed in a workmanlike manner at the locations and dimensions indicated on the Contract Drawings. ***Precast structures shall be set on a foundation of crushed stone, a minimum of twenty-four (24) inches thick per Section 02276 "Gravel and Crushed Rock Base for Structures".*** Crushed stone material shall be a well-graded crushed stone or crushed gravel meeting the requirements of ASTM C-33, Gradation No. 67 ($\frac{3}{4}$ -inch to No. 4 sieve). The crushed stone base material shall extend one (1) foot beyond the outside edge of the concrete structure. The precast structures shall be constructed such that the structure will not transmit dead or live loads to the piping. Care shall be taken to prevent earth and other material from entering the precast structures.
- C. Fill all interior and exterior joints between precast sections with a joint sealant, as recommended by the precast structure manufacturer.
- D. Installing Precast Sections
 1. Set each precast concrete unit plumb on a bed of sealant to make a watertight joint at least $\frac{1}{2}$ -inch thick with the concrete base or with the preceding unit. Point the inside joint and wipe off the excess sealant.

2. Assemble units so that the cover conforms to the elevations shown on the Contract Drawings.
3. Pipe connections at precast structures shall be provided at the locations shown on the Contract Drawings. **Connections shall be resilient and waterproof.**
4. All voids in interior and exterior manhole section joints and lift holes for manhole sections shall be filled with a non-shrinking, non-metallic grout. Grout shall be applied and cured in strict accordance with the manufacturers recommendations. The grout shall be finished smooth and flush with the wall surface of the manhole.

E. Manhole Flow Channels and Bench Walls

1. Unless prior approval is obtained from the Engineer, manhole flow channels (inverts) and bench walls shall be precast into the manhole based section as specified above in Article 2.01(A)(20).
2. Upon prior approval from the Engineer, manhole inverts may be constructed in the field. Invert channel bottoms shall be smooth and semi-circular in shape conforming to the inside of adjacent sewer sections. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in the size and grade of the channels shall be made gradually and evenly to give a smooth uninterrupted flow pattern through the manhole. Channel height shall match the crown of the connection sewer pipe exiting the manhole.
3. Manhole bench walls shall be smooth and shall slope one (1) inch per foot from the edge of the invert channel to the precast manhole wall. Invert channels may be constructed by forming in concrete or by building up brick and mortar to form the manhole bench walls on each side of the channel, and plastering over bricks with cement mortar with a minimum thickness of ½-inch. Manhole invert construction shall only be performed by experienced and qualified workmen.
4. Bricks used to construct manhole invert channels and bench walls shall be standard size (2½" (H) x 4" (W) x 8" (L)) brick in conformance with ASTM C32, "Sewer and Manhole Brick (made from clay and shale)". Mixing shall be as follows: One (1) volume of Type II Portland Cement with three (3) volumes of sand and sufficient clean water to produce a rich mass of approved consistency. Mixing mortar on the ground or any paved surface shall not be permitted. Sand to be used in making mortar shall be clean, well-graded, and shall pass a No. 4 sieve.

F. Setting Frames and Covers

1. Unless otherwise indicated on the Contract Drawings, in unpaved areas the tops of concrete structures/manholes shall be set 0.20 feet above finished grade and the

tops of wet wells and valve vaults shall be set 0.50 feet above finished grade, unless otherwise indicated on the Contract Drawings. In paved areas, the top of the cover shall be flush with the paving surface.

2. The top of all precast concrete structures/manholes may be brought to the proper grade for receiving the precast concrete structure/manhole frame by using not more than three (3) courses of brick or precast concrete grade rings. Bricks and mortar used for manhole top adjustment shall be as specified above in Article 3.01(E)(4). Precast concrete grade rings shall be precast with steel reinforcement in conformance with ASTM C-478 and concrete with a compressive strength of 4,000 psi in twenty-eight (28) days. Precast concrete grade rings shall be manufactured in half annular shapes for ease of handling. The grade ring dimensions shall be two (2) inches thick with an annular width of eight (8) inches and an inside diameter of twenty-four (24) inches.
 3. Masonry construction shall be performed by experienced and qualified workmen only. All work shall be laid plumb, straight, level, square and true. Brick shall be laid in full beds of mortar and shoved into place. All joints shall be full and not more than ½-inch in thickness. The Contractor shall set in place and bond in the masonry all necessary anchor bolts and miscellaneous items specified elsewhere. The masonry walls shall be plastered on the inside and outside with a ½-inch coat of Portland Cement mortar.
 4. Following curing of any masonry construction required for structure top adjustment, set the frame in a bed of ¼-inch to ½-inch thick flexible bitumastic sealing material (Ram-Nek) and anchor in place with two ¾-inch diameter anchor bolts, which shall be securely embedded in the top of the manhole. Seal the flange of the structure ring to the top of the structure with cement mortar.
- G. Install piping, equipment, access frames, covers, pump guide bars, etc., in accordance with the instructions and approved shop drawings furnished by the manufacturer and as shown on the Contract Drawings.
- H. All openings for pipes and joints between concrete sections shall be sealed watertight.
- I. The interior coating system, if called for, shall be applied following installation of the precast structures and any piping or equipment that will penetrate or attach to the walls. Surface preparation and application of the coating system shall be in strict accordance with the manufacturer's recommendations.
- J. After the structure and all appurtenances are in place and approved by the Engineer and Owner, backfill shall be place to the original ground elevation or to the limits designated on the Contract Drawings. Backfill material shall consist of sand or loose earth, free from stones, clods, and other deleterious material. It shall be placed in

horizontal layers not exceeding twelve (12) inches in depth, and shall be moistened and thoroughly compacted to a minimum relative density according to the requirements of Division 2, "Earthwork".

- K. Where an HDPE liner has been specified, the liner shall be installed per the manufacturers recommendations. Seams shall be heat fused at the factory where practical. All field welds shall be performed by a factory trained technician and be fully warranted for a period of five (5) years.

L. Parking Blocks

1. Install parking blocks where indicated on the Concrete Drawings. Anchor the parking blocks with ½-inch steel dowels, eighteen (18) inches long.

M. Splash Pads

1. Install splash pads where indicated on the Contract Drawings. Slope them to drain rainwater away from the structure.

N. Concrete Sills and Copings

1. Install through-wall flashing and all other flashings as indicated on the Contract Drawings and as specified under Section 07600, "Flashing and Sheet Metal". All surfaces on which flashing material is to be installed shall be clean and rough particles removed.
2. Handle sills and copings by methods that will guard against soiling, mutilating, or chipping.
3. Where sills are backed-up with concrete or concrete blocks, coat the face of the back-up material with a waterproofing material as specified in Section 07100, "Waterproofing".
4. Set sills and copings plumb, level, and true to line in a full bed of mortar and tap to even bearing.
5. Set the concrete sills/coping in a solid bed of non-staining mortar with not less than ¼-inch wide joints, except where otherwise indicated or specified. All vertical joints, except those specified below, shall be filled full depth with mortar; before the mortar has set, the joints shall be raked back ¾-inch from the face to allow for pointing. Completely fill all holes for anchors, dowels, and accessories. Avoid splashing mortar on the exposed surface.
6. All copings, sills, and other projecting stones, shall be set with unfilled vertical joints. Caulk the exterior profile of these joints for ¾-inch from the face with non-staining

dry rope yarn or oakum. Fill the joint from above with mortar to within $\frac{3}{4}$ -inch of the top. After the grout has set remove caulking leaving joints ready for back-up material, caulking and sealing compound as required.

7. Provide expansion or control joints in work at locations indicated. Form expansion joints by placing continuous strips of preformed joint filler material in vertical joint to within $\frac{1}{2}$ -inch of the exposed face; fill remainder of joint with polysulfide sealant.
8. All concrete workmanship shall conform to the requirements of Division 3, "Concrete".
9. Waterproofing
 - a. The exposed face of sills and copings shall be treated with a coat of clear non-staining water repellent as detailed and specified in Section 07100, "Waterproofing".
 - b. Apply the waterproofing material after the walls have been cleaned and are thoroughly dry. Application shall be in strict accordance with manufacturer's directions
 - c. Avoid splashing the waterproofing material on metals, glass and other adjacent surfaces. Immediately remove any splashes.

END OF SECTION

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SECTION 03420

PRESTRESSED HOLLOWCORE PLANK

1. GENERAL

1.01 Description

A. Description of Work

1. Furnish all labor, materials, equipment and services necessary to complete the precast hollowcore plank as shown on the Contract Drawings and/or specified herein, including, but not necessarily limited to, the following
 - a. Hollowcore plank.
 - b. Grouting between units.

1.02 Related Work Described Elsewhere

A. Cast-in-Place Concrete:	Section 03300
B. Structural Steel:	Section 05120
C. Nailbased Insulation Panels:	Section 07221
D. Roofing System:	Division 7
E. Joint Sealants:	Section 07900

1.03 Quality Assurance

A. Manufacturer Qualifications

1. The precast concrete manufacturing plant shall be certified by the Prestressed Concrete Institute (PCI) Plant Certification Program prior to the start of production. The manufacturer shall be certified in Category C3.

2. The manufacturer shall, at his expense, meet the following requirements:

- a. The basis of inspection shall be the Prestressed Concrete Institute's *"Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products"*, MNL-116, and the criteria for acceptance shall be the same as the Plant Certification Program.

B. Erector Qualifications

1. PCI Qualified and regularly engaged for at least three (3) years in the erection of precast structural concrete similar to the requirements of this project. Retain a registered structural engineer to certify that erection is in accordance with design requirements.

C. Welder Qualifications: In accordance with AWS D1.1.

D. Testing

1. In general compliance with applicable provisions of Prestressed Concrete Institute MNL-116, *"Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products"*.

E. Requirements of Regulatory Agencies

1. All local codes plus the following specifications, standards and codes are a part of these specifications:
 - a. ACI 318 – Building Code Requirements for Reinforced Concrete.
 - b. AWS D1.1 – Structural Welding Code-Steel.
 - c. AWS D1.4 – Structural Welding Code-Reinforcing Steel.
 - d. ASTM Specifications – As referred to in Part 2-Products, of this Specification.

1.04 Submittals and Design

A. Shop Drawings

1. Erection Drawings

- a. Plans locating and defining all hollowcore planks furnished by the manufacturer, with all major openings shown.

- b. Sections and details showing connections, weld plates, edge conditions and support conditions of the hollowcore plank units.
- c. All dead, live and other applicable loads used in the design.
- d. Fire rating.
- e. Estimated Camber.

2. Production Drawings

- a. Plan view of each hollowcore slab unit type.
- b. Sections and details to indicate quantities, location and type of reinforcing steel and prestressing strands.
- c. Lifting and erection inserts.
- d. Dimensions and finishes.
- e. Prestress for strand and concrete strength.
- f. Camber.

B. Approvals

- 1. Submit five (5) copies of erection drawings and calculations for approval prior to fabrication.
- 2. Fabrication not to proceed prior to receipt of approved drawings and calculations.

C. Product Design Criteria

1. Loadings for Design

- a. Initial handling and erection stresses.
- b. All dead and live loads as specified per Florida Building Code 2017.
- c. All other loads specified for hollowcore plank where applicable.

- 2. Design steel plank support headers when such headers are determined necessary by the manufacturer's engineer.

3. Design calculations shall be performed by an engineer, registered in the state that the project is located in, and experienced in precast prestressed concrete design. Design calculations to be submitted for approval upon request.
4. Design shall be in accordance with ACI 318 and applicable codes.

D. Permissible Design Deviations

1. Design deviations will be permitted only after the Engineer's written approval of the manufacturer's proposed design supported by complete design calculations and drawings.
2. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the Owner.

E. Test Reports

1. Test reports on concrete and other materials shall be submitted upon request.

1.05 Safety

- A. The Contractor shall provide and maintain all safety barricades, rebar caps and opening covers required for plank in accordance with current industry safety standards.

1.06 Product Delivery, Storage and Handling

A. Delivery and Handling

1. Hollowcore plank shall be lifted and supported during manufacturing, stockpiling, transporting and erection operations only at the lifting or supporting points, or both, and with approved lifting devices. Lifting inserts shall have a minimum safety factor of 4.
2. Exterior lifting hardware shall have a minimum safety factor of 5.
3. Transportation, site handling and erection shall be performed with acceptable equipment and methods and by qualified personnel.

B. Storage

1. Store all units off ground on firm, level surfaces with dunnage placed at bearing points.
2. Place stored units so that identification marks are discernible.
3. Separate stacked units by dunnage across full width of each plank.

2. PRODUCTS**2.01 Materials****A. Portland Cement**

1. ASTM C150 - Type I or III.

B. Admixtures

1. Air Entraining Admixtures, ASTM C260, Water Reducing, Retarding, Accelerating, High-Range Water Reducing Admixtures: ASTM C494.

C. Aggregates

1. ASTM C33 or C330.

D. Water

1. Potable or free from foreign materials in amounts harmful to concrete and embedded steel.

E. Reinforcing Steel**1. Bars**

- a. Deformed Billet Steel: ASTM A615.
- b. Deformed Rail Steel: ASTM A616.
- c. Deformed Axle Steel: ASTM A617.

d. Deformed Low Alloy Steel: ASTM A706.

2. Wire

a. Cold Drawn Steel: ASTM A82.

F. Prestressing Strand

1. Uncoated, 7-Wire, Low Lax strand: ASTM A416 (including supplement) – Grade 270K.

G. Welded Studs

1. In accordance with AWI D1.1.

H. Structural Steel Plates and Shapes

1. ASTM A36.

I. Grout

1. Grout shall be a mixture of not less than one (1) part Portland cement to three (3) parts fine sand, and the consistency shall be such that joints can be completely filled but without seepage over adjacent surfaces.
2. The grout shall achieve a minimum 28-day compressive strength of 2,000 psi. Any grout that seeps from the joint shall be completely removed before it hardens.

J. Bearing Strips: Hardboard

2.02 Concrete Mixes

A. 28-day compressive strength: 5,000 psi, minimum.

B. Release strength: 3,000 psi, minimum.

C. Use of calcium chloride, or admixtures containing chlorides is not permitted.

2.03 Manufacturer

- A. Hollowcore plank shall be machine cast in 48-inch widths as manufactured by High Concrete Group LLC or equivalent.
- B. Manufacturing procedures and tolerances shall be in general compliance with PCI MNL-116.
- C. Openings
 - 1. Manufacturer shall provide for rectangular openings 12 inches or larger on all sides and as clearly shown on the architectural and structural drawings. They shall be located by the trade requiring them and then field cut.
 - 2. Round and small openings (less than 12 inches) shall be drilled or cut by the respective trades after grouting.
 - 3. Openings requiring cutting of prestressing strand shall be approved by the precast plank manufacturer before drilling or cutting.
- D. Finishes
 - 1. The bottom surface shall be flat and uniform as resulting from an extrusion process, without major chips, spalls and imperfections.
 - 2. The top surface shall be machine formed.
- E. Patching
 - 1. Will be acceptable providing the structural adequacy of the hollow core unit is not impaired.

3. EXECUTION

3.01 Erection

- A. Site Access
 - 1. Erection access suitable for cranes and trucks to move unassisted from public roads to all crane working areas as required by erector, or otherwise indicated herein, will be provided and maintained by the General Contractor.

B. Preparation

1. The General Contractor shall be responsible for the following:
 - a. Providing true, level, bearing surfaces on all field-placed bearing walls and other field-placed supporting members. Masonry wall bearing surfaces shall be bond beams with properly filled concrete of adequate strength.
 - b. All pipes, stacks, conduits and other such items shall be stubbed off at a level lower than the bearing plane until after the plank are set.
 - c. Masonry, concrete or steel shall not be installed above plank-bearing surface until after the plank is in place and grout reaches adequate strength.

C. Installation

1. Installation of hollowcore plank shall be performed by the manufacturer or a competent erector.
2. Members shall be lifted with slings at points determined by the manufacturer. Bearing strips shall be set where required.
3. Grout keys shall be filled.
4. Openings shall be field cut only after grout has reached adequate strength, unless authorized by the manufacturer's engineer.
5. The General Contractor is to provide temporary shoring or bracing of framing to accept hollowcore plank prior to plank being set.

D. Alignment

1. Members shall be properly aligned.
2. Variations between adjacent members shall be reasonably leveled out by jacking, bolting or any other feasible method as recommended by the manufacturer.

3.02 Field Welding

- A. Field welding is to be done by qualified welders using equipment and materials compatible to the base material.

3.03 Attachments and Openings

A. Attachments

1. Subject to approval of the Engineer, hollowcore plank units may be drilled or “shot” provided no contact is made with the prestressing steel.
2. Should spalling occur, it shall be repaired by the trade doing the drilling, shooting or cutting.
3. Holes shall be drilled by the General Contractor.

B. Openings

1. Any unframed opening shall be drilled or cut by the respective trades without making contact with prestressing strand.

3.04 Weep Holes

- A. Quarter-inch ($\frac{1}{4}$ -inch) holes shall be drilled into the bottom of each core at each end of hollowcore plank to allow drainage of accumulated moisture.
- B. Holes shall be drilled and patched by the General Contractor.

3.05 Cleanup

- A. Remove rubbish and debris resulting from hollowcore plank work from premises upon completion.

END OF SECTION

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SECTION 03600

GROUT

1. GENERAL

1.01 Description

A. Provide all labor, materials, tools, manpower, and equipment and perform all grouting as specified hereinafter and as indicated on the Contract Drawings.

B. Related Work Described Elsewhere

Specification Section	Title
03300	Cast-in-Place Concrete
03400	Precast Concrete Structures
Division	Description
11	Equipment
Contract Drawings and General Provisions of the Contract	

1.02 Submittals

A. The Contractor shall submit manufacturers' literature for review on the following items in accordance with Section 01300, "Shop Drawings, Submittals and Samples":

1. Non-shrink grout data and shall include grout properties, mixing, surface preparation, and installation instructions.
2. Portland Cement Grout
3. Mix design for all other types of grout.

1.03 Quality Assurance

A. Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM C-33	Standard Specification for Concrete Aggregates
ASTM C-109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C-150	Standard Specification for Portland Cement
ASTM C-191	Standard Test Method for Time of Setting of Hydraulic Cement
ASTM C-1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
U.S. Army Corps of Engineers (COE)	
CRD-C-588	Standard Specification for Grout
CRD-C-621	Standard Specification for Grout
Building Codes	
	Florida Building Code

1.04 Product Delivery, Storage and Handling

- A. Grouting materials shall be delivered and stored in unbroken containers with seals and labels intact as packaged by the manufacturer.
- B. Prevent damage to or contamination of the grouting materials.

2. PRODUCTS

2.01 Materials

A. Portland Cement Grout

1. To be used for grouting CMU cells and similar items.

a. Grout Characteristics

- 1) Portland Cement: ASTM C-150, Type I
- 2) Sand: ASTM C-33, Fine Aggregate
- 3) Water: Potable
- 4) Pea Gravel: ASTM C-33; coarse aggregate, graded so that at least 90% passes a $\frac{3}{8}$ -inch sieve and 90% is retained by a No. 4 sieve.

2. Grout Mortar for use as fillets and leveling.

a. Grout Characteristics

- 1) Portland Cement: ASTM C-150, Type I
- 2) Sand: ASTM C-33, Mason's Sand
- 3) Water: Potable
- 4) Mix: One (1) part Portland cement to three (3) parts sand.

B. Non-Shrink Grout

1. Non-shrink grout shall conform to the Corps of Engineers Specification for Non-shrink Grout, CRD-C-588, CRD-C-621, ASTM C-1107 and to these specifications.
2. Use only a nongas-lubricating type, cement base, pre-mixed product requiring only the addition of water for the required consistency. Components shall be "inorganic".
3. Non-shrink grout for setting bearing plates for structural steel, machinery and other equipment shall be mixed as recommended by the manufacturer to give the necessary consistency for placing and to give a minimum compressive strength of 3,000 psi in three (3) days, and 6,800 psi in twenty-eight (28) days.
4. Subject to compliance with requirements, non-shrink grout shall be:
 - a. Master Flow 713, Master Builders, Co.
 - b. Euco N-S, Euclid Chemical Co.
 - c. Five Star Grout, Five Star Products, Inc.
 - d. Or equal.

C. Non-shrink, Metallic Grout

1. Master Builders Embeco 636 Grout, pre-mixed type, or equal.

D. Expansive Grout

1. Premixed, cementitious mixture with a minimum 28-day strength of 3,500 psi. Provide air entraining content as recommended by the manufacturer.

E. Epoxy Grout

1. Mix the two components of epoxy bonding compound in compliance with the manufacturer's instructions. Use sand that is oven dry and meets the following gradation requirements for epoxy grout:

Sieve Size	No. 8	No. 50	No. 100
% Passing	100	30 ± 15	5 ± 5

2. Sikadur 42 Grout-Pak, or equal, for grouting sleeves for anchor bolts, etc.

3. EXECUTION

3.01 Procedures

- A. Installation methods and procedures shall be approved by the Engineer and shall be in accordance with the manufacturer's printed specifications before work is begun.

3.02 Preparation

- A. Surface preparation shall be in accordance with the manufacturer's written instructions.
- B. **Remove defective concrete, laitance, dirt, oil, grease and other foreign material from the concrete surfaces to be grouted** by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.
- C. **Lightly roughen the concrete**, but not enough to interfere with the proper placement of the grout. Cover concrete areas with a waterproof membrane until ready to grout. Immediately before grouting, remove the waterproof membranes and clean any contaminated surfaces.

- D. **Remove all foreign materials from metal surfaces in contact with grout.** Align, level and maintain final positioning of components to be grouted.
- E. **Saturate concrete surfaces with clean water;** remove excess water and leave none standing.

3.03 Placing of Grout

A. Non-shrink Grout

1. Non-shrink, non-metallic grout shall be used for grouting column base plates, concrete wall panel connections, anchor bolts, reinforcing bars, pipe sleeves, machinery supports and pump base plates. Use epoxy grout for anchor bolts, etc., where indicated on the Contract Drawings.
2. Non-shrink grout shall be mixed and placed as recommended by the manufacturer. After the grout has been mixed, do not add any more water for any reason.
3. Grout shall be mixed as close to the work area as possible and transported quickly to its final position in a manner that will not permit segregation of materials.
4. Place grout in accordance with the manufacturer's written instructions.
5. **Place non-shrink grout quickly and continually by the most practical means** permissible; pouring, pumping or under gravity pressure.
6. **Apply grout from one side to avoid entrapping air.** The final grouting installation shall be thoroughly compacted and free from air pockets.
7. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment.
8. Do not remove leveling shims for at least twenty (20) days after the grout has been placed. After shims have been removed, fill all voids with Portland cement grout.
9. After non-shrink grout has reached initial set, rake out exposed edges approximately one (1) inch into the grouted area and paint with Portland cement mortar.

3.04 Grouting Machinery Foundations

- A. Block out the original concrete or finish off a sufficient distance below the bottom of the machinery base to provide for the thickness of grout shown on the Contract Drawings.

- B. After the machinery has been set in position and wedged to the proper elevation by steel wedges, the space between the bottom of the machinery base and the original pour of concrete shall be filled with a pourable non-shrink grout.
- C. Grout and grouting procedures shall be in accordance with API 610, Seventh Edition, Appendix L.

3.05 Curing

- A. ***Non-shrink grout shall be cured with water saturated burlap for at least three (3) days or with Super Rez Seal cure and seal compound applied immediately after grout placement.***
- B. Machinery set on grout pads shall not be operated until the grout has cured for at least thirty-six (36) hours.

END OF SECTION

SECTION 03700

CONCRETE ELECTRICAL RACEWAY ENCASEMENT

1. GENERAL

1.01 Description

A. Description of Work

1. Furnish all labor, materials, equipment and incidentals required and install concrete encasement around underground electrical raceways as shown on the Contract Drawings and as specified herein.

B. Related Work Described Elsewhere

Specification Section	Title
02215	Finish Grading
02220	Excavation, Backfilling and Compaction
03100	Concrete Formwork
03200	Concrete Reinforcement
03250	Concrete Accessories
03300	Cast-in-Place Concrete
03400	Precast Concrete Structures
09905	Piping, Valve and Equipment Identification System
Division	Description
16	Electrical Conduit
Contract Drawings and General Provisions of the Contract	

1.02 Submittals

- A. Submit to the Engineer, as provided in the General Conditions and in accordance with Section 01300, "Shop Drawings, Submittal and Sample", shop drawings showing dimensions and layouts of concrete encasement and reinforcement for concrete work.

- B. All materials specified shall be certified by the producer or manufacturer that the furnished material meets the specific requirements of the Contract Documents.

1.03 Testing

- A. Testing requirements and frequencies for concrete encasement and related items shall be as outlined in Section 03300, "Cast-in-Place Concrete".
- B. Sample backfill materials by ASTM D-75.
- C. "*Relative compaction*" is defined as the ratio, expressed as a percentage, of the in-place density to the laboratory maximum density.
- D. Compaction shall be deemed to comply with the Specifications when no tests fall below the specified relative compaction. The Contractor shall pay the costs of any retesting of work not conforming to the Specifications.
- E. Density tests will be made for determination of specified compaction by an independent testing laboratory provided by the Contractor and as approved by the Engineer as specified in Section 01410, "Testing and Testing Laboratory Services". Testing shall be performed in locations reviewed and approved by the Engineer and as specified in the Contract Documents.
- F. If any tests are unsatisfactory, the Contractor shall re-excavate and re-compact the fill or backfill until the desired compaction is obtained. Additional compaction tests will be taken on each side of an unsatisfactory test at locations approved by the Engineer to determine the extent of re-excavation and re-compaction necessary. All testing shall be incidental to the Contract.
- G. The Contractor shall pay for each compaction test, failed compaction test and for each additional test taken to determine the extent of re-excavation and re-compaction as previously described.

2. PRODUCTS

2.01 Concrete

- A. All concrete for electrical raceway encasement shall ***be made with Class B concrete, having a minimum 28-day compressive strength of 3,000 psi, and a maximum slump of four (4) inches*** as specified in Section 03300, "Cast-In-Place Concrete".

- B. Concrete encasement of piping and related items shall be constructed, after being thoroughly consolidated in place, to the thickness indicated herein.

2.02 Forming

- A. Use forms of either wood or metal with a depth equal to the plan dimensions for the depth of concrete being deposited against them.
- B. Forms shall be straight, free from warp or bends, and of sufficient strength when staked to resist the pressure of the concrete without deviation from line and grade.
- C. **Clean the forms each time they are used**, and oil or saturate with water prior to placing the concrete.

3. EXECUTION

3.01 Installation

- A. The Contractor shall form the concrete electrical raceway encasement as specified in Section 03100, "Concrete Formwork".
- B. Concrete shall conform to the requirements Section 03300, "Cast-in-Place Concrete" and as specified herein.
- C. The Contractor shall provide not less than four (4) inches of concrete between the outside of a raceway and the earth. Provide not less than two (2) inches of concrete between adjacent raceways.
- D. All raceway concrete placements shall be continuous between manholes or handholes and between manholes or handholes and structures.
- E. Where raceways pass through concrete walls, concrete encasement shall be extended through the finished flush with inside surfaces. Watertight construction joints with waterstops conforming to Section 03250, "Concrete Accessories", shall be provided.
- F. Concrete encasements shall be reinforced as and where indicated on the Contract Drawings.
- G. **Concrete encasements shall be laid in trenches on mats of screened gravel not less than six (6) inches thick.**

- H. *The minimum cover for electrical raceway banks shall be twenty-four (24) inches.*

END OF SECTION

SANFORD MAIN WTP IMPROVEMENTS

SANFORD, FLORIDA



DIVISION 4

MASONRY

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DIVISION 4

MASONRY

Specification Section	<u>Title</u>
04050	Masonry
04230	Reinforced Unit Masonry
04450	Marble Window Sills and Thresholds

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SECTION 04050

MASONRY

1. GENERAL

1.01 Description

- A. Furnish all labor, materials, equipment and incidentals required to construct all masonry work, in a first-class condition, as shown on the Contract Drawings and as specified herein.

- B. The Work under this Section includes, but is not limited to, the following:
 - 1. Standard Concrete Masonry Units (CMU).
 - 2. Split-Faced Concrete Masonry Units (CMU).
 - 3. Ground faced Concrete Masonry Units (CMU).
 - 4. Masonry reinforcing, ties and anchors.
 - 5. Control Joints.
 - 6. Grouting of masonry units is required throughout the project.

- C. Related Work Specified Elsewhere:
 - 1. Reinforced Unit Masonry: Section 04230
 - 2. Masonry Building Insulation: Section 04250
 - 3. Firestopping: Section 07270
 - 4. Doors and Windows: Division 8

1.02 Submittals

- A. Submit to the Engineer, in accordance with Section 01300, "Shop Drawings, Submittals and Samples", two (2) samples of all required concrete unit masonry for the Project, including split-face CMU and component and accessory materials (include catalog data on metal ties and anchors, joint reinforcement, control joint material, etc.). Submit with the samples, all certifications and test data required to prove compliance of the products with this Section and the Florida Building Code.
- B. Submit color samples for integral colored split-faced concrete masonry units and colored mortar mixers. ***(units/ mortar shall match existing split-face CMU Bldg).***
- C. Submit documentation that all components submitted comply with the specified reference standards. Submit certification of compliance with OSHA Section 1926.700(A) and (B) for construction techniques for high masonry walls, as necessary.
- D. Submit manufacturer's split-face CMU samples for final color "matching" approval. After color approval, submit three (3) full split-face CMU units in each profile indicated showing maximum color variation.
- E. Job Mock-up - NOT USED
- F. Material Test Reports
 - 1. From a qualified testing agency indicating and interpreting test results of the following for compliance with the requirements indicated:
 - a. Each type of masonry unit required.
 - 1) Include size variation, verifying that the actual range falls within specified tolerances.
 - 2) Include test results, measurements, and calculations establishing the net-area compressive strength of masonry units.
 - b. Mortar complying with the property requirements of ASTM C-270.
 - c. Grout mixes complying with the compressive strength requirements of ASTM C-476. Include a description of the type and proportions of grout ingredients.

1.03 Quality Assurance

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM A82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron & Steel Hardware
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C90	Standard Specification for Loadbearing Concrete Masonry Units
ASTM C91	Standard Specification for Masonry Cement
ASTM C129	Standard Specification for Non-Loadbearing Concrete Masonry Units
ASTM C140	Standard Test Methods of Sampling and Testing Concrete Masonry Units
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C207	Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C270	Standard Specification for Mortar for Unit Masonry
ASTM C331	Standard Specification for Lightweight Aggregates for CMU's
ASTM C426	Standard Test Method for Drying Shrinkage of Concrete Block
ASTM C476	Standard Specification for Grout for Masonry
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C780	Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM A951	Standard Specification for Masonry Joint Reinforcement
ASTM C1019	Standard Method for Sampling and Testing Grout
ASTM C-1093	Standard Practice for Accreditation of Testing Agencies for Unit Masonry
ASTM C1142	Extended Life Mortar for Unit Masonry
ASTM C1180	Standard Terminology for Mortar and Grout for Unit Masonry
ASTM 1329	Mortar Cement
ASTM E-84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E-119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E-548	Standard Guide for General Criteria Used for Evaluating Laboratory Competence
American Concrete Institute (ACI)	
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 530.1-88	Specifications for Masonry Structures
ACI 531-79	Building Code Requirements for Concrete Masonry Structures

STANDARD	DESCRIPTION
Other Reference Standards	
ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications (SAE Recommended Practice J200)
	Recommendations of the Brick Institute of America (BIA)
	Recommendations of the National Concrete Masonry Association (NCMA)

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

C. Testing

1. The Engineer may require materials to be subjected to test to determine their quality whenever there is a reason to believe that a material is not of acceptable quality. The costs of such tests shall be incidental to the Contract.
2. Tests of materials shall be conducted in accordance with the Standard Specifications of the American Society for Testing Materials (ASTM).

D. Variation from Plumb

1. For vertical walls and arises, do not exceed $\frac{1}{4}$ -inch in ten (10) feet or $\frac{3}{8}$ -inch in a story height.
2. For external corners, expansion joints and other conspicuous lines, do not vary more than $\frac{1}{4}$ -inch in ten (10) feet.

E. Variation from Level

1. For lines of exposed lintels, sills, parapets and other conspicuous lines, do not exceed $\frac{1}{4}$ -inch in twenty (20) feet.

F. Variation of Linear Building Line

1. For position show in plan and related portion of walls and partitions, do not exceed $\frac{1}{4}$ -inch in twenty (20) feet.

G. Variation in Cross-Sectional Dimensions

1. For columns and thickness of walls, from the dimensions shown on the drawings, do not exceed $\pm \frac{1}{4}$ -inch.

H. Concrete Masonry Units (CMU)

1. The Contractor shall ensure that ***all concrete masonry units are of the same color and shade and match the existing "on-site" split-face CMU Building.***
2. The CMU's shall be cast from the same lot and batch numbers using the same materials and coloring agents.
3. Any CMU ***that does not "color-match" shall be not be used*** and shall be removed from the Project site.

I. Mortar

1. The mortar used shall be of the same color throughout the entire building expansion and shall ***match*** the mortar color of the existing "on-site" split-face CMU Building.
2. Mortar that is not consistent in color shall ***not be used*** in the construction of any buildings and/or structures.

J. Testing Agency Qualifications

1. An independent testing agency, acceptable to the Engineer and Owner, qualified according to ASTM C-1093 to conduct the testing indicated, as documented according to ASTM E-548.

K. Source Limitations for Masonry Units

1. Obtain exposed masonry units of a uniform texture and color or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

L. Source Limitations for Mortar Materials

1. Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

M. Preconstruction Testing Service

1. The Contractor will engage a qualified independent testing agency to perform the preconstruction testing indicated below. Payment for these services will be made by the Contractor. Retesting of materials failing to meet specified requirements shall be done at the Contractor's expense.
 - a. Concrete Masonry Unit Test: *For each CMU indicated, per ASTM C-140*
 - b. Grout Test: *For compressive strength, per ASTM C-1019*

N. Fire-Resistance Ratings

1. Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E-119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.04 Protection of Materials

- A. All perishable materials for the work of this Section shall be delivered, stored and handled so as to preclude any damage of any nature. Manufactured materials, such as cement and lime, shall be delivered and stored in their original containers, plainly marked with identification of material and maker.
- B. Materials in broken containers, or in packages showing water marks or other evidence of damage, shall not be used and shall be removed from the site.
- C. ***Store masonry units on elevated platforms or pallets in a dry location.*** If the masonry units are not stored in an enclosed location, cover the tops and sides of stacks with waterproof sheeting, securely tied. If masonry units become wet, do not install until they are dry.
- D. ***Any masonry units damaged or chipped during shipment, storage or installation shall be rejected and removed from the site.***
- E. Deliver pre-blended, dry mortar mix in moisture resistant containers designed. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location.
- F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

- G. Stockpile and handle aggregate to prevent contamination from foreign materials.
- H. Store admixtures to prevent contamination or damage from excessive temperature changes.
- I. Keep water free of harmful materials.

1.05 Protection of Work

- A. ***During construction, cover the top of walls, projections, and sills with heavy waterproof sheeting at the end of each day's work. Cover partially completed structures when the work is not in progress.*** Extend the cover a minimum of twenty-four (24) inches down both sides and hold the cover securely in place.
- B. Do not apply a uniform floor or roof loads for at least twenty-four (24) hours after the building masonry walls or columns.
- C. Do not apply concentrated loads for at least three (3) days after building masonry walls or columns.
- D. Prevent grout, mortar and soil from staining the face of the masonry to be left exposed or painted on the "new" split-face CMU Building's masonry. Immediately remove all grout, mortar and soil that comes into contact with such masonry.
 - 1. Protect the base of walls from rain-splashed mud and from mortar splatter by coverings spread on the ground and over the wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

1.06 Weather Construction Conditions

A. Cold Weather Requirements

- 1. Masonry construction in cold weather shall conform to the applicable requirements of the following:

- a. "Cold Weather Masonry Construction", Specifications for Masonry Structures, ACI 530.1.
- b. "Construction and Protection Recommendations for Cold Weather Masonry Construction" of the Technical Notes on Brick and Tile Construction by the Brick Institute of America.

B. Hot Weather Requirements

1. Protect unit masonry work when the temperature and humidity conditions produce excessive evaporation of water from mortar and grout.
2. Provide artificial shade and wind breaks and use cooled materials as required.
3. When ambient temperature exceeds 100°F (38°C), or 90°F (32°C) with a wind velocity greater than 8 mph (13 km/hr), do not spread mortar beds more than 48 inches ahead of the masonry. Set masonry units within one (1) minute of spreading the mortar.
4. Masonry construction in hot weather shall also conform to the applicable requirements of "Hot Weather Masonry Construction", Specifications for Masonry Structures, ACI 530.1.

1.07 Performance Requirements

- A. *Provide unit masonry that develops the following net-area strengths (f'm) at 28 days.*** Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

2. PRODUCTS

2.01 Concrete Masonry Units

- A. Standard weight Concrete Masonry Units (CMU) for interior and exterior walls where indicated on the Contract Drawings, shall conform to ASTM C-90, Grade N, Type II, non-moisture controlled, two cell hollow, load bearing units of eight (8) inch by sixteen (16) inch normal face size and bed dimension as shown on the Contract Drawings.
- B. Split-faced and ground face Concrete Masonry Units (CMU) for interior and exterior walls where indicated on the Contract Drawings, shall be as manufactured by DeMaco Corporation (Rinker), Rockblock Inc., or approved equal.

- C. Units shall have eight (8) inch by sixteen (16) inch, four (4) inch by sixteen (16) inch, and twelve (12) inch by sixteen (16) inch nominal face size. Matching end and corner units shall be selected from samples provided by the block manufacturer.
- D. No overall dimension (width, height or length) shall differ by more than $\frac{1}{16}$ -inch from the specified standard dimension, except for dimensions measured to a split-face or end shall not be held to this tolerance.
- E. **Minimum compressive strength on the CMU net area (average of three units) when tested in accordance with ASTM C140 shall be 3,500 psi on the net area.** Minimum compressive strength on any individual unit shall not be less than 3,000 psi.
- F. **The minimum acceptable water absorption rate shall be six percent (6%) of the oven dry weight** of the masonry unit in pounds per cubic feet.
- G. Oven dry weight of the concrete shall not be less than 125 lb/ft³.
- H. **Precast concrete lintels shall be minimum compressive strength of 3,500 psi** with reinforcing steel placed all as shown.
- I. CMU's shall be free from substances that will cause staining or popouts and shall be fine and even textured with straight and true edges. All units shall have been wet steam cured for at least eighteen (18) hours and then air cured in covered storage for not less than twenty-eight (28) days before delivery. Units shall have a maximum linear drying shrinkage of 0.025 percent (ASTM C-426) and have a moisture content at the time of delivery not exceeding thirty (30) percent of total absorption.
- J. **Split-faced CMU's shall be factory prefinished with an integral coloring agent** that is added during the mixing process. The coloring agent used for this Project shall be from the same lot and batch numbers. **The fieldcolor for the split-faced CMU's to be used for the "new" Main WTP Operations Building shall match the existing "on-site" split-faced CMU Building (Reclaimed Water Operations Building).** Columns and other accent colors shall be selected by the Engineer and Owner.
- K. Units shall be obtained from one manufacturer to **insure even color and texture of all units**. If all of the units (wall, end, corner and special units) provided for the project are not of the same color and texture, the units will be rejected and shall be removed from the site at the Contractor's cost. The Contractor shall ensure, that prior to delivery, all units were produced and colored from the same batch, guaranteeing uniform color and texture. The additional cost of removal and replacement of the block shall be incidental to the Contract.
- L. Provide special shapes, including, but not necessarily limited to lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
- M. Masonry insulation shall be as specified in Section 04250, "Masonry Building Insulation".

2.02 Mortar and Grout Materials

- A. Portland Cement shall conform to ASTM C150, Type I or II requiring only sand and water for mixing. Masonry cements **shall not** be used. Provide natural color or white cement as required to ***produce a mortar color that matches the existing “on-site” split-faced CMU Building (Reclaimed Water Operations Building) mortar.***
- B. Hydrated lime used for masonry mortar shall conform to ASTM C207, Type S.
- C. Aggregate for Mortar
 - 1. Aggregate for mortar shall conform to ASTM C-144; except for joints less than ¼-inch thick, use aggregate graded with one hundred percent (100%) passing the No. 16 sieve.
 - a. White-Mortar Aggregates: *Natural white sand or ground white stone*
 - b. Colored-Mortar Aggregates: *Natural-colored sand or ground marble, granite or other sound stone; of color necessary to produce the required mortar color*
 - c. Sand shall be clean, hard, durable particles, free from injurious amounts of organic matter.
- D. Mortar Coloring
 - 1. Colored mortar mixers shall be factory premixed with color pigments and Portland Cement, requiring only sand and water for mixing. Colored mortar for the Project shall be from the same factory lot and batch numbers. The color of the mortar mix ***shall match the existing “on-site” split-face CMU Building (Reclaimed Water Operations Building) mortar.***
 - 2. ***All mortar, for colored CMU’s, shall have the same coloring, tinting and shading for each particular building/structure. Colored mortar that varies in shading and tinting from area to area, and does not match the existing “on-site” split-face CMU Building (Reclaimed Water Operations Building) mortar will be rejected*** by the Engineer/Owner. The additional cost of removal of the mortar and CMU and Contract Time lost shall be incidental to the Contract.
- E. Aggregate for Grout shall conform to ASTM C-404.
- F. Water shall be free from injurious amounts oils, acids, alkalis or organic matter, and shall be clean and fresh (potable).
- G. Integral type waterproofing for use in all exterior mortar shall be a polymeric admixture resistant to water penetration with a Class E rating in accordance with ASTM E514-74.

Integral mortar waterproofing shall be Dry-Block mortar admixture by W.R. Grace and Company, Connecticut.

- H. Non-shrink grout shall be Masterflow 713 as manufactured by Master Builders Company; Euco –S by Euclid Chemical Co.; Five Star Grout by U.S. Grout Corporation; or equal. The grout shall attain a 28-day compressive strength of 6,800 psi.

2.03 Mortar and Grout Mixes

A. General

1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
2. Do not use calcium chloride in mortar or grout.

B. Pre-blended Dry Mortar Mix

1. Furnish dry mortar ingredients in the form of a pre-blended mix.
2. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry

1. Comply with ASTM C-270, Proportion Specification.
2. For reinforced masonry and where indicated, comply with ASTM C-270, Type S.

D. Grout for Unit Masonry

1. Grout for unit masonry shall comply with ASTM C-476.
2. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C-143.

2.04 Masonry Accessories

A. Joint Reinforcement

1. Reinforcement of masonry joints shall conform to ASTM A-951 and shall be welded wired units prefabricated in straight lengths of not less than ten (10) feet with matching corner and tee units fabricated from cold-drawn steel wire complying with ASTM A82, with deformed continuous side rods and plain cross-rods butt welded to side rods and a unit width of $1\frac{5}{8}$ -inch less than the thickness of the wall or partition. Units shall be galvanized after fabrication conforming to ASTM A-153, Class B-2, 1.5 oz./ft².
2. For single-wythe masonry, joint reinforcement shall be of the truss ladder type, fabricated with a single pair of galvanized 9-gauge side rods and continuous 9-gauge cross rods spaced not more than sixteen (16) inches on center. Reinforcement shall be manufactured by Dur-O-Wall; Hohmann and Barnard; AA Wire Products; or equal.
3. For additional masonry reinforcement requirements, see Section 04230, "Reinforced Unit Masonry".

B. Wall Ties and Anchors

1. Galvanized dove-tailed anchor slots, with anchors at twenty-four (24) on center, shall be furnished for anchorage to concrete framework or walls. Provide at ends of all CMU partitions where concrete is adjacent.
2. Approved 16-gauge corrugated nonferrous metal ties, manufactured for use with the anchor slots, provided shall be spaced at a maximum of eight (8) inches on center vertically and in each anchor slot (horizontally).
3. Ties to concrete deck at tops of nonload bearing CMU partitions and walls shall be No. 9 wire joint stabilizing anchors, Dur-O-Wall, D/A 2,200 (wire and sheet metal galvanized steel) spaced at 32 inches on center in head joints of CMU.
4. The Contractor shall provide miscellaneous metal ties, where ties are not shown on the Structural Drawings, shall be $1\frac{1}{2}$ -inches wide, 16 gauge, galvanized steel, of proper length to provide embedment as shown or as approved, spaced at 16 inches on center.
5. The Contractor shall provide and install miscellaneous anchors and attachment members, required both for the anchorage of his own work and that of other trades requiring attachment to masonry, which are not specifically provided under separate sections.

6. All galvanizing shall be of the hot dipped type conforming with ASTM A-82; with ASTM A153, Class B-2.
7. Ties and anchors shall be manufactured by Dur-O-Wal; Hohmann and Barnard; AA Wire Products; or equal.

C. Post Installed Anchors

1. Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E-488, conducted by a qualified independent testing laboratory.
 - a. Chemical Anchors
 - b. Expansion Anchors
 - c. Undercut Anchors
2. Corrosion Protection: Stainless steel components complying with ASTM F-593 and ASTM F-594, Group 1 alloy 304 or 316 for bolts and nuts; alloy 304 and 316 for anchors.
3. Cast-in-Place and Post-Installed Anchors in Concrete: Capability to sustain, without failure a load equal to four times the load imposed by the masonry.
4. Post Installed Anchors in grouted Concrete Masonry Units: Capability to sustain, without failure, a load equal to six (6) times the load imposed by the masonry.

D. Reinforcing Bar Positioners

1. Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication.
2. Provide units with either two loops or four loops as needed for the number of bars indicated.
3. Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:
 - a. Reinforcing Bar Positioners
 - 1) D/A 811 or D/A 816; Dur-O-Wal, Inc.
 - 2) No. 376 Rebar Positioner; Heckman Building Products, Inc.
 - 3) #RB Rebar Positioner; Hohmann & Barnard, Inc.

- 4) #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
- 5) Double O-Ring Rebar Positioner; Masonry Reinforcing Corp. of America.
- 6) O-Ring Rebar Positioner; Masonry Reinforcing Corp. of America.
- 7) Or Approved Equal.

E. Weep Holes

1. Wicking material shall be $\frac{3}{8}$ -inch diameter, treated cotton sash cord rope in the length required to produce a 2-inch exposure on the exterior and 18-inch in the cavity between wythes. Tie to the horizontal reinforcing above.

F. Reinforcing Bars

1. Reinforcement bars for lintels, bond beams, pilasters and other masonry reinforcement shall be deformed steel conforming to ASTM A615, Grade 60.

G. Compressible Filler

1. Premolded filler strips complying with ASTM D-1056, Grade 2A1; compressible up to thirty-five percent (35%); of the width and thickness indicated; formulated from neoprene or PVC.

H. Preformed Control Joint Gaskets

1. Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 - a. PVC: *Conforming to ASTM D 2287, Type PVC-65406*
 - b. Rubber gaskets: *Conforming to ASTM D-2000 2AA-205*
2. ***Control joints shall be installed as determined by the Contractor's structural engineer for the Project and shall meet all applicable standards and requirements.***

I. Bond Breaker Strips

1. Asphalt-saturated, organic roofing felt complying with ASTM D-226, Type I (No. 15 asphalt felt).

2.05 Masonry Cleaners

- A. The cleaning compound shall be a mild, non-caustic detergent solution such as 801 Super Real Clean by Superior Manufacturing Company, or 600 Sureclean by Process Solvent Company, Inc., or approved equal.
- B. The Contractor may also use a job-mixed detergent solution of ½-cup (0.14-L) dry measure tetrasodium polyphosphate and ½-cup (0.14-L) dry measure laundry detergent dissolved in 1 gallon (3.785 L) of water.

3. EXECUTION

3.01 Examination

- A. Examine conditions, with the Installer present, for compliance with the requirements for installation tolerances and other conditions affecting performance.
 - 1. Verify that foundations are within the tolerances specified.
 - 2. Verify that reinforcing dowels are properly placed.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify the actual locations of all piping connections.
- C. Do not proceed until all unsatisfactory conditions have been corrected.

3.02 Construction Tolerances

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
 - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than ¼-inch in twenty (20) feet, nor ½-inch maximum.
 - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼-inch in ten (10) feet, nor ½-inch maximum.

3. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than $\frac{1}{4}$ -inch in twenty (20) feet, nor $\frac{1}{2}$ -inch maximum.
4. For exposed bed joints, do not vary from the thickness indicated by more than $\pm \frac{1}{8}$ -inch (3 mm), with a maximum thickness limited to $\frac{1}{2}$ -inch (12 mm). Do not vary from the bed-joint thickness of adjacent courses by more than $\frac{1}{8}$ -inch (3 mm).
5. For exposed head joints, do not vary from thickness indicated by more than $\pm \frac{1}{8}$ -inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than $\frac{1}{8}$ -inch (3 mm).

3.03 Masonry Installation

- A. No material that is frozen or covered with frost shall be used in the construction and no anti-freeze salts or ingredients shall be mixed with the mortar.
- B. Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- C. Build chases and recesses as shown or required to accommodate items specified in this Section and in other Sections of the Specifications. Provide not less than eight (8) inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.
- D. Leave openings for equipment to be installed before completing masonry. After installing the equipment, complete the masonry to match the construction immediately adjacent to the opening.
- E. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- F. Bond Pattern for Exposed Masonry
 1. Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
 - a. One-half running bond with vertical joint in each course centered on units in courses above and below.

- G. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than two (2) inches (50 mm). Bond and interlock each course of each wythe at the corners. Do not use units with less than nominal four (4) inch (100-mm) horizontal face dimensions at corners or jambs.
- H. Stopping and Resuming Work
1. In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- I. As construction progresses, build in items specified under this and other Sections of the Contract Documents. Fill in solidly with masonry around all built-in items.
- J. Fill the space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
- K. Fill cores in hollow concrete masonry units with grout, 3 courses or approximately twenty-four (24) inches (600 mm), under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- L. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
1. Install compressible filler in the joint between the top of the partition and the underside of the structure above.
 2. Wedge non-load-bearing partitions against the structure above with small pieces of tile, slate, or metal. Fill the joint with mortar after dead-load deflection of structure above approaches final position.
 3. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Section 07270, "Firestopping."
- M. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- N. **Masonry shall not be laid at temperatures below 40°F**, without the approval of the Engineer, and all work shall be done in such a manner as to insure the proper and normal hardening of all mortar. All masonry work shall be so protected and heated that

- the temperature at the surface will not fall below 50°F for a period of seventy-two (72) hours after placing. Any completed work found to be affected by cold weather shall be taken down and rebuilt by the Contractor at his expense.
- O. ***Split-faced CMU's shall be laid with a horizontal stringline control to the inside face of the block.***
- P. ***All split-faced and standard CMU's for walls shall be laid in a ½-running bond.***
Vertical joints in each course shall be centered on units in courses above and below, unless otherwise indicated on the Contract Drawings. Tool dense and neat.
- Q. Sizes shall be as specified and called for on the Contract Drawings and where "soaps" and "splits" are used, the space between these members and the backup materials shall be slushed full of mortar and tied back as approved.
- R. All ties and reinforcing for masonry shall be furnished and installed by the Contractor. Continuous longitudinal joint reinforcing shall be provided in all CMU walls interrupted at control joints. Space them at sixteen (16) inches, on center, vertically, unless shown otherwise.
- S. Build in and grout fully all wall reinforcing as shown and described within these Contract Documents.
- T. Loose lintels shall be set in a full bed of mortar and supported by solid or mortar filled hollow concrete blocks as detailed in the Contract Drawings.
- U. Install all frames required to be set in the masonry. Set masonry to allow a ⅜-inch joint between the masonry and frames. Build in all frame anchors, and fill frames with mortar.
- V. CMU Cell Filling
1. Insulation: Refer to Section 04250, "Masonry Building Insulation".
 2. Grout: Refer to Section 04230, "Reinforced Unit Masonry".
 3. Care shall be taken to prevent the introduction of moisture while filling cells.
 4. Install in accordance with the manufacturers instructions.
- W. All masonry slots, chases, or openings required for the proper installation of the work of other sections shall be constructed as indicated on the Contract Drawings or in accordance with information furnished before the work is started at the points affected. No chase shall be cut into any wall constructed of hollow units after it is built, except as directed and approved by the Engineer.

- X. ***The Contractor shall build in all miscellaneous items to be set in masonry*** for which placement is not specifically provided under separate Sections or Divisions, including, but not limited to, reglets, lintels, ties, electrical panel boxes, sleeves vents, grilles, anchors, grounds, and exterior electrical conduits and fixtures, and shall cooperate with other trades whose work is to be coordinated with the work under this Section.
- Y. All anchorage, attachment, and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar or grout.
- Z. Miscellaneous
1. Bed and grout all steel, for equipment and machinery, and items coming in contact with masonry where grouting is required, including wall and joint reinforcing, ties and anchors, pressed metal frame anchors, and door bucks and frames set in masonry. The Contractor shall install all anchor bolts, base plates and seats in masonry walls, and build in all items required for the completion of the project Buildings as they apply to masonry.
 2. The tops of walls or other unfinished work shall be protected against all damage by frost or the elements by means of waterproof paper, tarpaulins, boards or other means approved by the Engineer.

3.04 Mortar Bedding and Jointing

- A. Lay hollow masonry units as follows:
1. With full mortar coverage on horizontal and vertical face shells.
 2. Bed webs in mortar in the starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
- B. Masonry Bonding
1. CMU shall be laid in running bond unless otherwise shown.
 2. Fill all joints with mortar, dense and neat.
 3. Both vertical and horizontal joints shall be maintained uniform in spacing.
 4. Joints for CMU's shall be $\frac{3}{8}$ -inch wide.

5. Joints for standard CMU shall be rubbed with a sponge to provide a flush, neat, rubbed joint.
 6. Joints on the exterior side of the CMU, to receive stucco, plaster or other direct-applied finishes (other than paint, if shown), shall be struck flush.
 7. Cut joints flush for masonry walls to receive, unless otherwise indicated.
- C. All CMU's shall be laid in a full bed of mortar, applied to shells only. Butter the vertical joint of the unit already set in the wall and all contact faces of the unit to be set. Each unit shall be placed and shoved against the unit previously laid so as to produce a well compacted vertical mortar joint for the full shell thickness. Units shall be set with all cells in the vertical position. The moisture content of the units when laid shall not exceed thirty-five percent (35%) of the total absorption as determined by laboratory testing.
- D. Tool exposed joints slightly concave when "thumbprint" hard, using a jointer larger than the joint thickness, unless otherwise indicated. Exterior joints for split-faced CMU's shall be rubbed with a sponge, paddle or styrofoam tool to cause the joint to blend with the masonry units exterior split-face. Interior face joints or split-faced CMU's shall match standard CMU joints. The required personnel of the Contractor shall be kept on the job after hours, if necessary, to properly tool joints.

3.05 Masonry Joint Reinforcement

- A. The Contractor is referred to the requirements of Section 04230, "Reinforced Unit Masonry".
- B. Provide continuous horizontal masonry joint reinforcement as indicated. Install the entire length of longitudinal side rods in mortar with a minimum cover of $\frac{5}{8}$ -inch (16 mm) on the exterior side of walls, $\frac{1}{2}$ -inch (13 mm) elsewhere. Lap reinforcement a minimum of six (6) inches (150 mm).
- C. Space reinforcement not more than sixteen (16) inches (406 mm), on center. This reinforcement is in addition to continuous reinforcement.
- D. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- E. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by the manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.06 Anchoring Masonry to Structural Members

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide an open space of not less than one (1) inch (25 mm) in width between the masonry and structural member, unless otherwise indicated.
 - 2. Keep the open space free of mortar or other rigid materials.

3.07 Control and Expansion Joints

- A. ***Control and expansion joints shall be determined by the Contractor's structural engineer for the Project and shall meet all applicable standards, codes and requirements.*** Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
 - 2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.
- C. Control Joints shall be installed at the intersection of masonry walls with structural concrete and elsewhere as detailed on the Contract Drawings and by referenced standards. Joints shall be raked out to a depth of $\frac{3}{4}$ -inch for the full height of the wall and suitable for caulking. The maximum length, horizontally, between vertical control joints shall be twenty-six (26) feet, but joints shall be located only as directed or shown. Joints shall be equal in width to the standard mortar joint.

3.08 Lintels

- A. Provide masonry lintels where shown and where openings of more than twelve (12) inches (305 mm) for brick-size units and twenty-four (24) inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- B. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout.

- C. Cure precast lintels before handling and installing.
- D. Temporarily support built-in-place lintels until cured.
- E. Provide a minimum bearing of eight (8) inches (200 mm) at each jamb, unless otherwise indicated.
- F. ***Power Steel Lintels shall be used on all split-face block lintel applications as indicated on the Contract Drawings.***

3.09 Reinforced Unit Masonry Installation

- A. The Contractor shall place all reinforcement in compliance with Section 04230, "Reinforced Unit Masonry" and the requirements of ACI 530.1/ASCE 6/TMS 602.
- B. Temporary Formwork and Shores
 - 1. Construct formwork and shores to support reinforced masonry elements during construction.
 - 2. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 3. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

3.10 Inspection, Repair, Cleaning and Coatings

- A. Inspection and Adjustment
 - 1. Upon completion of the Work of this Section, the Contractor and masonry subcontractor shall make a thorough inspection of installed masonry and verify that units have been installed in accordance with the provisions of this Section.
 - 2. The Contractor and/or masonry subcontractor shall make all necessary adjustments.

- B. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh, matching mortar and grout pointed to eliminate evidence of replacement. These costs shall be incidental to the Contract.

C. Pointing

1. During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar matching the color approved and selected by the Engineer/Owner and tool to match.
 2. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance and properly prepare joints for application of sealants where required.
 3. Before final cleaning, repoint all unsatisfactory joints as specified above and as required by the Engineer.
- D. All holes in exposed masonry shall be pointed, and defective joints shall be cut out and repointed with mortar of the same color as that of the original and adjoining work.
- E. Excess mortar shall be wiped off the surface as the work progresses to reduce the need for cleaning at completion of the work.
- F. Dry brush the work at the end of each days work.
- G. Protect all exposed masonry from damage, staining, soiling, etc., through the use of wall coverings or other materials during subsequent building/structure operations.
- H. Surfaces shall be brushed as work progresses and maintained as clean as it is practicable. Unfinished work shall be raked back where possible, and toothed only where absolutely necessary. Before leaving fresh or unfinished work, walls shall be fully covered and protected against rain and wind. Before continuing work previously laid, the previous work shall be swept clean.

I. Cleaning

1. Acid solutions shall not be used for cleaning CMU, glazed facing tile, glass block or ceramic veneer units
2. Upon completion of the work, all surfaces of CMU, masonry and glazed wall units shall be cleaned with an approved detergent solution in accordance with the manufacturer's printed directions, and then rinsed with clean, clear water
3. Other cleaning methods may be ordered to obtain the required appearance.

4. Metal cleaning tools and brushes or abrasive powders shall not be used on ground face or glazed surfaces.
5. Masonry areas not satisfactorily cleanable will be ordered replaced at no additional cost to the Owner.
6. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately twenty (20) square feet in a location approved by the Engineer. No further cleaning work may proceed until the sample area has been approved by the Engineer, after which time the same cleaning materials and method shall be used on the remaining wall area.

END OF SECTION

SECTION 04230

REINFORCED UNIT MASONRY

1. GENERAL

1.01 Description

A. Provide all labor, materials, equipment and incidentals required to complete the reinforced unit masonry construction in accordance with the Contract Drawings and Specifications. The Contractor shall coordinate all work with that of other trades.

B. Related Work Specified Elsewhere:

1. Masonry:	Section 04050
2. Masonry Building Insulation:	Section 04250
3. Doors and Windows:	Division 8

1.02 Submittals

A. Submit shop drawings, product data, accessories, etc., in accordance with Section 01300, "Shop Drawings, Submittals and Samples".

B. Submit complete shop drawings, including fabrication and installation details for all reinforcing steel.

1. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement".
2. Include bar lists and placement drawings.
3. Show elevations of reinforced walls.

C. Submit mill test certificate(s) for the reinforcing steel.

1.03 Reference Standards

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM A153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A951	Steel Wire for Masonry Joint Reinforcement
ASTM C55	Concrete Building Brick
ASTM C90	Standard Specification for Loadbearing Concrete Masonry Units
ASTM C140	Sampling and Testing Concrete Masonry Units
ASTM C270	Standard Specification for Mortar for Unit Masonry
ASTM C387	Standard Specification for Premix Mortar
ASTM C426	Standard Test Method for Drying Shrinkage of Concrete Block
ASTM C1019	Standard Method of Sampling and Testing Grout
ASTM C1314	Standard Test Method for Compressive Strength of Masonry Prisms
American Concrete Institute (ACI)	
ACI 315	Details and Detailing of Concrete Reinforcement
Other Reference Standards	
	Florida Building Code
	Local Building Code and Regulations

- B. The Contractor shall refer to Section 04050, "Masonry", for masonry materials and accessories not included in this Section.

1.04 Product Delivery, Storage and Handling

- A. Reinforcement shall be shipped to the Work with bars of the same size and shape fastened in bundles with metal identification tags with waterproof markings giving size and mark securely wired on.

- B. The identification tags shall be labeled with the same designation as shown on the submitted bar lists and shop drawings.
- C. **All bars shall be stored off of the ground and shall be protected from moisture** and be kept free from dirt, oil, or injurious contaminants.

2. PRODUCTS

2.01 Materials

- A. Construct all building exterior walls of reinforced concrete masonry in accordance with Section 04050, "Masonry" and as follows:
 - 1. Concrete Masonry Units shall conform to ASTM C90, Grade N, Type II, normal weight units with a minimum compressive strength of 3,000 psi (each).
 - 2. Portland Cement shall conform to ASTM C150, Type I or II requiring only sand and water for mixing. Masonry cements **shall not** be used.
 - 3. Premix mortar shall conform to ASTM C270, Type S; ASTM C387 Type M.
 - 4. Vertical reinforcing shall be provided as shown on the Contract Drawings, or if not shown, as required by the governing code.
 - 5. Concrete Grout for filling CMU cells shall consist of a $\frac{3}{8}$ -inch pearock mix with a minimum compressive strength of 3,000 psi.
 - 6. Horizontal reinforcing shall be of the 9-gauge ladder type at sixteen (16) inches on center.
 - 7. Reinforcing Steel shall conform to ASTM Designation A615, Grade 60, unless otherwise specified.

3. EXECUTION

3.01 Placing of Reinforcement

- A. **Clean reinforcement of loose rust, mill scale, earth or other materials which will reduce bonding to the mortar or grout.** Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

- B. **Place reinforcement accurately at the spacing shown.** Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between the bars of not less than the nominal bar diameter or one (1) inch, whichever is greater.
- C. Anchor reinforced masonry work to the supporting structure as indicated.
- D. For columns, piers and pilasters, provide a clear distance between vertical bars as shown, but not less than 1.5 times the nominal bar diameter or 1½ inches, whichever is greater. Provide lateral ties as shown.
- E. Splice reinforcement bars only as shown. Do not splice at other points unless approved by the Engineer. Provide lapped splices, unless otherwise shown. In splicing vertical bars or attaching dowels, tie splices with wire.
- F. Provide not less than the minimum lap length shown, or if not shown, as required by the governing code.
- G. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of ⅝-inch on the exterior face of walls and ½-inch at other locations.

3.02 General Installation

- A. Perform general installation of unit masonry in accordance with the requirements specified in Section 04050, "Masonry".
- B. Provide formwork and shores as required for temporary support of reinforced masonry elements. Design, erection, support, bracing and maintenance of formwork is the Contractor's responsibility.
- C. Construct formwork to conform to the shape, line and dimensions shown and sufficiently tight to prevent leakage of mortar, grout, or concrete (if any).
- D. Do not remove forms and shores until the reinforced masonry member has hardened sufficiently to carry its own weight and all other reasonable temporary loads that may be placed on it during construction. Do not remove forms and shoring supporting the weight of concrete in beams, slabs, and other members until the concrete has attained its specified twenty-eight (28) day compressive strength.
- E. Coordinate the cell reinforcing layout with the electrical and mechanical contractors. Contact the Engineer regarding any conflicts as soon as possible.

3.03 Installation of Reinforced Concrete Unit Masonry

A. General

1. Do not wet Concrete Masonry Units (CMU).
2. Where solid CMU units are shown, lay units with full mortar head and bed joints.
3. **Place CMU with full-face shell mortar beds.** Fill vertical head joints (end joints between units) solidly with mortar from the face of the unit to a distance behind the face equal to not less than the thickness of the longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths as shown, or if not shown, provide $\frac{3}{8}$ -inch joints.

B. Walls

1. Pattern Bond
 - a. Lay CMU wall units as specified in Section 04050, "Masonry". Bond and interlock each course at the corners and intersections and use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Maintain vertical continuity of core and cell cavities, which are to be reinforced and grouted, to provide minimum clear dimensions indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under the bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.
4. Where all vertical cores are not shown to be grouted, the Contractor may elect to fill all vertical cores with grout, in which case, requirements for mortar bedding of cross-webs and closing of core spaces below bond beams will not apply.

C. Columns, Piers and Pilasters

1. Use CMU of the size, shape and number of vertical core spaces shown. If not shown, provide units which provide minimum clearances and grout coverage for the number and size of vertical reinforcement bars shown.

2. Provide pattern bond as shown, or if not shown, provide alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, construct wall and pilaster units together to the maximum pour height specified.

D. Grouting

1. Use fine grout for filling spaces less than four (4) inches in both horizontal directions.
2. Use coarse grout for filling four (4) inch spaces or larger in both horizontal directions.
3. **Place grout within 1½ hours from introducing water in the mixture and prior to initial set.**
4. Grouting Technique
 - a. At the Contractor's option, use either low-lift or high lift grouting techniques subject to the requirements that follow.
5. Consolidate grout by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

E. Low-Lift Grouting

1. Provide a minimum clear dimension of two (2) inches and clear area of eight (8) square inches in vertical cores to be grouted.
2. **Place vertical reinforcement prior to laying the CMU.** Extend the vertical reinforcement above the elevation of the maximum pour height as required to allow for splicing and support it in position at vertical intervals not exceeding 192 bar diameters nor ten (10) feet.
3. **Lay CMU to the maximum pour height.** Limit the pour height to five (5) feet. If a bond beam occurs below the five (5) feet height stop, pour at the course below the bond beam.
4. Preparation of Grout Spaces
 - a. Prior to grouting, inspect and clean out the grout spaces.

- b. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from the grout spaces.
 - c. Clean the reinforcement and adjust to the proper position.
 - d. Clean the top surface of structural members supporting the masonry to ensure the proper bond.
5. Pour grout using a container with a spout or by chute and rod or vibrate during placing. Place the grout continuously. Do not interrupt the pouring of the grout for more than one (1) hour. Terminate grout pours 1½ inches below the top course of the pour.
6. Bond Beams
- a. Terminate the grout in vertical cells 1½ inches below the bond beam course.
 - b. Place horizontal reinforcement in the bond beams with corners and intersections lapped as shown.
 - c. Place the grout in the bond beam course before filling vertical cores above the bond beam.

F. High-Lift Grouting

- 1. Do not use the high lift grouting technique for grouting CMU unless the minimum cavity dimension and area is three (3) inches and ten (10) square inches, respectively.
- 2. Provide cleanout holes in the first course at all vertical cells which are to be filled with grout. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
- 3. Construct masonry to the full height of maximum grout pour specified, prior to placing the grout.
- 4. ***Limit grout lifts to a maximum height of five (5) feet and pour grout to a maximum height of twenty-four (24) feet***, for single wythe hollow concrete masonry walls, unless otherwise indicated.
- 5. ***Place vertical reinforcement prior to grouting.*** Tie vertical reinforcement to dowels at the base of the masonry, where shown, and thread CMU over or around the reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor ten (10) feet.

6. Where reinforcement is prefabricated into cage units before placing, fabricate the units with vertical reinforcement bars and lateral ties of the size and spacing shown.
7. **Place horizontal beam reinforcement as the masonry units are laid.**
8. **Embed lateral tie reinforcement in mortar joints** where shown as masonry units are laid.
9. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than No. 2 bars or 8-gauge wire ties spaced sixteen (16) inches on center for members with twenty (20) inches or less side dimensions, and eight (8) inches on center for members with side dimensions exceeding twenty (20) inches.
10. Preparation of Grout Spaces
 - a. **Prior to grouting, inspect and clean out the grout spaces.** Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from the grout spaces. Clean the reinforcement and adjust to the proper position. Clean the top surface of structural members supporting the masonry to ensure the proper bond.
 - b. **After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.**
11. Do not place grout until the entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
12. Place the grout by pumping the grout spaces unless alternate methods are acceptable and approved by the Engineer prior to the grouting operations.
13. **Limit grout pours to sections that can be completed in one working day with not more than one (1) hour interruption of pouring operation.** Place the grout in lifts that do not exceed five (5) feet. Allow not less than thirty (30) minutes, nor more than one (1) hour between lifts of a given pour. Vibrate each grout lift during the pouring operation.
14. Place grout in lintels or beams over openings in one continuous pour.
15. Where the bond beam occurs more than one course below the top of the pour, fill the bond beam course within one (1) inch of vertically reinforced cavities, during construction of the masonry.

16. ***When more than one pour is required to complete a given section of masonry, extend the reinforcement beyond the masonry as required for splicing.*** Pour the grout to within 1½ inches of the top course of the first pour. After the grouted masonry is cured, lay masonry units and place reinforcement for the second pour section before grouting. Repeat this sequence if more pours are required.

END OF SECTION

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SECTION 04450

MARBLE WINDOW SILLS AND THRESHOLDS

1. GENERAL

1.01 Description

- A. Provide all labor, materials, equipment and incidentals required to install marble window sills in the “new” Main WTP Operations Building.
- B. The Contractor shall coordinate all Work with that of other trades.

1.02 Submittals

- A. Submit shop drawings, product data, etc., in accordance with Section 00700, “General Conditions”, Section 00800, “Supplementary Conditions”, and Section 01300, “Shop Drawings, Submittals and Samples”.
- B. The Contractor shall submit manufacturer’s literature and product data for each type of marble, marble accessory, and other manufactured products required.
- C. The Contractor shall submit shop drawings detailing fabrication and installation of marble. The shop drawings shall include cutting and setting drawings indicating sizes, dimensions, sections, and profiles of stones; arrangement and provisions for jointing, supporting, anchoring, and bonding stonework; and details showing relationship with, attachment to, and reception of related work.
- D. The Contractor shall submit samples for verification purposes of marble in the form of sets for each color, grade, finish, type, and variety required and consisting of marble not less than twelve (12) inches square. Include two (2) in each set of samples showing the full range of variations in appearance characteristics to be expected in the completed Work.

1.03 Quality Assurance

- A. Obtain each color, grade, finish, type, and variety of stone from a single quarry with resources to provide materials of consistent quality in appearance and physical

properties, including the capacity to cut and finish material without delaying the progress of the Work.

1.04 Delivery, Storage and Handling of Materials

- A. Deliver the materials to Project Site in an “*undamaged*” condition.
- B. Store and handle stone and related materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breakage, chipping, or other causes.
- C. The Contractor shall not use pinch or wrecking bars. Lift with wide-belt-type slings where possible; do not use wire rope or ropes containing tar or other substances that might cause staining. If required to move stone, use wood rollers with cushions at end of wood slides.
- D. Store stone on wood skids or pallets covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute the weight evenly and to prevent breakage or cracking of stones.
- E. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stones.
- F. Store cementitious materials off the ground, under cover, and in dry location.

2. PRODUCTS

2.01 Materials

- A. Comply with referenced standards and other requirements indicated applicable to each type of material required.
- B. Provide matched marble from a single quarry for each type, variety, color, and quality of stone required.

2.02 Marble

- A. Thresholds and sills shall be sound white marble with a fine sand textured finish. The marble to be utilized shall be "White Cherokee" as manufactured by the Georgia Marble Company, Dimension Stone Group, Nelson, Georgia or equal.

- B. The physical properties of the marble shall be in accordance with ASTM C-503 as follows:

Parameter	Value
Absorption, by weight (%)	0.09
Density (lb/ft ³)	169
Compressive Strength (psi)	9333
Modulus of Rupture (psi)	1364
Abrasion Resistance, hardness	16.6
Flexural Strength (psi)	1296

2.03 Anchors and Attachments

- A. Provide stainless steel anchors and attachments of the type and size required to support dimension stonework. The stainless steel, ASTM A 666, AISI Type 304, shall be tempered as required to support loads imposed without exceeding allowable design stresses, for anchors in direct contact with the stone and the fasteners connecting them to other anchors and to building structure.

2.04 Dimension Stone Fabrication

- A. Fabricate dimension stonework in the sizes and shapes required to comply with requirements indicated, including details on the Drawings and final shop drawings. For marble, comply with the recommendations of the Marble Institute of America, Inc. (MIA) as published in "Dimensional Stone - Design Manual III".
- B. Cut stones to produce pieces of the thickness, size, and shape indicated to comply with fabrication and construction tolerances recommended by the applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.
- C. Finish exposed faces and edges of stones to comply with requirements indicated for the finish under each type and application of stone required and to match approved samples and field-constructed mock-ups.
- D. Carefully inspect the finished stones at the fabrication plant for compliance with the requirements relative to qualities of appearance, material, and fabrication; the Contractor shall replace defective stones with ones that do comply.

3. EXECUTION

3.01 Examination

- A. Examine surfaces to receive marble, and conditions under which the marble will be installed, with the installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of dimension stonework. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. For the record, prepare a written report, endorsed by the installer, listing conditions detrimental to performance of dimension stonework.

3.02 Installation

- A. All materials used in the installation of marble shall be installed in accordance with the manufacturers requirements.
- B. Installation shall be in accordance with the Drawings, reviewed shop drawings, and manufacturers recommendations.

3.03 Cleaning

- A. After completion of the Work, all marble surfaces shall be carefully cleaned to remove dirt, stains, or other defacements.
- B. Under no circumstances shall wire brushes, harsh abrasive cleansers or acid be used to clean marble.

3.04 Protection

- A. Provide final protection and maintain conditions in a manner acceptable to the Fabricator.
- B. The Installer shall ensure the dimension stonework has been installed without damage or deterioration at time of Substantial Completion.

END OF SECTION

SANFORD MAIN WTP IMPROVEMENTS

SANFORD, FLORIDA



DIVISION 5

METALS

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DIVISION 5

METALS

Specification Section	<u>Title</u>
05025	Metal Materials, Methods and Fastening
05120	Structural Steel
05140	Structural Aluminum
05410	Metal Trusses
05500	Metal Fabrications
05510	Metal Stairs and Walkways
05520	Handrails and Accessories
05530	Grating, Plates and Frames
05570	Miscellaneous Metal Assemblies
05810	Expansion Joint Cover Assemblies

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SECTION 05025

METAL MATERIALS, METHODS AND FASTENING

1. GENERAL

1.01 Description

- A. This Section includes the basic materials and methods required for the work of Division 5, Metals.
- B. Related work specified elsewhere includes:

Specification Section	Title
03300	Cast-in-Place Concrete
05120	Structural Steel
05140	Structural Aluminum
05500	Metal Fabrications
05510	Metal Stairs and Walkways
05520	Handrails and Accessories
05530	Grating, Plates and Frames
05570	Miscellaneous Metal Assemblies
09900	Painting
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Standards

- Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American Institute of Steel Construction (AISC)	
	Code of Standard Practice for Steel Buildings and Bridges
	Specification for the Design, Fabrication and Erection of Structural Steel for Buildings
Steel Structures Painting Council (SSPC)	
	Surface Preparation Specifications
American Society for Testing and Materials (ASTM)	
ASTM A-36	Standard Specification for Structural Steel
ASTM A-53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A-123	Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A-307	Standard Specification for Carbon Steel Externally Threaded Standard Fastener
ASTM A-325	Standard Specification for High Strength Bolts for Structural Steel Joints
ASTM A-500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A-501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
American Welding Society (AWS)	
AWS A5.1	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1	Structural Welding Code - Steel
Building Codes	
	Florida Building Code
	Local Building Code

1.03 Submittals

- A. Submit shop drawings in accordance with the General Conditions, Supplementary Conditions, and Section 01300, "Shop Drawings, Submittals and Samples".
- B. Submit manufacturer's catalog data for bolts, washers, and concrete anchors. Show dimensions and reference materials of construction by ASTM designation and grade.

- C. Submit shop drawings detailing fabrication and erection of each metal fabrication item indicated. The shop drawings should include plans, elevations, sections, and details of metal fabrications and their connections. Show all anchorage and accessory items. Provide templates for all anchors and bolts specified for installation under other sections.

1.04 Delivery, Storage and Handling

- A. Deliver all hardware (anchors, bolts, nuts, washers, eyebolts, etc.) to the Project Site in sufficient time to permit their timely installation. Provide proper setting drawings, templates, and directions for their installation. Store all hardware in the manufacturer's original, unopened, waterproof containers, properly labeled with the type of hardware, ASTM designation, and the location that the hardware is to be installed.
- B. ***Store all structural metal members above the ground on platforms, skids or other supports.*** Keep the material free from dirt, grease, and other foreign matter and protect from corrosion.
- C. ***Cover all metalwork in protective polyethylene wrap to avoid exposure to the elements until the material is to be installed.***

2. PRODUCTS

2.01 Metal Surfaces - General

- A. For metal fabrications exposed to view in the completed work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. The Contractor, prior to the punchlist walkthrough, shall clean all metal surfaces and remove all dust, dirt, grease, foreign matter, construction markings, etc.

2.02 Steel

- A. Steel plates, shapes and bars shall comply with ASTM A-36 / A-36M, unless otherwise specified.
- B. Rolled Steel Floor Plates, if used, shall comply with ASTM A-786 / A-786M.

C. Steel tubing

1. Cold-Formed Steel Tubing: ASTM A-500, Grade B
2. Hot-Formed Steel Tubing: ASTM A-501.
 - a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A-53

D. Steel pipe

1. Steel pipe shall comply with ASTM A-53, standard weight (Schedule 40), unless otherwise indicated, or another weight required by structural loads.
 - a. Black finish, unless otherwise indicated.
 - b. Galvanized finish for exterior installations and where indicated.
- E. Gray-Iron Casting shall comply with ASTM A-48, Class 30, unless otherwise indicated on the Contract Drawings.
- F. Malleable-Iron Casings shall comply with ASTM A-47, Grade 3510 (ASTM A47M, Grade 22010).
- G. Cast-in-Place Anchors shall be of corrosion resistant material capable of sustaining, without failure, the load imposed within a safety factor of 4.0, as determined by testing per ASTM E-488, conducted by a qualified independent testing agency.
- H. Welding Rods and Bare Electrodes shall be selected according to AWS Specifications for the metal alloy to be welded.
- I. Structural Steel Sheet shall be hot-rolled, ASTM A-570, or cold-rolled ASTM A611, Class 1; of the grade required for the design loading.
- J. Galvanized Structural Steel Sheet shall comply with ASTM A-446, and be of the grade required for the design loading. Coating designation as indicated, or if not indicated, G-90.
- K. Brackets, Flanges, and Anchors shall be cast or formed metal of the same type material and finish as the supported rails, unless otherwise indicated.
- L. Concrete Inserts shall be of the threaded or wedge type, galvanized ferrous castings, either ASTM A-47 (ASTM A-47M) malleable iron or ASTM A-27 (A-27M) cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized, ASTM A-153.

- M. Galvanized sheet metal shall be commercial quality with 0.20 percent copper, ASTM A-525; G-90 hot-dip galvanized, mill phosphatized where indicated for painting; 24 gauge thickness except as otherwise indicated.

2.03 Stainless Steel

- A. Stainless steel shall comply with ASTM A-167, Type 304 or 316, as specified herein and in the Contract Documents.

2.04 Aluminum

- A. Aluminum for structural and rolled shapes shall be Aluminum Association alloy 6061-T6.
- B. Aluminum for extruded shapes shall be Aluminum Association alloy 6063-T6.
- C. Aluminum for pipe shall be Aluminum Association alloy 6063-T6.
- D. Aluminum for castings shall be Aluminum Association alloy F-514, or approved equal.

2.05 Fasteners

- A. Provide plated stainless steel fasteners complying with ASTM B-633, Class Fe/Zn 25 for electro-deposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and Nuts
 - 1. Regular hexagon-head stainless steel bolts, ASTM A-307, Grade A (ASTM F-568, Property Class 4.6), with hex nuts, ASTM A-563 (ASTM A-563M), and, where indicated, stainless steel flat washers.
- C. Stainless Steel Bolts
 - 1. Stainless steel bolts shall be ASTM A-193, Grade B8M or ASTM F 593, Type 316, unless specified otherwise
 - 2. Nuts shall be 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.
 - 3. Provide washer for each nut and bolthead. Washers shall be of the same material as the nuts.

D. Machine Screws

1. Machine screws shall comply with ANSI B18.6.3.

E. Lag Bolts

1. Lag bolts shall comply with ANSI B18.2.1 (ANSI B18.2.3.8M).

F. Wood Screws

1. Wood screws shall be of the flat head type, Type 316 stainless steel, and shall comply with ANSI B18.6.1

G. Plain washers

1. Plain washers shall be round, Type 316 stainless steel, and shall comply with ANSI B18.22.1.
2. Washers for American Standard beams and channels shall be square or rectangular, tapered in thickness, smooth, hot-dipped galvanized, and conforming to ASTM F 436.

H. Lock Washers

1. Lock washers shall be of the helical, spring type, Type 316 stainless steel, and shall comply with ANSI B18.21.1.

I. Expansion Anchors

1. Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, **a load equal to 6.0 times (6X) the load imposed when installed in unit masonry and equal to 4.0 times (4X) the load imposed when installed in concrete** as determined by testing per ASTM E-488 conducted by a qualified independent testing agency.
 - a. Stainless steel components, zinc plated to comply with ASTM B-633, Class Fe/Zn 5.
 - b. Group 1 Alloy, Type 316 stainless steel bolts and nuts complying with ASTM F-593 (ASTM F-738M) and ASTM F-594 (ASTM F-836M).

J. Toggle Bolts

1. Toggle bolts shall be FS FF-B-588, tumble-wing type, Class and Style as required.

K. Beveled Washers

1. Washers for American Standard beams and channels shall be square or rectangular, tapered in thickness, smooth, and Type 316 stainless steel.

L. Drilled Anchors

1. Unless otherwise indicated on the Drawings, drilled anchors shall be Type 316 stainless steel wedge anchors as manufactured by Hilti, or approved equal.
2. Anchors shall have ICBO-approved testing.

M. Anchor Bolts

1. Anchor bolts and connection bolts for aluminum shall be Type 316 stainless steel.
2. Steel anchor bolts shall conform to ASTM F1554, Grade 36, galvanized.

N. Epoxy Anchors

1. Epoxy anchors shall be Type 316 stainless steel threaded rod adhesive anchors, unless specified otherwise.
2. Epoxy adhesive shall comply with ASTM C 881, Type IV, Grade 3, Class B or C.
3. Adhesive shall be Rawl Power-Fast, Hilti HSE 2421, Simpson Epoxy-tie with SET epoxy, Hilti HY-200, or equal.
4. Epoxy anchor assemblies shall be ICBO approved.

O. Embedded Eyebolts

1. Eyebolts shall be of the welded-eye or forged type, Type 316 stainless steel.

P. Threaded Carbon Steel Lifting Eyes

1. Threaded carbon steel lifting eyes shall comply with ASTM A-489, Type 1, Style B.

Q. Threaded Alloy Steely Eyebolts

1. Threaded alloy steel eyebolts shall comply with ASTM F-541 and ASME/ANSI B18.5, Type 1, long length.

2.06 Welding Electrodes

- A. Filler metal for welding shall comply with AWS D1.1, Structural Welding Code.

2.07 Grout

- A. Grout for bedding and grouting structural steel shall be non-shrink grout as specified in Section 03600, "Grout".

2.08 Fabrication

A. General

1. Fabricate all metal parts to comply with the design indicated on the Contract Drawings. Make field measurements and prepare templates as required to ensure proper fit. Assemblies shall be fitted together in the shop and delivered to the site complete and ready for installation.
2. Form metal shapes with sharp lines and angles, and finish with smooth surfaces. Shearings and punchings shall be clean and true. In general, holes for bolts shall be drilled or reamed $\frac{1}{16}$ -inch larger than the diameter of the bolt. Holes for anchor bolts shall be $1\frac{1}{3}$ times the anchor bolt diameter.
3. Metal thicknesses, assembly details, and supports shall provide ample strength and stiffness. Joints shall be designed to prevent trapping of moisture.

B. Shop Coatings

1. Prepare and shop prime ferrous metal in compliance with Section 09900, "Painting". Do not shop prime stainless steel, aluminum, galvanized or plated metals, bronze, or machined bearing surfaces.
2. Anchors, sleeves, and metal parts built into masonry or concrete shall be stainless steel.

3. Castings for exterior exposure shall be cleaned and coated per Section 09900, "Painting".
4. Hot-dip galvanizing for products fabricated from steel shapes, plates, bars, and strips shall comply with ASTM A-123. Hot-dip galvanizing for assembled steel products shall comply with ASTM A-386. Except for bolts and nuts for field assembly, galvanize all subassemblies immediately after fabrication. Hardware shall be galvanized in compliance with ASTM A-153.
5. Aluminum in direct contact with dissimilar metals, concrete, or masonry shall be covered with a neoprene gasket, non-absorptive insulating tape, or coated with a heavy-bodied bituminous paint. The method used must be approved by the Engineer prior to placement or application.

C. Fasteners and Connections

1. Provide fastening devices as required, as specified herein, and in compliance with the Drawings and shop drawings. Provide welded shop connections or concealed fastenings wherever practicable.
2. Power-driven fasteners shall be of the types and sizes recommended by the manufacturer for the particular application. Power-driven fasteners that will be exposed to view shall be set through a steel finishing disc. When set in concrete or masonry, the minimum penetration of power-driven fasteners shall be six (6) times the diameter of the shank.
3. **Structural joints made using high strength bolts, hardened washers, and nuts** tightened to a high bolt tension shall comply with the "Specification for Structural Joints Using ASTM A-325 or A-490 Bolts", issued by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
4. Welded joints shall comply with AWS D1.1, Structural Welding Code, and AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings". All welds shall be made by operators who have been previously qualified as prescribed by AWS B3.0, Welding Procedure and Performance Qualification. All welds exposed to view shall be dressed smooth.
5. **Anchor holes in concrete or masonry for grouted bolts shall be a minimum of 1½ times the bolt shank diameter.** Anchor holes in concrete and masonry for expansion type anchor bolts shall comply with the bolt manufacturer's recommendations.
6. Lock washers and nylock washers shall be provided to prevent nut loosening.

2.09 Templates, Leveling Plates, and Appurtenances

- A. Provide all templates, leveling plates, and appurtenances required for the installation of metal work.

3. EXECUTION

3.01 Delivery, Storage and Handling of Materials

- A. Delivery, storage and handling of all materials shall be in accordance with Article 1.04 of this Specification Section.

3.02 Galvanizing

- A. Other than A325 bolts, zinc coating for bolts, anchor bolts, and threaded parts shall be in accordance with ASTM A 153.

3.03 Installing Connection Bolts

- A. Use steel bolts to connect structural steel members. Use stainless steel bolts to connect structural aluminum members.
- B. Install washers per AISC Specification for ASD.
- C. Bolt holes in structural members shall be $\frac{1}{16}$ -inch in diameter larger than bolt size. Measure cast-in-place bolt locations in the field before drilling companion holes in structural steel beam or assembly.
- D. Slotted holes, if required in the Contract Documents, shall conform to AISC Specifications, Chapter J, Section J3, Table J3.1.
- E. Drive bolts accurately into the holes without damaging the thread. Protect boltheads from damage during driving. Boltheads and nuts or washers shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, provide beveled washers to give full bearing to the head or nut. Where self-locking nuts are not furnished, bolt threads shall be upset to prevent the nuts from backing off.

- F. Bolts shall be of the length that will extend entirely through but not more than ¼-inch beyond the nuts. Draw boltheads and nuts tight against the work. Tap boltheads with a hammer while the nut is being tightened.

3.04 Installing Anchor Bolts

- A. Preset bolts and anchors by the use of templates. For mechanical equipment (pumps, compressors, and blowers), do not use concrete anchors set in holes drilled in the concrete after the concrete is placed.
- B. For static items (storage tanks and heat exchangers), use preset anchor bolts or drilled anchors with ICBO report data.
- C. After anchor bolts have been embedded, protect projecting threads by applying grease and having the nuts installed until the time of installation of the equipment or metalwork.
- D. The **minimum** depth of embedment of drilled mechanical anchors shall be as recommended by the manufacturer, but no less than that shown on the Contract Drawings.
- E. The **minimum** depth of embedment of epoxy anchors shall be as recommended by the manufacturer, but no less than that shown on the Contract Drawings.
- F. Prepare holes for drilled and epoxy anchors in accordance with the anchor manufacturer's recommendations prior to installation.

3.05 Erection

- A. Before starting work, verify locations and elevations of bearings and anchor bolts. Immediately report inaccuracies.
- B. Work under this Section includes responsibility for accurate bearing of steel and correct location of anchorage.
- C. Erection shall be in accordance with the requirements of the specified standards.
- D. Weld field connections or bolt as indicated.
- E. Bolting
 - 1. As erection progresses, bolt up work to take care of all dead loads, construction live loads, lateral forces and erection stresses.

2. Unless otherwise noted, erection bolts used in welded construction may be either tightened securely and left in place or removed and the holes filled with plug welds.
3. Drift pins may be used for assembling parts provided the metal is not distorted or holes enlarged. Ream holes requiring enlargement to admit bolts. Misaligned holes will subject members to rejection.
4. Make all metal to metal connections by high strength bolting except where field welding is specifically shown. Provide not less than two $\frac{3}{4}$ -inch bolts per connection and use not less than $\frac{1}{4}$ -inch thick clip angles (Type 316 stainless steel).
5. Tighten bolted connections designated as beating-type connections to the snug tight condition. Where specified, tighten other bolted connections to full pretension by turn-of-nut or calibrated wrench tightening.
6. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in its proper location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels.
7. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations.

F. Welding

1. Field welding shall be done only where shown or specified and only by certified welders qualified for the procedures used. No welding shall be done when surfaces are wet, exposed to rain or wind, or when welders are exposed to inclement conditions that will hamper good workmanship.
2. Each certified welder shall be assigned an identification mark. This mark shall be made at each completed connection with a paint stick.

G. Temporary Bracing

1. Introduce, wherever necessary, temporary bracing to provide for all loads to which the structure is subjected including erection equipment and its operation.
2. Leave the temporary bracing in place until it is no longer required for safety.
3. Make proper provisions for construction loads, piles of materials, equipment, etc., carried by the structural frame during erection.

- H. After erection, clean all fixed connections (bolts and welds) and the structural members and repair as necessary.
- I. Preset bolts and anchors by the use of templates. For mechanical equipment (pumps, compressors, air compressors, etc.), do not use concrete anchors set in holes drilled in the concrete after the concrete is placed.
- J. For static items (storage tanks and heat exchangers), use preset anchor bolts or drilled anchors.
- K. After the anchor bolts have been embedded, protect their threads by applying grease and by having the nuts screwed on until the time of installation of the equipment or metalwork.

3.06 Inspection

- A. The Engineer shall have free access to the Work. ***The Contractor shall notify the Engineer in writing four (4) days in advance of any welding or high strength bolting operations.***
- B. High-strength bolting may be visually inspected. All high-strength bolts shall have the turned portion marked with reference to the metal being connected after the nut has been made snug and prior to final tightening. These marks shall be considered in the inspection. Rejected bolts shall be either replaced or retightened as required. In cases of disputed bolt installations, the bolts in question shall be checked by a calibrated wrench certified by an independent testing laboratory selected by the Engineer.
- C. ***Field welding will be inspected visually by AWS certified welding inspectors*** provided by the Contractor. Magnetic particle testing or ultrasonic testing may be used in the inspection, if deemed necessary, by the welding inspector. A welding certification report shall be submitted to the Engineer based on the results of the welding inspection. The Contractor shall comply with all requests of inspector to correct deficiencies.
- D. ***All costs for testing and inspection required as a result of defection work, repairs, or retests shall be paid for by the Contractor and are incidental to the Contract.***
- E. ***Any material or workmanship which is rejected by the Engineer, either at the shop, mill or building must be promptly replaced by the Contractor to the Engineer's entire satisfaction, at no additional cost to the Owner.***
- F. The fact that metal work has been accepted at the shop and mill shall not prevent its final rejection at the site, or even after it has been erected, if it is found to be defective in any way.

- G. Any metal work rejected at the site shall be removed by the Contractor from the premises within ten (10) working days from the time the Contractor is notified of the rejection.

3.07 Field Quality Control

A. Erection Tolerances

1. ***Erect individual pieces so that the deviation from plumb, level and alignment shall not exceed 1:500.***

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

1. GENERAL

1.01 Description

- A. The work in this Section includes providing all labor, materials, equipment and incidentals necessary for fabrication and erection of structural steel, including framing members, support members, base plates, bearing plates, beams, columns and miscellaneous shapes and plates, bracing, welding, bolting, shimming and grouting required as shown on the Contract Drawings and specified herein.
- B. Furnish anchor bolts with templates to be installed under Division 3, "Concrete". Furnish and install nuts and washers for anchor bolts.
- C. Install portions of masonry ties to be welded to structural steel as shown on the Contract Drawings and as specified herein.
- D. Structural Steel is defined as elements of structural steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges", that support design loads.
- E. Related work specified elsewhere includes:

Specification Section	Title
01410	Testing and Laboratory Services
03300	Cast-in-Place Concrete
03600	Grout
04050	Masonry
05025	Metal Materials, Methods, and Fastening
05500	Metal Fabrications
05570	Miscellaneous Metal Assemblies
09900	Painting
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American Institute of Steel Construction (AISC)	
	Code of Standard Practice for Steel Buildings and Bridges and Commentary
	Load and Resistance Factor Design Specification for Structural Steel Bldg's
	Specification for the Design of Steel Hollow Structural Sections
	Specification for Load and Resistance Factor Design of Single-Angle Members
	Specification for the Design, Fabrication and Erection of Structural Steel for Buildings and including the "Commentary" and "Supplements" thereto
Steel Structures Painting Council (SSPC)	
	Surface Preparation Specifications
American Society for Testing and Materials (ASTM)	
ASTM A-6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A-36	Standard Specification for Structural Steel
ASTM A-53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A-108	Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A-123	Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A-153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A-307	Standard Specification for Carbon Steel Externally Threaded Standard Fastener
ASTM A-325	Standard Specification for High Strength Bolts for Structural Steel Joints
ASTM A-436	Standard Specification for Austenitic Gray Iron Castings
ASTM A-490	Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A-500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A-501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A-563	Standard Specification for Carbon and Alloy Steel Nuts

Standard	Description
American Society for Testing and Materials (ASTM) - Cont'd	
ASTM A-568	Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
ASTM A-572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A-847	Standard Specification for Cold-Formed Welded and Seamless High Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
ASTM C-1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
American Welding Society (AWS)	
AWS A5.1	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1	Structural Welding Code - Steel
Other Standards and Building Codes	
	RCSC's "Spec. for Structural Joints using ASTM A-325 or A-490 Bolts"
	Florida Building Code

- B. Any material or operation specified by reference to the published specification of a manufacturer shall comply with the requirements of the standards listed herein. In case of a conflict between the referenced specification and the Contract Documents, the Contract Documents shall govern

C. AISC Code of Standard Practice

1. Make the following modifications:

- a. Delete Paragraph 3.3. and substitute the following: "All things which, in the opinion of the Contractor, appear to be deficiencies, omissions, contradictions or ambiguities in the Contract Documents shall be brought to the attention of the Engineer. The Contract Documents will be corrected or a written interpretation of the alleged deficiency, omission, contradiction or ambiguity will be made by the Engineer **before** the effected work proceeds."
- b. Qualifications for Welding Work
 - 1) Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure".

- 2) Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous twelve (12) months. If re-certification of welders is required, re-testing shall be the Contractor's responsibility.

c. Quality Control

- 1) The Contractor is responsible for all quality control. The Contractor shall be responsible to correct structural steel which does not conform to the specified requirements.

d. Quality Control Monitoring

- 1) The Contractor will monitor quality control by means of employing an testing agency to provide inspection, testing and reports as specified below:

a) High Strength Bolted Connections

- (i) Inspect and test in accordance with AISC "Specification for Structural Joints".
- (ii) **The Contractor is solely responsible to perform the work** in accordance with the Contract Documents and all referenced standards and requirements. The Contractor shall promptly remove and replace materials or fabricated components which do not comply with requirements of the Contract Documents.

b) Design of Connections

- (i) **The Contractor is responsible for the design and adequacy of all connections** that are not designed on the Contract Documents.
- (ii) **The Contractor shall retain a professional engineer** registered in the state of Florida to design and be responsible for all connections not shown or only partially shown on the Contract Documents.
- (iii) Design beam connections to support half of the allowable load on the beam, defined in the AISC Beam Tables as $W_c/2L$, or the reaction shown on the Contract Documents, whichever is greater.

c) Detailing of Members

- (i) All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the Project site wherever possible without causing delay in the Work.

- (ii) Promptly notify the Engineer whenever the design of members for any portion of the structure is not clearly indicated.

D. Installer Qualifications

- 1. A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

E. Fabricator Qualifications

- 1. A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

F. Shop-Painting Applicators

- 1. Qualified according to AISC's Sophisticated Paint Endorsement P2 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators".

- G. Fabrication and erection shall be performed by a qualified fabricator and erector approved by the Engineer. Preparation of shop drawings shall not begin until the fabricator and erector have been approved.

1.03 Submittals

- A. Submit shop drawings for the work in accordance with the General Conditions, Supplementary Conditions, and Section 01300, "Shop Drawings, Submittals and Samples".
- B. ***Complete shop drawings, including material lists, fabrication, schedules for fabrication and shop assembly, data for all structural steel, working drawings and erection drawings shall be submitted for review.*** Drawings shall bear the seal of professional Engineer registered in the State of Florida. Approval will be for strength only and shall not relieve the Contractor of responsibility for proper fit of members, of connections not detailed on the Drawings, or for supplying all material required by the Contract Documents. Mark numbers painted on the shop assembled pieces of steel shall be the same mark numbers used on the detailed shop and erection drawings.
 - 1. Include details of cuts, connections, splices, camber, holes and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
5. Provide setting drawings, templates and directions for the installation of anchor bolts and other anchorages to be installed under other Section of Work.
6. Erection drawings and shop details shall clearly show the capacity of the connection.
7. The Engineer's review of Shop Drawings is for general conformance with design concepts only. Compliance with the requirements for materials, fabrication and erection of structural steel is the Contractor's responsibility.

C. Mill Test Reports

1. ***Certified mill test reports, signed by the manufacturer's*** certifying that the following products comply with the requirements:
 - a. Structural steel including chemical and physical properties.
 - b. Bolts, nuts and washers including mechanical properties and chemical analyses.
 - c. Non-shrink grout.
- D. Certifications that welders are qualified, in accordance with AWS D1.1, on the shop and field welding procedures to be used.
- E. Fabrication shall not be approved until the shop drawing submission has been approved.

1.04 Delivery, Storage and Handling

- A. Deliver materials to the site at such time intervals to insure uninterrupted progress of the Work.
- B. Deliver anchor bolts and other anchorage devices which are to be embedded in cast-in-place concrete or masonry, in sufficient time to permit their timely installation. Provide proper setting drawings, templates and directions for installation of these items.
- C. Store materials to permit easy access for inspection and identification. Keep steel members above the ground and spaced by using pallets, platforms or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

- D. ***Store fasteners in a protected place.*** Clean and relubricate bolts and nuts that become dry or rusty before use.
- E. ***Do not store materials on the structure in a manner that may cause distortion, damage, or overload to members or supporting structures.***
- F. Store all fasteners and welding electrodes in a weather-tight and dry place until ready for use.
- G. Store packaged materials in their original containers.
- H. Repair or replace damaged materials or structures as directed.

2. PRODUCTS

2.01 Materials

- A. ***All steel shall be manufactured in the United States of America (AIS project requirement) and shall meet all ASTM codes, standards and requirement.***
- B. W-Shapes
 - 1. ASTM A-572 / A-572M, Grade 50 (345).
- C. Channels, Angles and Shapes
 - 1. ASTM A-36 / A-36M.
- D. Plate and Bar
 - 1. ASTM A-36 / A-36M.
- E. Cold-Formed Hollow Structural Sections
 - 1. ASTM A-500, Grade B, structural tubing.
- F. Corrosion Resisting Cold-Formed Hollow Structural Sections
 - 1. ASTM A-847, structural tubing.

G. Steel Pipe Columns

1. ASTM A-53, Grade B.

H. Hollow Structural Stainless Steel Tubing

1. Hollow structural stainless steel tubing shall conform to ASTM A-554, Grade MT-316.

I. Stainless Steel Plate and Members

1. Except where otherwise specified, stainless steel shall be Type 316, ASTM A-240. Stainless steel pipe conform to ASTM A-312, Grade TP316.
2. Wrought stainless fittings shall conform to ASTM A-403, Class WP316.

J. Welding Electrodes

1. Welding electrodes for structural steel shall conform to AWS Requirements.
2. Welding electrodes for stainless steel shall conform to AWS Requirements. Use electrodes as follows:

Stainless Steel Material	Welding Electrode Material
Type 304	E-308
Type 304L	E-347
Type 316	E-316
Type 316L	E-318

K. Drilled-in Expansion Bolts

1. Drilled in expansion bolts shall be "Kwik Bolts" by Hilti; "Redhead Anchors" by ITT Phillips Drill Co.; WEJ-IT by WEJ-IT Corporation or approved equal.
2. Diameter and minimum capacity shall be as indicated on the Contract Drawings, or if not shown, **the Contractor shall be responsible for the design and adequacy of all connections** that are not designed on the Contract Documents.
3. **A "minimum" safety factor of four (4) shall be provided.**

2.02 Bolts, Connectors and Anchors

A. High-Strength Bolts, Nuts, and Washers (HDZC)

1. ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts.
2. ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts.
3. ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

B. High-Strength Bolts, Nuts, and Washers

1. ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts.
2. ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts
3. ASTM F 436 (ASTM F 436M) hardened carbon-steel washers, plain.

C. Headed Anchor Rods

1. ASTM A-307, Grade A (ASTM F-568M, Property Class 4.6), straight.
 - a. Nuts: ASTM A-563 (ASTM A-563M) heavy hex carbon steel.
 - b. Plate Washers: ASTM A 36 / A-36M carbon steel.
 - c. Washers: ASTM F-436 (ASTM F-436M) hardened carbon steel.
 - d. Finish: Hot-dip zinc coating, ASTM A-153 / A-153M, Class C.

D. Clevises and Turnbuckles

1. ASTM A-108, Grade 1035, cold-finished carbon steel.

E. Eye Bolts and Nuts

1. ASTM A-108, Grade 1030, cold-finished carbon steel.

F. Sleeve Nuts

1. ASTM A-108, Grade 1018, cold-finished carbon steel.

2.03 Primer

- A. SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd.

2.04 Non-Metallic, Shrinkage-Resistant Grout

- A. The non-metallic, shrinkage-resistant grout shall comply with ASTM C-1107.
- B. Factory-packaged, non-metallic aggregate grout, non-corrosive, non-staining, mixed with water to the consistency suitable for application and a thirty (30) minute working time.
- C. Non-shrink grout shall be used under steel base plates and bearing plates.
- D. All grouting shall be performed in accordance with the recommendations of ACI and the grout manufacturer's printed specifications and instructions for site preparation, product mixing and placing.
- E. The minimum compressive strength of non-shrinking grout when tested in accordance with ASTM C-109, "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)", shall be 7,000 psi after seven (7) days.

2.05 Fabrication

- A. Fabrication shall be in accordance with the specified standards.
- B. Splices not indicated on the Contract Drawings will not be permitted.
- C. Fabricate and assemble structural steel in the shop to the greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges", AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings" and the final "approved" shop drawings.
 - 1. Camber structural steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A-6/ A-6M and maintain markings until the structural steel has been erected.
 - 3. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling materials.

4. Ream unmatched holes in shop assembly of field connections. Reject and replace with new pieces any piece weakened by reaming to a point where the strength of the joint is impaired.
5. Complete structural steel assemblies, including welding of the units, before starting shop-priming operations.
6. Where shop painting is required, complete the assembly, including welding of units, before the start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs and other defects.

D. Thermal Cutting

1. Perform thermal cutting by machine to greatest extent possible.
2. Plane thermally cut edges to be welded to comply with requirements AWS D1.1.

- E. Weld connections or bolt as indicated. Weld shop connections not otherwise shown. Eccentric connections are not permitted unless shown in detail on the structural Drawings. Bolted connections shall have a minimum of two (2) bolts.

F. Bolt Holes

1. Cut, drill or punch standard bolt holes perpendicular to the metal surfaces.

G. Finishing

1. Accurately finish the ends of columns and other members transmitting bearing loads.

H. Cleaning

1. Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

I. Holes

1. Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

2. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
3. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
4. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 Shop Connections

- A. Bolt field connections, except where welded connections or other connections are included on the Drawings. Provide high-strength threaded fasteners for all bolted connections.
- B. High-Strength Bolts
 1. Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A-325 or A-490 Bolts" for the type of bolt and type of joint specified except that "X" type bearing connections shall not be used.
 2. All bolts shall be tightened to the "*snug-tight*" condition in accordance with Supplement No. 1 of the AISC Code.
- C. Weld Connections
 1. Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

2.07 Shop Priming

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of two (2) inches (50 mm).
 2. Surfaces to be field welded.

B. Surface Preparation

1. Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - a. Steel Structures Painting Council (SSPC) SP 2, "Hand Tool Cleaning."

C. Priming

1. Immediately after surface preparation, apply primer according to the manufacturer's written instructions and at rate recommended by SSPC to provide a **uniform dry film thickness of not less than 2.0 mils (0.051 mm)**. Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.
2. **Apply two (2) coats of shop paint to inaccessible surfaces** after assembly or erection. Change color of second coat to distinguish it from the first coat.

D. Painting

1. Apply a one (1) coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a **dry film thickness of not less than 2.0 mils (0.051 mm)**.

2.08 Galvanizing

A. Hot-Dip Galvanized Finish

1. Apply a zinc coating by the hot-dip process to structural steel according to ASTM A-123 / A-123M.
2. Fill vent holes and grind smooth after galvanizing.

2.09 Source Quality Control

- A. The Contractor will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Provide a testing agency with access to places where structural steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections

1. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections

1. In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Ultrasonic Inspection: ASTM E-164, "Standard Practice for Ultrasonic Contact Examination of Weldments".
 - b. Radiographic Inspection: ASTM E-94, "Standard Guide for Radiographic Examination".

3. EXECUTION

3.01 Examination

- A. Verify elevations of concrete and masonry-bearing surfaces and locations of anchor rods, anchor bolts, bearing plates, and other embedments, with the steel erector present, for compliance with the requirements.
- B. Examine the areas and conditions under which structural steel work is to be installed, and notify the Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Storage of Materials

- A. Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.03 Preparation

- A. Prepare temporary shores, guys, braces and other supports during erection to keep structural steel secure, plumb, an in alignment against temporary construction loads and loads equal in intensity to the design loads.
- B. Remove temporary supports when permanent structural steel, connections and bracing are in place, unless otherwise indicated.
- C. All Work under this Section includes responsibility for accurate bearing of steel and correct location of anchorage.

3.04 Fabrication and Erection

- A. ***Fabricate miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Continuously weld permanent connections along the entire area of contact.*** Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated in the Contract Drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded.
- B. ***Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.***
- C. Set embedded metalwork accurately in position when concrete is placed and support rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03300, "Cast-in-Place Concrete.
- D. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges", and "Commentary" as modified herein; "Load and Resistance Factor Design Specification for Structural Steel Buildings"; and the requirements of all other specified standards.
- E. Base and Bearing Plates
 - 1. Clean concrete- and masonry-bearing surfaces of bond reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean the bottom surface of base and bearing plates.

2. Set loose and attached base plates and bearing plates for structural members on wedges, shims, setting nuts or other adjusting devices. Tighten the anchor bolts after the supported members have been positioned and plumbed. Weld plate washers to the top of base plate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates to ensure that no voids remain. Neatly finish exposed surfaces; protect installed materials and allow grout to cure. Comply with the manufacturer's written installation instructions for shrinkage resistant grouts.
- F. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".
- G. Set structural frames to the lines and elevations indicated. Align and adjust various members forming part of the complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. **Level and plumb individual members** of the structure within specified AISC tolerances.
 2. **Make allowances for difference between the temperature** at the time of erection and the mean temperature when the structure is completed and in service.
- H. Bolting
1. Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in place work.
 2. Furnish templates and other devices, as necessary, for presetting bolts and other anchors to accurate locations.
 3. As erection progresses, bolt up work to take care of all dead loads, construction live loads, lateral forces and erection stresses.
 4. Unless otherwise noted, erection bolts used in welded construction may be either tightened securely and left in place or removed and the holes filled with plug welds.

5. Drift pins may be used for assembling parts provided the metal is not distorted or holes enlarged. Ream holes requiring enlargement to admit bolts. Misaligned holes will subject members to rejection.
6. Make all steel to steel connections by high strength bolting except where field welding is specifically shown. Provide not less than two $\frac{3}{4}$ -inch bolts per connection and use not less than $\frac{1}{4}$ -inch thick clip angles.
7. Tighten bolted connections designated as bearing-type connections to the snug tight condition. Where specified, tighten other bolted connections to full pretension by turn-of-nut or calibrated wrench tightening.
8. Install expansion bolts in strict accordance with the manufacturer's recommendations including spacing and edge distances.

I. Welding

1. Field welding shall be done only where shown or specified and only by welders qualified for the procedures used. No welding shall be done when surfaces are wet, exposed to rain or wind, or when welders are exposed to inclement conditions that will hamper good workmanship.
2. **Each welder shall be assigned an identification mark.** This mark shall be made at each completed connection with a paint stick.
3. **Perform welding on steel by the shielded metal arc welding (SMAW) process.** Welding shall conform to the AWS Structural Welding Code-Steel, D1.1-98, except as modified in AISC Section J2.
4. **Perform welding on stainless steel by the gas tungsten arc (TIG) process.** All welds shall be full penetration and smooth unless otherwise indicated on the Contract Drawings. Provide inert gas on the inside of pipe during welding to reduce oxidation.
5. **Provide a minimum of two (2) passes for metal in excess of $\frac{5}{16}$ -inch thickness.**
6. Welds
 - a. **Produce welds, uniform in width and size,** throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal.
 - b. Avoid irregular surface, non-uniform bead pattern, and high crown.

- c. **Form fillet welds of the indicated size of uniform height and fully penetrating.** Accomplish repair, chipping and grinding of welds in a manner that will not gouge, groove or reduce the base metal thickness.

J. Temporary Bracing

1. Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads including erection equipment and its operation.
2. Leave in place until no longer required for safety.
3. Make proper provisions for construction loads, piles of materials, equipment, etc., carried by structural frame during erection.
4. Remove temporary members and connections when permanent members are in place and final connections made.
5. Provide temporary guy wires to achieve proper alignment of the structures as erection proceeds.

K. Provide temporary planking and working platforms as necessary to effectively complete the Work.

L. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment and the removal of paint on surfaces adjacent to welds.

M. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members which are not under stress only when approved by the Engineer. Finish gas-cut sections equal in accordance with the requirements of Section 3.2.2 of AWS D1.1 when permitted.

N. Splice members only where indicated.

O. No alterations will be performed in the field without the written approval of the Engineer.

3.05 Field Connections

A. High-Strength Bolts

1. Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A-325 or A-490 Bolts" for the type of bolt and type of joint specified except that "X" type bearing connections shall not be used.

2. All bolts shall be tightened to the "snug-tight" condition in accordance with Supplement No. 1 of the AISC Code.

B. Weld Connections

1. Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
2. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
3. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3.06 Field Quality Control

A. Testing Agency

1. The Contractor will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Welded Connections

1. Field welds will be visually inspected according to AWS D1.1.
2. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Ultrasonic Inspection: ASTM E-164, "Standard Practice for Ultrasonic Contact Examination of Weldments".
 - b. Radiographic Inspection: ASTM E-94, "Standard Guide for Radiographic Examination".
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents at no additional cost to the Owner.
- D. ***Erect individual pieces so that the deviation from plumb, level and alignment shall not exceed 1:500.***

3.07 Repairs and Protection

- A. ***Repair damaged galvanized coatings on galvanized items*** with galvanized repair paint according to ASTM A-780 and the manufacturer's written instructions.
- B. Touch-up Painting
 - 1. After installation, promptly clean, prepare, and prime or reprime field connections (bolts and welds), rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
 - 2. Clean and prepare surfaces by SSPC-SP 2 hand tool cleaning or SSPC-SP 3 power tool cleaning.
 - 3. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
 - 4. Finish painting shall be as specified in Section 09900, "Painting".
 - 5. Zinc coating which has been burned by field welding, abraded, or otherwise damaged shall be cleaned and repaired after erection of the structural steel. The damaged 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 (2) coats of zinc oxide-zinc dust paint.

3.08 Inspection

- A. The Engineer shall have free access to the Work. The Contractor shall notify the Engineer, in writing, four (4) days in advance of any welding or high strength bolting operations.
- B. High-strength bolting may be visually inspected. All high-strength bolts shall have the turned portion marked with reference to the steel being connected after the nut has been made snug and prior to final tightening. These marks shall be considered in the inspection. Rejected bolts shall be either replaced or retightened as required.

In cases of disputed bolt installations, the bolts in question shall be checked by a calibrated wrench certified by an independent testing laboratory selected by the Owner.

- C. ***All costs for testing and inspection required as a result of defection work, repairs, or retests shall be paid for by the Contractor.***

- D. Any material or workmanship which is rejected by the Engineer either at the shop, mill or building must be promptly replaced by the Contractor to the Engineer's entire satisfaction.
- E. The fact that steel work has been accepted at the shop and mill shall not prevent its final rejection at the site, or even after it has been erected, if it is found to be defective in any way.
- F. ***Any steel work rejected at the site shall be removed by the Contractor from the premises within ten (10) working days from the time the Contractor is notified of the rejection.***

END OF SECTION

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SECTION 05140

STRUCTURAL ALUMINUM

1. GENERAL

1.01 Description

A. The work in this Section includes providing all labor, materials, equipment and incidentals necessary for fabrication and erection of structural aluminum, tubing, sheets, checkered plate, etc. as shown on the Contract Drawings and specified herein.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
01300	Shop Drawings, Submittals and Samples
03300	Cast-in-Place Concrete
03600	Grout
05025	Metal Materials, Methods, and Fastenings
05500	Metal Fabrications
05510	Metal Stairs and Walkways
05520	Handrails and Accessories
05570	Miscellaneous Metal Assemblies
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM A-167	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B-209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B-221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B-241	Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B-308	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
Other Standards and Building Codes	
	OSHA
	Aluminum Construction Manual, latest edition, by the Aluminum Association
	Florida Building Code

- B. Fabrication and erection shall be performed by a qualified fabricator and erector approved by the Engineer. Preparation of shop drawings shall not begin until the fabricator and erector have been approved.

C. Quality Control

1. ***The Contractor is responsible for all quality control.*** The Contractor shall be responsible to correct structural aluminum which does not conform to the specified requirements.

D. Quality Control Monitoring

1. The Contractor will monitor quality control by means of employing an testing agency to provide inspection, testing and reports as specified below:
 - a. High Strength Bolted Connections
 - 1) Inspect and test structural aluminum joints for compliance with referenced bolting connection industry standards for the proposed applications.
 - 2) ***The Contractor is solely responsible to perform the work in accordance with the Contract Documents and all referenced standards and requirements.*** The Contractor shall promptly remove and replace materials or fabricated components which do not comply with requirements of the Contract Documents.

b. Design of Connections

- 1) ***The Contractor is responsible for the design and adequacy of all connections*** that are not designed on the Contract Documents.
- 2) ***The Contractor shall retain a professional engineer registered in the State of Florida to design and be responsible for all connections not shown or only partially shown on the Contract Documents.***
- 3) Design beam connections to support the allowable load on the beam, or the reaction shown on the Contract Documents, whichever is greater.

c. Detailing of Members

- 1) All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the Project site wherever possible without causing delay in the Work.
- 2) Promptly notify the Engineer whenever the design of members for any portion of the structure is not clearly indicated.

E. Fabrication and erection shall be performed by a qualified fabricator and erector approved by the Engineer. Preparation of shop drawings shall not begin until the fabricator and erector have been approved.

1.03 Submittals

A. Shop Drawings

1. Submit shop drawings for the work in accordance with the General Conditions, Supplementary Conditions, and Section 01300, "Shop Drawings, Submittals and Samples".
2. Complete shop drawings, including material lists, fabrication and erection drawings shall be submitted for review. Complete shop drawings, including material lists, fabrication, schedules for fabrication and shop assembly, data for all structural aluminum, working drawings and erection drawings shall be submitted for review. Drawings shall bear the seal of professional Engineer registered in the State of Florida. Approval will be for strength only and shall not relieve the Contractor of responsibility for proper fit of members, of connections not detailed on the Drawings, or for supplying all material required by the Contract Documents. Mark numbers painted on the shop assembled pieces of aluminum shall be the same mark numbers used on the detailed shop and erection drawings.

- a. Include details of cuts, connections, splices, camber, holes and other pertinent data.
 - b. Include embedment drawings.
 - c. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - d. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
 - e. Provide setting drawings, templates and directions for the installation of anchor bolts and other anchorages to be installed under other Section of Work.
 - f. Erection drawings and shop details shall clearly show the capacity of the connection.
 - g. The Engineer's review of Shop Drawings is for general conformance with design concepts only. Compliance with the requirements for materials, fabrication and erection of structural aluminum is the Contractor's responsibility.
3. Fabrication shall not be approved until the shop drawing submission has been approved.

1.04 Delivery, Storage and Handling

- A. Deliver materials to the site at such time intervals to insure uninterrupted progress of the Work.
- B. Deliver anchor bolts and other anchorage devices which are to be embedded in cast-in-place concrete or masonry, in sufficient time to permit their timely installation. Provide proper setting drawings, templates and directions for installation of these items.
- C. Store materials to permit easy access for inspection and identification. **Keep aluminum members above the ground and spaced by using pallets, platforms or other supports and spacers. Protect aluminum members and packaged materials from erosion and deterioration.**
- D. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
- E. Do not store materials on the structure in a manner that may cause distortion, damage, or overload to members or supporting structures.

- F. Store all fasteners and welding electrodes in a weather-tight and dry place until ready for use.
- G. Store packaged materials in their original containers.
- H. Repair or replace damaged materials or structures as directed.

2. PRODUCTS

2.01 Materials

A. Aluminum Sheet

- 1. Aluminum sheet shall conform to ASTM B-209, Alloy 3003, H 14 temper.

B. Structural Aluminum

- 1. Aluminum Structural members shall conform to ASTM B-308, Alloy 6063-T6.
- 2. Aluminum bars and rods shall conform to ASTM B-221, Alloy 6063-T6.

C. Aluminum Tubing

- 1. Aluminum seamless pipe and tubing shall conform to ASTM B-241, Alloy 6063-T6. Wall thickness shall be Schedule 80, per ANSI H35.2, unless otherwise shown on the Drawings.

D. Standard Threaded Fasteners

- 1. Fasteners shall be manufactured of stainless steel, shall comply with ASTM A-167, Type 316 and shall be in accordance with Section 05025, "Metal Materials, Methods and Fastening".

E. Welding Electrodes

- 1. Welding electrodes for aluminum shall be ER 4043 filler metal.

F. Checkered Plate

- 1. ***All checkered plates shall be aluminum, mill finish, and designed for a live load of 150 pounds per square foot of the gross projected area and a 250 pound concentrated load***, with the limits for deflections as specified in Federal Specification RR-G-6610.

2. **Aluminum checkered plates shall have a minimum thickness of $\frac{3}{8}$ -inch standard pattern "non-slip" plates of minimum $\frac{3}{8}$ -inch thickness and sizes** shown on the Contract Drawings. Stiffener angles (aluminum) shall be provided as required to meet the superimposed live load requirements specified above. Stiffeners, if utilized, shall be concealed. All checkered plate sections shall be cut to the dimensions shown on the Contract Drawings. Flush type lifting handles shall be provided for each plate, unless otherwise noted on the Contract Drawings.
3. **Plate shall be 6063-T6 alloy aluminum.** Raised lugs shall be diamond shaped and have an angled and opposed pattern.
4. Provide U-bolt lifting handles located on opposite ends on each removable section. Steel plates, including angle edgings, support angles, and lifting handles shall be Type 316 stainless steel.

2.02 Fabrication

- A. Fabrication shall be in accordance with the specified standards.
- B. Splices not indicated on the Contract Drawings will not be permitted.
- C. Fabricate miscellaneous aluminum metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations.
- D. Surface Treatment is required only if indicated on the Contract Drawings.

3. EXECUTION

3.01 Examination

- A. Verify elevations of concrete and masonry-bearing surfaces and locations of anchor rods, anchor bolts, bearing plates, and other embedments, with the aluminum erector present, for compliance with the requirements.
- B. Examine the areas and conditions under which structural aluminum work is to be installed, and notify the Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Preparation

- A. Prepare temporary shores, guys, braces and other supports during erection to keep structural aluminum secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to the design loads.
- B. Remove temporary supports when permanent structural aluminum, connections and bracing are in place, unless otherwise indicated.
- C. All Work under this Section includes responsibility for accurate bearing of aluminum and correct location of anchorage.

3.03 Erection

- A. Erection shall be in accordance with the specified standards and as indicated on the Contract Drawings.
- B. Base and Bearing Plates
 - 1. Clean concrete and masonry-bearing surfaces of bond reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean the bottom surface of base and bearing plates.
 - 2. Set loose and attached base plates and bearing plates for structural members on wedges, shims, setting nuts or other adjusting devices. Tighten the anchor bolts after the supported members have been positioned and plumbed. Weld plate washers to the top of base plate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates to ensure that no voids remain. Neatly finish exposed surfaces; protect installed materials and allow grout to cure. Comply with the manufacturer's written installation instructions for shrinkage resistant grouts.
- C. **Set structural frames to the lines and elevations indicated.** Align and adjust various members forming part of the complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. **Perform necessary adjustments to compensate for discrepancies in elevations and alignment.**

1. **Level and plumb individual members** of the structure within specified tolerances.
2. **Make allowances for difference between the temperature** at the time of erection and the mean temperature when the structure is completed and in service.

D. Bolting

1. Furnish anchor bolts and other connectors required for securing structural aluminum to foundations and other in place work.
2. Furnish templates and other devices, as necessary, for presetting bolts and other anchors to accurate locations.
3. As erection progresses, bolt up work to take care of all dead loads, construction live loads, lateral forces and erection stresses.
4. Unless otherwise noted, erection bolts used in welded construction may be either tightened securely and left in place or removed and the holes filled with plug welds.
5. Drift pins may be used for assembling parts provided the metal is not distorted or holes enlarged. Ream holes requiring enlargement to admit bolts. Misaligned holes will subject members to rejection.
6. Make all aluminum to aluminum connections by high strength bolting except where field welding is specifically shown. Provide not less than two $\frac{3}{4}$ -inch bolts per connection and use not less than $\frac{1}{4}$ -inch thick clip angles.
7. Tighten bolted connections designated as bearing-type connections to the snug tight condition. Where specified, tighten other bolted connections to full pretension by turn-of-nut or calibrated wrench tightening.
8. Install expansion bolts in strict accordance with the manufacturer's recommendations including spacing and edge distances.

E. Maintain erection tolerances of structural aluminum within specified standard practices.

F. Welding

1. Welding on aluminum shall be performed by the Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) Process. Welding shall conform to the AWS Structural Welding Code - Aluminum, D1.2-90.
2. Provide a minimum of two (2) passes for metal in excess of $\frac{5}{16}$ -inch.

3. Produce a weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base material. Avoid irregular surface, non-uniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in a manner that will not gouge, groove, or reduce the base metal thickness.
- G. Fabricate miscellaneous aluminum metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Continuously weld permanent connections along the entire area of contact. Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be true in alignment. Unless specifically indicated on the Drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fasteners wherever possible. Built-up parts shall be free from warp. Exposed ends and edges of metal shall be slightly rounded.
- H. Clean the surfaces of aluminum metalwork to be in contact with concrete, rust, dirt, grease and other foreign substances before placing concrete.
- I. Set embedded metalwork accurately in position when concrete is placed and support rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03600, "Grout".
- J. No painting is required.

3.04 Corrosion Protection of Aluminum Surfaces

- A. ***Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry*** per Section 09900, "Painting", before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.
- B. ***Where the contact of dissimilar metals may cause electrolysis and where aluminum will come into contact with dissimilar metals, except stainless steel, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.*** Where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be separated using not less than one (1) coat of zinc chromate primer and one (1) heavy coat of aluminum pigmented asphalt paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, shall be used.

- C. Finished works shall be cleaned and excess cement removed.
- D. All work shall be adequately anchored in place at proper elevations, planes and locations. Allow the coating to dry before the aluminum is placed in contact with the concrete.
- E. ***Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets.***

END OF SECTION

SECTION 05410

METAL TRUSSES

1. GENERAL

1.01 Description

- A. The work in this Section includes providing all labor, materials, equipment and incidentals necessary for fabrication and erection of pre-engineered, pre-fabricated light gauge cold-formed steel framing elements, anchors and fastening and shop painting, etc. as shown on the Contract Drawings and specified herein.
- B. Furnish anchor bolts with templates to be installed. Furnish and install nuts and washers for anchor bolts.
- C. Install portions of masonry ties to be welded to structural steel as shown on the Contract Drawings and as specified herein.
- D. Related work specified elsewhere includes:

Specification Section	Title
01300	Shop Drawings, Submittals and Samples
05025	Metal Materials, Methods, and Fastening
05120	Structural Metal Framing
07600	Flashing and Sheet Metal
09900	Painting
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
Steel Structures Painting Council (SSPC)	
	Surface Preparation Specifications
American Society for Testing and Materials (ASTM)	
ASTM A-653 / A-653M-94	Standard Specification for Sheet Steel, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
ASTM A-780-93a	Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
American Welding Society (AWS)	
AWS D1.1	Structural Welding Code - Steel
AWS A1.3	Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
Other Standards and Building Codes	
	Florida Building Code

- B. Fabrication and erection shall be performed by a qualified fabricator and erector approved by the Engineer. Preparation of shop drawings shall not begin until the fabricator and erector have been approved.

C. Quality Control

1. **The Contractor is responsible for all quality control.** The Contractor shall be responsible to correct metal trusses which do not conform to the specified requirements.
2. Inspect all metal trusses for compliance with referenced industry standards for the proposed applications.
3. The Contractor shall promptly remove and replace materials or fabricated components which do not comply with requirements of the Contract Documents.
4. **The Contractor is responsible for the design and adequacy of all connections** that are not designed on the Contract Documents.
5. All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the Project site wherever possible without causing delay in the Work.

D. Fabricator Qualifications

1. Fabrication shall be performed by a cold-formed steel truss fabricator with experience in designing and fabricating cold-formed steel truss systems equal in material, design, and extent to the systems required for this Project.
2. Cold-formed steel truss system installation shall be performed by an experienced installer approved by the steel truss system fabricator.

E. Calculate structural characteristics of cold-formed steel truss members according to AISI's *"Specification for the Design of Cold-Formed Steel Structural Members, 1986 (1990)"*.

F. Structural Performance

1. Design, engineer, fabricate, and erect cold-formed steel trusses to withstand specified design loads within limits and under conditions required.
 - a. Design Loads: As specified
 - b. Deflections: Live load deflection meeting the following (unless otherwise specified):
 - 1) Floor Trusses: Vertical deflection less than or equal to $1/360$ of the span
 - 2) Roof Trusses: Vertical deflection less than or equal to $1/240$ of the span
2. Design framing systems to provide for movement of framing members without damage or over-stressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120°F (67°C).
3. Specifically, the prefabricated light gauge steel roof truss manufacturer (vendor) shall provide the following services:
 - a. Design and supply a complete light gauge steel roof system stamped by a Florida registered Engineer to include all of the following components:
 - 1) Light gauge steel trusses for gravity and lateral loads with truss sizes, gauges and connections at truss joints.
 - 2) Design and stamp truss to truss connections and truss to bearing connections for gravity, lateral and uplift loads.
 - 3) Design and stamp the top cord, bottom cord and web permanent bracing locations.

- 4) Design and stamp the roof deck structural support at eave edge, valley, hip and ridge transition planes to support corrugated steel or plywood decking.
 - 5) Design the roof deck shear transfer framing required to transfer the roof deck shear to the building structure. The Engineer-Of-Record is responsible to determine the roof diaphragm, to determine the location and magnitude of the roof shear transfer and to determine location within the building structure through which this shear will pass.
 - 6) Provide stamped calculations and shop drawings for project submittal requirements.
- b. The metal truss manufacturer is to inspect the roof and/or floor trusses after the installation is complete and issue a written report indicating whether the trusses were installed in accordance with these specifications.

1.03 Submittals

A. Shop Drawings

1. Submit shop drawings for the work in accordance with the General Conditions, Supplementary Conditions, and Section 01300, "Shop Drawings, Submittals and Samples".
2. Complete shop drawings, including material lists, fabrication and erection drawings shall be submitted for review. Complete shop drawings, including product information, material lists, fabrication, schedules for fabrication and shop assembly, member, type, location, spacing, size and gauge of member, method of attachment to supporting members, working drawings and erection drawings, and all necessary details shall be submitted for review. Drawings shall bear the seal of professional Engineer registered in the State of Florida.
3. Submit detailed floor truss and roof truss layouts.
4. Submit truss drawings, sealed and signed by a qualified Professional Engineer registered in the State of Florida, verifying the truss ability to meet local code and design requirements. Specifically include the engineering and design for all of the following:
 - a. Description of design criteria.
 - b. Engineering analysis depicting member stresses and truss deflection.

- c. Truss member sizes, gauges and connections at truss joints; truss to truss attachment details.
 - d. Truss reaction at all bearing locations; truss to bearing attachment details.
 - e. Top chord, bottom chord and web permanent bracing requirements; construction and temporary bracing per the Light Gauge Steel Engineers Association (LGSEA) "Field Installation Guidelines", dated October 1999.
 - f. Eave edge, valley, hip and ridge structural support for roof corrugated or plywood decking.
 - g. Roof deck shear transfer framing required transferring the roof deck shear to the building structure.
- 5. The Engineer's review of Shop Drawings is for general conformance with design concepts only. Compliance with the requirements for materials, fabrication and erection of structural aluminum is the Contractor's responsibility.
 - 6. Certification: An affidavit shall be furnished from the manufacturer certifying that the materials or products delivered to the Project meet the requirements specified herein.
 - 7. Fabrication shall not be approved until the shop drawing submission has been approved.

1.04 Delivery, Storage and Handling

- A. Deliver materials to the site at such time intervals to insure uninterrupted progress of the Work.
- B. Deliver materials in manufacturer's unopened containers or bundles, fully identified by name brand, type and grade. Exercise care to avoid damage during unloading, storing and erection.
- C. Store trusses on blocking pallets, platforms or other supports off the ground and in an upright position sufficiently braced to avoid damage from excessive bending.
- D. Protect trusses and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep trusses free of dirt and other foreign matter.
- E. Store fasteners in a protected place.

- F. Repair or replace damaged materials or structures as directed.

1.05 Project Conditions

- A. During construction, adequately distribute all loads applied to trusses so as not to exceed the carrying capacity of any one joist, truss or other component

2. PRODUCTS

2.01 Manufacturers

- A. Acceptable truss manufacturers for light gauge metal trusses:
 - 1. MiTek Industries, Inc. "Ultra-Span" truss system.
 - 2. Or approved equal.

2.02 Components

- A. System components: MiTek Industries, Inc. ULTRA-SPAN® light gauge steel roof trusses and floor truss components.
- B. Provide manufacturer's standard steel truss members, bracing, bridging, blocking, reinforcements, fasteners and accessories with each type of steel framing required, as recommended by the manufacturer for the applications indicated and as needed to provide a complete light gauge cold-formed steel truss package.

2.03 Materials

- A. Materials
 - 1. All component gauges: Fabricate components of structural quality steel sheet per ASTM A653/A653M-95 with a minimum yield strength of 45,000 psi.
 - 2. Bracing, bridging and blocking members: Fabricate components of commercial quality steel sheet per ASTM A653/A653M-95 with a minimum yield strength of 33,000 psi.

B. Ultra-Span Steel Truss Components

1. Provide sizes, shapes and gauges indicated.
 - a. Design Uncoated-Steel Thickness: 20 gauge, 0.0350 inch (0.91 mm)
 - b. Design Uncoated-Steel Thickness: 18 gauge, 0.0460 inch (1.20 mm).
 - c. Design Uncoated-Steel Thickness: 16 gauge, 0.0570 inch (1.52 mm).
 - d. Design Uncoated-Steel Thickness: 14 gauge, 0.0730 inch (1.90 mm).

C. Finish

1. Provide components with protective zinc coating complying with ASTM A653/A653M-95, minimum G60 coating.

D. Fastenings

1. Manufacturer recommended self-drilling, self-tapping screws with corrosion-resistant plated finish. Fasteners shall be of sufficient size and number to ensure the strength of the connection.
2. ***Welding of any nature to these trusses is specifically prohibited*** unless permission is received from the truss manufacturer.
3. Other fasteners as accepted by truss engineer.

2.04 Fabrication

- A. Factory fabricate cold-formed steel trusses plumb, square, true to line and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.
 1. Fabricate truss assemblies in jig templates.
 2. Cut truss members by sawing or shearing or plasma cutting.
 3. Fasten cold-formed steel truss members by screw fastening, or other methods as standard with fabricator. Wire tying or welding of framing members is not permitted.
 - a. Locate mechanical fasteners and install according to cold-formed steel truss component manufacturer's instructions with screw penetrating joined members by not less than three (3) exposed screw threads.

- B. Care shall be taken during handling, delivery and erection. Use of a crane or lull with a spreader bar is recommended for trusses longer than thirty (30) feet. Brace, block or reinforce truss as necessary to minimize member and connection stresses.

C. Fabrication Tolerances

- 1. Fabricate trusses to a maximum allowable tolerance variation from plumb, level, and true to line of $\frac{1}{8}$ -inch in 10 feet (1:960) and as follows:
 - a. Spacing: Space individual trusses no more than plus or minus $\frac{1}{8}$ -inch (3mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - b. Sequences: Fabricate each cold formed steel truss to a maximum out-of-square tolerance of $\frac{1}{8}$ -inch (3mm).

3. EXECUTION

3.01 General

- A. Verify elevations of concrete and masonry-bearing surfaces and locations of anchor rods, anchor bolts, bearing plates, and any other embedments, with the metal truss erector present, for compliance with the requirements.
- B. Examine the areas and conditions under which metal truss work is to be installed, and notify the Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. All erection procedures for metal trusses shall comply with applicable standards and the recommendations of the truss manufacturer.
- D. Set metal trusses accurately to the lines and levels indicated on the Drawings or on the shop details approved by the Engineer and shall be plumb and level unless otherwise indicated.
- E. Prior to assembling members, clean bearing surfaces and surfaces to be in permanent contact to remove dirt and scale.
- F. Exercise care in handling and erection to insure that metal trusses are not twisted, bent, or otherwise damaged. Field correction of fabrication errors shall be allowed only if approved by the Engineer for each specific condition.

3.02 General Installation

A. General

1. Erection of trusses, including proper handling, safety precautions, temporary bracing and other safeguards or procedures are the responsibility of the General Contractor and the installation subcontractor. The use of a crane or lull with a spreader bar is recommended for trusses over thirty (30) feet in length.
 2. Exercise care and provide erection bracing required to prevent toppling or dominoing of trusses during erection as identified in the Light Gauge Steel Engineers Association (LGSEA) publication "*Field Installation Guide For Cold-Formed Steel Roof Trusses*" October, 1999.
- B. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at design spacing indicated.
- C. Provide proper lifting equipment suited to sizes and types of trusses required, applied at lift points recommended by truss fabricator and use spreader bars for larger span trusses. Exercise care to avoid damage to truss members during erection and to keep horizontal bending of the trusses to a minimum.
- D. Provide framing anchors as indicated or accepted on the engineering design drawing or erection drawings. Anchor trusses securely at bearing points and the anchor must be attached to the correct side of the truss as shown in the truss drawings and attachment details.
- E. Install roof framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations.
1. ***DO NOT cut truss members without prior approval of the truss manufacturer.***
 2. Fasten cold-formed steel roof framing by mechanical fasteners only per truss manufacturer's recommendation. Wire tying or welding of roof framing is not permitted.
 - a. Welding of any nature to these trusses is strictly prohibited unless specific permission is received from the truss manufacturer.
 - b. Locate mechanical fasteners and install according to cold-formed roof framing manufacturer's instructions with screw penetrating joined members by not less than three (3) exposed screw threads.
 - c. Install roof framing in one-piece lengths, unless splice connections are indicated.

- d. Provide temporary bracing per Light Gauge Steel Engineers Association (LGSEA) publication "*Field Installation Guide For Cold-Formed Steel Roof Trusses*" and leave in place until trusses are permanently stabilized.

F. Erection Tolerances

1. Install trusses to a maximum allowable tolerance variation from plumb, level, and true to line of 1/4-inch in 10 feet (1:480) and as follows:
 - a. Space individual trusses no more than plus or minus 1/4-inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.03 Open-Web Floor Truss Installation

- A. Install perimeter joist tracks or belly band sized to match trusses. Align and securely anchor or fasten track to supporting structure at comers, end, and spacing indicated or as recommended by the manufacturer.
- B. Install trusses bearing on supporting framing, level, straight, and plumb, adjust to final position, brace, and reinforce. Install trusses over supporting framing with a minimum end bearing of 1½-inches (38mm).
- C. Space trusses not more than 2 inches (51mm) from abutting walls and not greater than 24 inches on center or less as indicated on the erection drawings.
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists where indicated.
- E. Install bridging at each end of the trusses and at intervals indicated. Fasten bridging at each truss intersection as follows:
 1. Cold-rolled steel channel or cold-formed steel section, fastened to truss bottom chord.
 2. Flat, steel-sheet straps of width and thickness indicated, fastened to truss bottom chord flange.
 3. Cold-formed steel section strongback (6-inch minimum), fastened to truss web or other means.
- F. Secure trusses to load-bearing interior walls to prevent lateral movement of bottom flange.

- G. Install miscellaneous truss framing and connections, including closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable truss-framing assembly.

3.04 Roof Truss Installation

- A. Install, bridge, and brace trusses according to the truss manufacturer's recommendations and requirements of this Section.
- B. Space trusses as shown on the Erection Drawings.
- C. Do not alter, cut, or remove truss members or connections of trusses.
- D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacing indicated.
- E. Erect trusses without damaging truss members or connections.
- F. Align truss bottom chords with load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.
- G. Install construction continuous bridging, bracing, cross bracing and diagonal bracing per Light Gauge Steel Engineers Association (LGSEA) publication "Field Installation Guide For Cold-Formed Steel Roof Trusses" October 1999.
- H. Attach trusses to trusses per the truss manufacturer's recommendation.
- I. Attach trusses to bearings per the truss manufacturer's recommendation.
- J. Attach permanent truss lateral and diagonal bracing per the manufacturer's recommendation.
- K. Attach roof deck or sheathing structural support per the truss manufacturer's recommendation.
- L. Attach roof deck shear transfer framing per the truss manufacturer's recommendation.

3.05 Repairs and Protection

- A. Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanizing repair paint according to ASTM A-780 and the truss manufacturer's instructions.

3.06 Final Inspection Report

- A. The truss manufacturer shall inspect the roof and/or floor trusses after the installation is complete and issue a written report indicating whether the trusses were installed in accordance with these specifications.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

1. GENERAL

1.01 Description

- A. The work in this Section includes providing all labor, materials, equipment and incidentals necessary to install miscellaneous metals, shapes and sheets, metal items and fasteners not specified elsewhere in these Specifications.
- B. Related work specified elsewhere includes:

Specification Section	Title
00700	General Conditions
01300	Shop Drawings, Submittals and Samples
03300	Cast-in-Place Concrete
03600	Grout
05025	Metal Materials, Methods and Fastening
05510	Metal Stairs and Walkways
05520	Handrails and Accessories
05570	Miscellaneous Metal Assemblies
09900	Painting
Division	Information
8	Doors and Windows
Contract Drawings and General Provisions of the Contract	

- C. All materials, practices and workmanship shall conform to the Florida Building Code.

1.02 Submittals

A. Shop Drawings

1. Submit shop drawings for the work in accordance with the General Conditions, Supplementary Conditions, and Section 01300, "Shop Drawings, Submittals and Samples.
2. Submit product data for non-slip aggregates and non-slip aggregate surface finishes, prefabricated building columns, cast nosings, treads and thresholds, steel floor plate, paint products, and grout.
3. ***The Contractor shall submit shop drawings detailing fabrication and erection of each metal fabrication indicated.*** Include plans, elevations, sections, and details of metal fabrications and their connections. Show sizes of members, fastenings, supports, clearances, and anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
4. The Contractor shall provide samples representative of the materials and finished products as may be requested per Section 01300, "Shop Drawings, Submittals and Samples".
5. The Contractor shall submit welder certificates, signed by the Contractor, certifying that the welders to be used on this Project comply with the requirements specified under Article 1.03 of this Specification Section ("*Quality Assurance*").
6. The Contractor shall submit Qualification data for firms and persons specified in Article 1.03 of this Specification Section ("*Quality Assurance*") to demonstrate their capabilities and experience. Include a list of completed projects with project names, addresses, names and addresses of engineer's, architect's and Owner's, and other information specified.
7. Shop drawings shall be approved by the Engineer before fabrication begins.

1.03 Quality Assurance

A. Fabricator Qualifications

1. Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce the required units without delaying the Work.

B. Welding Standards

1. Comply with, at a minimum, the applicable provisions of:
 - a. AWS D1.1 "Structural Welding Code-Steel".
 - b. AWS D1.2 "Structural Welding Code-Aluminum".
 - c. AWS D1.3 "Structural Welding Code-Sheet Steel".
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

C. Inserts and Anchorages

1. Furnish inserts and anchoring devices that must be set in concrete or built into masonry for installation of miscellaneous metal work. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other-work to avoid delay.
2. See Concrete and Masonry Sections (Divisions 3 and 4) of these Specifications for installation of inserts and anchorage devices.

D. Shop Assembly

1. Pre-assemble items in shop to the greatest extent possible to minimize field splicing and assembly.
2. Disassemble units, only as necessary, for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.04 Project Conditions

- A. Where metal fabrications are indicated to fit walls and other construction, the Contractor shall verify dimensions by accurate field measurements before fabrication and indicate said measurements on the shop drawings.
- B. Coordinate the fabrication schedule with the construction progress schedule to avoid delaying the Work.

- C. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

2. PRODUCTS

2.01 General

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

2.02 Ferrous Metals

- A. Miscellaneous steel plates, shapes, bars and connections shall conform to the requirements of ASTM A-36 / ASTM A-36M.
- B. Rolled steel floor plates shall conform to the requirements of ASTM A-786 / ASTM A-786M.
- C. Hot-Rolled Carbon Steel Bars (and Bar size shapes) shall conform to ASTM A-575, grade as selected by fabricator.
- D. Hot-Rolled Carbon Steel Sheets and Strips shall conform to ASTM A-568 and ASTM A-569, pickled and oiled.
- E. Cold-Rolled Carbon Steel Sheets shall conform to ASTM A-366.
- F. Galvanized Carbon Steel Sheets shall conform to ASTM A-526 with 1.25 oz. "commercial" galvanizing per ASTM A-525.
- G. Steel Tubing
 - 1. Product type (manufacturing method) and as follows:
 - a. Cold-formed Steel Tubing shall conform to the requirements of ASTM A-500.
 - b. Hot-formed Steel Tubing shall conform to the requirements of ASTM A-501.
 - 2. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A-53.

H. Steel Pipe

1. Steel pipe shall comply with ASTM A-53, standard weight, Schedule 40, unless otherwise indicated, or another weight required by structural loads.
 - a. Black finish unless otherwise indicated.
 - b. Galvanized finish where indicated or directed by the Engineer.
- I. Malleable-Iron Casting shall conform to ASTM A-47, Grade 32510 (ASTM A-47M, Grade 22010).

J. Masonry Anchorage Devices

1. Expansion shields as follows:
 - a. Lead expansion shields for machine screws and bolts $\frac{1}{4}$ -inch and smaller, head-out embedded nut type, single unit class.
 - b. Lead expansion shields for machine screws and bolts larger than $\frac{1}{4}$ -inch in size, head-out embedded nut type, multiple unit class.
- K. Welding rods and bare electrodes shall be selected according to AWS specifications for the metal alloy to be welded.

2.03 **Stainless Steel**

- A. Except where otherwise specified use Type 316, ASTM A-167 stainless steel plate, members, and hardware and washers.
- B. Use ASTM A-193, Grade B8M bolts and ASTM A-194, Grade 8M nuts.

2.04 **Structural Aluminum**

- A. The Contractor shall refer to the requirements of Section 05140, "Structural Aluminum".
- B. Aluminum Structural members shall conform to ASTM B-308, Alloy 6063-T6.

- C. Aluminum bars and rods shall conform to ASTM B-221, Alloy 6063-T6.
- D. Structural shapes and plates shall conform to ASTM B-241, Alloy 6063-T6.
- E. Aluminum Extrusions shall conform to ASTM B-221 / ASTM B-221M, alloy 6063-T6.
- F. Aluminum-alloy rolled tread plate shall conform to ASTM B-632 / ASTM B-632M, Pattern 1, alloy 6061-T6.

2.05 Cast-in-Place Anchors in Concrete

- A. Unless otherwise indicated on the Drawings, use Type 316 stainless steel wedge anchors as manufactured by Phillips Drill Company or approved equal.
- B. Where steel anchors are indicated, use a one-piece design with expander ring consisting of steel zinc coated and chrome plated as manufactured by McCullough Industries, Inc., Kwik Bolt, or approved equal.
- C. ***Anchors shall be capable of sustaining, without failure, a load equal to four (4) times the design load imposed*** when installed in concrete, as determined by testing per ASTM E-488, conducted by a qualified independent testing agency.

2.06 Fasteners

- A. General
 - 1. Provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with electro-deposited zinc coating complying with ASTM B-633, Class Fe/Zn 25, unless specified otherwise, where built into exterior walls. Select fasteners for type, grade, and class required.
 - 2. Bolts for securing equipment, above grade piping and aluminum structures shall be stainless steel.
- B. Bolts and Nuts shall be regular hexagon-head bolts, ASTM A 325, Type I, heavy hex steel structural bolts and heavy hex carbon steel nuts.
- C. Anchor Bolts shall comply with ASTM F-1554, Grade 36.
- D. Machine Screws shall comply with ASME B18.6.3 (ASME B18.6.7M).

- E. Lag bolts shall comply with ASME B18.2.1 (ASME B18.2.3.8M).
- F. Toggle bolts shall comply with FS FF-B-588 and shall be of the tumble-wing type, class and style as required.
- G. Wood screws shall be of the flathead, carbon steel type and shall comply with ASME B18.6.1.
- H. Plain washers shall be of the round, carbon steel type and shall comply with ASME B18.22.1 (ASME B18.22M).
- I. Lock washers shall be of the helical, carbon steel, spring type and shall comply with ASME B18.21.1 (ASME B18.21.2M).
- J. Expansion Anchors
 - 1. Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, **a load equal to six (6) times the load imposed when installed in unit masonry**, as determined by testing per ASTM E-488, conducted by a qualified independent testing agency.
 - a. Material for Anchors in Exterior Locations shall be Alloy Group 1 (A1) stainless steel bolts complying with ASTM F-593 (F-738M) and nuts complying with ASTM F-594 (ASTM F-836M).
 - b. Material for Anchors in Interior Locations shall be carbon steel components, zinc-plated, to comply with ASTM B-633, Class Fe/Zn 5.

2.07 Paint

A. Shop Primer for Ferrous Metal

- 1. Organic zinc-rich primer, complying with SSPC - Paint 20 and compatible with topcoat.
- 2. The Contractor is also referred to Section 09900, "Painting".
- 3. Products
 - a. Subject to compliance with requirements, provide one of the following:
 - 1) Carboline 621; Carboline Company.
 - 2) Aquapon Zinc-Rich Primer 97-670; PPG Industries, Inc.

- 3) Tneme-Zinc 90-97; Tnemec Company, Inc.
- 4) Or approved equal.

B. Galvanizing Repair Paint

1. High-zinc-dust content paint for regalvanizing welds in galvanizing steel, with a dry film containing not less than ninety-four percent (94%) zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

C. Bituminous Paint

1. Cold-applied asphaltic mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.08 Grout

- A. Grout shall be of the non-shrink, non-metallic type and shall be factory-packaged, non-staining, non-corrosive, non-gaseous and comply with ASTM C-1107.
- B. Provide grout specifically recommended by the manufacturer for interior and exterior applications.

2.09 Galvanizing

- A. Galvanizing shall comply with ASTM A-153 for galvanizing iron and steel hardware.
- B. Galvanizing shall comply with ASTM A-123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8-inch thick and heavier.
- C. Galvanizing shall comply with ASTM A-386 for galvanizing assembled steel products.

2.10 Fabrication - General

A. Shop Assembly

1. ***Preassemble items in the shop to the greatest extent possible*** to minimize field splicing and assembly.

2. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Form metal fabrications from materials of the size, thickness and shapes indicated but not less than that needed to comply with the performance requirements indicated. Work to the dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for various components of each metal fabrication.
- C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- D. **Allow for thermal movement** resulting from the following maximum change (range) in ambient temperature in the design, fabrication and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss:
 1. Temperature Change: 100°F (55.6°C)
- E. Shear and punch metals cleanly and accurately. Remove burrs.
- F. Ease exposed edges to a radius of approximately $\frac{1}{32}$ -inch (0.8 mm), unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.
- G. Remove sharp or rough areas on exposed traffic surfaces.
- H. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- I. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of the type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

- J. Provide for anchorage of the type indicated and coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.11 Loose Bearing and Leveling Plates

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area.
- B. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.12 Loose Steel Lintels

- A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Weld adjoining members together to form a single unit where indicated.
- C. Size loose lintels for equal bearing of one (1) inch per foot (85 mm per m) of clear span but not less than eight (8) inches (200 mm) bearing at each side of openings, unless otherwise indicated. The minimum size shall be 5" x 3½" x $\frac{5}{16}$ " for each four (4) inch thickness of masonry supported.
- D. Galvanize loose steel lintels located in exterior walls.

2.13 Shelf and Relieving Angles

- A. Fabricate shelf and relieving angles from steel angles of the sizes indicated and for attachment to concrete framing. Provide slotted holes to receive ¾-inch (19mm) bolts, spaced not more than six (6) inches (150 mm) from ends and not more than twenty-four (24) inches (600 mm) on-center, unless otherwise indicated.

- B. For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity wall exterior wythe.
- C. Galvanize shelf angles to be installed on exterior concrete framing.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.14 Miscellaneous Framing and Supports

- A. Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- C. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Except as otherwise indicated, space anchors twenty-four (24) inches (600 mm) on-center and provide minimum anchor units in the form of steel straps 1¼ inches (32 mm) wide by ¼-inch (6 mm) thick by eight (8) inches (200 mm) long.
- D. Galvanize miscellaneous framing and supports in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations, where indicated.

2.15 Miscellaneous Steel Trim

- A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.
- B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other Work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than six (6) inches (150 mm) from each end, six (6) inches (150 mm) from corners, and twenty-four (24) inches (600 mm) on-center, unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior locations.
2. Interior locations, where indicated.

2.16 Floor Plate

A. Fabricate raised-pattern floor plates from rolled-steel floor plate or aluminum (location and material as indicated on the Contract Drawings) of the thickness and in the pattern indicated below:

1. Thickness: $\frac{3}{8}$ -inch, minimum
2. Pattern: As selected from manufacturer's standard patterns.

2.17 Bollards (Truck Guards)

- A. Provide truck guards (bollards) and covers where indicated on the Contract Drawings.
- B. ***The bollards shall be 7-inch (galvanized) standard weight steel pipe*** as specified in ASTM A-53.
- C. Anchor posts in concrete as indicated and fill solidly with Class B (3,000 psi) concrete conforming to Section 03300, "Cast-in-Place Concrete".

D. Bollard Covers

1. ***The bollard cover (post sleeve) shall be of the blow molded type, constructed from $\frac{1}{8}$ -inch thick High Density Polyethylene (HDPE) for weather resistant durability and long service life.***
2. ***The bollard covers shall have a bright "safety yellow" color with UV stabilizers for protection from the sun and dual 3M "red" reflective-tape bands*** shall be integrally provided for enhanced visibility for day and night protection.
3. The bollard covers shall be as manufactured by Thermoprene, Inc., or equal.

2.18 Abrasive Metal Nosings, Treads and Thresholds

A. Abrasive stair nosings shall be provided for all concrete stairs.

- B. ***Nosings shall extend the full width of the stair.***
- C. Cast-Metal Units shall be **cast aluminum**, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
- D. ***Nosings shall be cross-hatched units, three (3) inches (75 mm) wide safety groove treads with a one (1) inch (25 mm) lip, for casting into concrete steps.*** The nosings shall be Type 46 aluminum as manufactured by one of the following manufacturers:
- | | |
|------------------------------------|--------------------------------------|
| 1. American Safety Tread Co., Inc. | 4. Barry Pattern & Foundry Co., Inc. |
| 2. Wooster Products, Inc. | 5. Safe-T-Metal Co. |
| 3. Balco, Inc. | 6. Or approved equal. |
- E. Provide anchors for embedding units in concrete, as standard with manufacturer.
- F. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.

2.19 Finishes - General

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

2.20 Steel and Iron Finishes

A. Galvanizing

1. For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
 - a. ASTM A-153 / A-153M, for galvanizing iron and steel hardware.
 - b. ASTM A-123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip, 0.0299-inch (0.76 mm) thick or thicker.

B. Preparation for Shop Priming

1. Prepare uncoated ferrous metal surfaces to comply with the minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

- a. Exteriors (SSPC Zone 1 B): SSPC-SP 6/NACE No. 3 "Commercial Blast Cleaning."
- b. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."

- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1, "Paint Application Specification No. 1" for shop painting.

2.21 Aluminum Finishes

- A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish

1. AA-M10 (Mechanical Finish: as fabricated, unspecified).

3. EXECUTION

3.01 Preparation

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to Project site.
- B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.
- C. **Set sleeves in concrete with tops flush with finish surface elevations.** Protect sleeves from water and concrete entry.

3.02 Installation

A. Fastening to In-Place Construction

1. Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
2. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
3. Do not use concrete anchors set in holes drilled in the concrete after the concrete is placed in place of cast-in-place anchor bolts.
4. After anchor bolts have been embedded, protect their threads by applying grease and by having the nuts screwed on until the time of installation of the equipment or metalwork.

B. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Set embedded metalwork accurately in position when concrete is placed and supported rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with grout in conformance with Section 03600, "Grout".

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Comply with the following requirements for all field welding:

1. ***Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.***

- a. Welding on steel shall be performed by the Shielded Metal Arc Welding (SMAW) process. Welding procedures shall comply with AWS B3.0.

- b. Welding on aluminum shall be performed by the Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) process, per the AWS Welding Handbook.
2. Provide a minimum of two (2) passes for metal of $\frac{3}{16}$ -inch thickness plus one (1) additional pass for each additional $\frac{1}{8}$ -inch in metal thickness. Produce a weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and under-cuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size. Accomplish repair, chipping, and grinding of welds in a manner that will not gouge, groove, or reduce the base metal thickness.
 3. Obtain fusion without undercut or overlap. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
 5. Pre-assemble items in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
 6. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately $\frac{1}{32}$ -inch unless otherwise shown. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.
 7. Weld corners and seams continuously, complying with the AWS recommendations. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.
 8. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
 9. Cut, reinforce, drill, and tap miscellaneous metal work as required to receive finish hardware, screws, and similar items.

3.03 Installing Miscellaneous Framing and Supports

- A. Install framing and supports to comply with the requirements of the items being supported, including the manufacturers' written instructions and requirements indicated on the "approved" shop drawings, if any.

- B. Anchor supports for operable partitions securely to and rigidly brace from the building structure.
- C. Support steel and aluminum on solid grouted masonry or concrete. Secure with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates.

3.04 Setting Loose Plates

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve the bond to surfaces. Clean the bottom surface of the bearing plates.
- B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use non-shrink, metallic grout in concealed locations where not exposed to moisture; use non-shrink, non-metallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 Installing Pipe Bollards

- A. **Anchor bollards in concrete with pipe sleeves preset and anchored into concrete.** After bollards have been inserted into the sleeves, fill the annular space between the bollard and sleeve solidly with non-shrink, non-metallic grout, mixed and placed to comply with the grout manufacturer's directions.
- B. **Fill bollards solidly with concrete, mounding the top surface.**
- C. **Clean the exterior of the bollards** of all concrete spoils, debris and other materials. **Install the pipe bollard covers** in accordance with the manufacturers instructions.

3.06 Painting and Protective Coatings

- A. All ferrous metal, except stainless steel and galvanized surfaces, shall be properly cleaned and given one shop coat of primer compatible with the coating system specified in Section 09900, "Painting".

- B. ***Anchors that are built into masonry shall be coated with asphalt paint unless specified to be galvanized.***
- C. Metal work to be encased, in concrete shall be left unpainted unless specified or noted otherwise.
- D. Where hot-dip galvanized or zinc coated metal is specified or shown, it shall be shop primed unless specifically not required.
- E. Castings that are to be left unpainted shall be cleaned and coated with a coal-tar-pitch varnish.
- F. Aluminum to be placed adjacent to masonry shall be protected with an isolating coating of bitumastic, and/or neoprene or felt.

3.07 Dissimilar Metal Contact

- A. 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 separated using not less than one (1) coat of zinc chromate primer and one (1) heavy coat of aluminum pigmented asphaltic paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, shall be used.
- B. ***Finished works shall be cleaned and excess cement removed.***
- C. All work shall be adequately anchored in place at proper elevations, planes and locations.

3.08 Adjusting and Cleaning

- A. Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Section 09900, "Painting."
- B. Galvanized Surfaces
 - 1. ***Repair or replace metal with damaged galvanized surfaces at no additional cost to the Owner.***
 - 2. Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A-780.

3. The materials referred to above shall be applied in accordance with the manufacturer's instructions.

END OF SECTION

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SECTION 05510

METAL STAIRS AND WALKWAYS

1. GENERAL

1.01 Description

A. The work included in this Section consists of providing all labor, materials and equipment necessary to fabricate and install all aluminum stairs and walkways, complete, with anchors, brackets, structural support, integral handrails and kick-plate and balusters when applicable.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
01300	Shop Drawings, Submittals and Samples
05025	Metal Materials, Methods, and Fastenings
05140	Structural Aluminum
05500	Metal Fabrications
05520	Handrails and Accessories
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American Society for Testing and Materials (ASTM)	
ASTM B-221	Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes
Other Standards	
AWS D1.1	Structural Welding Code
	OSHA
	Aluminum Association, Designation System for Alum. Finishes
	Florida Building Code

B. NAAMM Stair Standard

1. Comply with “*Recommended Voluntary Minimum Standards for Fixed Metal Stairs*” in NAAMM AMP 510, “Metal Stairs Manual”, for the class of stair designated, unless more stringent requirements are indicated.
2. ***All aluminum stairs shall be of the “Industrial Class” type.***

C. Fabricator Qualifications

1. Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce the required units without delaying the Work.

D. Welding Standards

1. Comply with, at a minimum, the applicable provisions of AWS D1.2 “Structural Welding Code - Aluminum”.
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.03 Coordination

- A. Coordinate installation of anchorages for metal stairs and walkways. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

- B. Coordinate delivery of such items with other-work in time for installation.
- C. See Concrete and Masonry Sections (Divisions 3 and 4) of these Specifications for installation of inserts and anchorage devices.

1.04 Performance Requirements

A. Structural Performance of the Stairs

- 1. Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under the conditions indicated.
- 2. Stairs shall be designed to support **a minimum live load of 100 lb/ft² and a concentrated load of 1,000 pounds at midspan.**
- 3. Elevated stairway structural support shall meet the Building Code requirements for **a wind loading of 140 mph** and the stairway system shall not move or sway under application of this wind load or due to normal walking up or down of said stairs by employees of the facility.
- 4. The stair framing shall be capable of withstanding stresses resulting from handrail loads in addition to the uniform live and concentrated loads
- 5. The maximum deflection under **a concentrated load equivalent to 500 lb/ft** of tread width, applied at midspan, **shall not exceed $\frac{1}{1000}$ of the tread span length.**

1.05 Project Conditions

- A. Where stairways and walkways are indicated to fit walls and other construction, the **Contractor shall verify dimensions by accurate field measurements before fabrication and indicate said measurements on the shop drawings.**
- B. Coordinate the fabrication schedule with the construction progress schedule to avoid delaying the Work.
- C. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.06 Submittals

A. Materials and Shop Drawings

1. Submit shop drawings and product data for the products of this Section in compliance with the General Conditions, Supplementary Conditions and Section 01300, "Shop Drawings, Submittals and Samples.
2. Indicate construction plans, elevations, sections, details, sizes of metal sections, thicknesses of metals, profiles, attachments, dimensions and field joints, method of support from the structure, work to be built-in or provided by other Sections and finishes.
3. For installed products indicated to comply with design loads, include structural calculations, signed and sealed by a structural engineer registered in the State of Florida.
4. Submit two (2) pieces, each twelve (12) inches square in area, of each type of finished material.
5. Indicate welded connections, both shop and field, using standard AWS welding symbols. Indicate net weld lengths.
6. The Contractor shall submit welder certificates, signed by the Contractor, certifying that the welders to be used on this Project comply with the requirements specified under Article 1.02(D) of this Specification Section ("*Quality Assurance*").
7. Shop drawings shall be approved by the Engineer before fabrication begins.
8. Submit a manufacturer's certification that materials meet specification requirements.

2. PRODUCTS

2.01 Metal Stairs and Walkways

- A. Fabricate aluminum and galvanized steel stairs from materials complying with Section 05025, "Metal Materials, Methods and Fastening", Section 05120, "Structural Steel", Section 05140, "Structural Aluminum" and as indicated and detailed on the Contract Drawings. Provide all headers, supports for platforms and landings, hangers or struts, anchors, bolts, angles, and other accessories necessary for complete assembly and installation. Handrailing shall comply with Section 05520, "Handrails and Accessories". Floor plate, grating and grating treads shall comply with Section 05530, "Grating, Plates and Frames".

- B. Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names or blemishes.
- C. Fabricate integral railings and component connections capable of resisting lateral forces as indicated by the Florida Building Code.
- D. Shop assemble sections in largest practical sizes, easily handled through building openings.
- E. Accurately form and fit components and connections. **Grind exposed edges and welds smooth and flush.**
- F. Accurately form components required for proper anchorage of stairs and landings to each other and to the building structure.
- G. Stair members shall be welded, except bolting may be used for field assembly where welding cannot be used. **The nose of each tread shall extend a minimum of one (1) inch over the rear edge of the next lower tread.**

2.02 Materials

A. Aluminum

- 1. All metal stairs and walkways shall be manufactured of aluminum unless otherwise indicated on the Contract Drawings.
- 2. All aluminum used in the fabrication of the stairs and walkways shall be in accordance with ASTM B-221 / B-221M, Alloy 6063-T6, Finish AA-C22A31.
- 3. All handrailing shall be as specified in Section 05520, "Handrails and Accessories".
- 4. Stringers, header, risers, handrailing and railing shall be constructed of aluminum.
- 5. **All stairways or walkways indicated on the Contract Drawings shall be supplied in aluminum for this Project.**

B. Aluminum Castings

- 1. Aluminum castings shall be in accordance with ASTM B-26 / B-26M, Alloy 443.0-F.

C. Ferrous Metals - Galvanized Walkways Only (If identified on the Contract Drawings)

- 1. Miscellaneous steel plates, shapes, bars and connections shall conform to the requirements of ASTM A-36 / ASTM A-36M.

2. Steel Tubing shall be as follows:
 - a. Cold-formed Steel Tubing shall conform to the requirements of ASTM A-500.
 - b. Hot-formed Steel Tubing shall conform to the requirements of ASTM A-501.
3. Rolled steel floor plates shall conform to the requirements of ASTM A-786 / ASTM A-786M, rolled from plate complying with ASTM A-36 / A-36M or ASTM A-283 / A-283M, Grade C or D.
4. Uncoated, Cold-Rolled Carbon Steel Sheet shall conform to ASTM A-1008 / A-1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by the design loads.
5. Uncoated, Hot-Rolled Carbon Steel Sheet shall conform to ASTM A-1011 / A-1011M, structural steel, Grade 30 (Grade 205), unless another grade is required by the design loads.
6. Galvanized Carbon Steel Sheets shall conform to ASTM A-653 / A-653M, G90 (Z275) coating, structural steel, Grade 33 (Grade 230), unless another grade is required by the design loads.

2.03 Miscellaneous Materials

- A. Select welding rods and electrodes according to AWS specifications for the metal alloy being welded.
- B. Shop primers shall comply with Section 09900, "Painting".
- C. All hardware and washers for aluminum stairways and walkways shall be Type 316 stainless steel. Use ASTM A-193, Grade B8M bolts and ASTM A-194, Grade 8M nuts.
- D. Hardware for galvanized steel walkways
 1. Zinc-plated fasteners with electro-deposited zinc coating complying with ASTM B-633, Class Fe/Zn 25 where built into exterior walls. Select fasteners for type, grade, and class required.
 2. Bolts and nuts shall be regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F-568M, Property Class 4.6), with heavy hex nuts, ASTM A-563 / A-563M and where indicated, flat washers.
 3. Lag bolts shall comply with ASME B18.2.1 (ASME B18.2.3.8M).

4. Anchor bolts shall comply with ASTM F-1554, Grade 36 and shall be hot-dip or mechanically deposited, zinc-coated materials.
 5. Plain washers shall be of the round, galvanized, and shall comply with ASME B18.22.1 (ASME B18.22M).
 6. Lock washers shall be of the helical, galvanized, spring type and shall comply with ASME B18.21.1 (ASME B18.21.2M).
 7. Expansion Anchors
 - a. Anchor bolt and sleeve assemblies shall be of the material indicated below with the capability to sustain, without failure, **a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete**, as determined by testing per ASTM E-488, conducted by a qualified independent testing agency.
 - 1) Material for Anchors in Exterior Locations shall be Alloy Group 1 (A1) stainless steel bolts complying with ASTM F-593 (F-738M) and nuts complying with ASTM F-594 (ASTM F-836M).
 - 2) Material for Anchors in Interior Locations shall be carbon steel components, zinc-plated, to comply with ASTM B-633, Class Fe/Zn 5.
- E. Galvanizing Repair Paint (Galvanized Steel Walkways Only)
1. High-zinc-dust content paint for re-galvanizing welds in galvanizing steel, with a dry film containing not less than ninety-four percent (94%) zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- F. Bituminous paint shall be a cold-applied asphaltic emulsion complying with ASTM D-1187.
- G. Grout
1. Grout shall be of the non-shrink, non-metallic type.
 2. The grout shall be factory-packaged, non-staining, non-corrosive, non-gaseous and comply with ASTM C-1107.
 3. Provide grout specifically recommended by the manufacturer for interior and exterior applications.

2.04 Fabrication of Open Grating Stairs, Walkways and Landings

A. General

1. Fabricate stairs and walkways with open risers with trends of open gratings.
2. Treads shall be a minimum ¼-inch thick by 1½-inches deep by the width of the stair.
3. Properly secure beads to stringers, bolt in place.
4. Form stringers of channels. Weld fascial plates of a minimum 14-gauge sheet stock across channel toes.
5. Landings shall be the same as treads, a minimum of ¼-inch thick by 1½-inch deep grating. Reinforce the underside of landings with angle T's.

B. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on the supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

C. Preassembled Stairs

1. Assemble stairs in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
2. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately $\frac{1}{32}$ -inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
3. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.
4. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
5. Weld connections to comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

- b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Weld exposed comers and seams continuously, unless otherwise indicated.
 - e. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches adjacent surfaces.
- 6. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
 - 7. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.05 Finishes

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Galvanizing (For Galvanized Walkways identified on the Contract Drawings, If Any)
 - 1. Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - a. ASTM A-123 / A-123M, for galvanizing steel and iron products.
 - b. ASTM A-153 / A-153M, for galvanizing steel and iron hardware.
 - c. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

3. EXECUTION

3.01 Metal Stairways and Walkways

- A. Erect stairs and walkways square, level, plumb and free from distortion or defects detrimental to appearance and performance.

- B. Provide the necessary anchorage devices, plates, angles, hangers, fasteners and struts as required for connecting the stairs to the structure. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- C. ***The stair assembly and walkways are to be securely fastened to the structure such that no swaying or other distortion of the assembly will occur.***
- D. ***Ensure the alignment of the stairs and walkways with adjacent construction.***
Coordinate with related work to ensure no interruption in installation.
- E. Perform all necessary cutting, drilling, fitting and altering required for the installation of the stairways and walkways. Do not perform any other additional cutting without the review and approval of the Engineer. Set units accurately in location, alignment and elevation, measured from established lines and levels and free of rack.
- F. Field bolt and weld to match standard of shop bolting and welding. Hide bolts and screws whenever possible. Where the bolts and screws cannot be hidden, use flush countersunk fastenings, unless indicated otherwise.
- G. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- H. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- I. Make mechanically fastened joints flush hairline butted.
- J. Grind all welds smooth and flush.
- K. Field welding shall comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.02 Dissimilar Metal Contact

- A. 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 separated using not less than one (1) coat of zinc chromate primer and one (1) heavy coat of aluminum pigmented asphaltic paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, or neoprene shall be used. Finished works shall be cleaned and excess cement removed.
- B. ***All work shall be adequately anchored in place at proper elevations, planes and locations.***

3.03 Adjusting and Cleaning

- A. Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Section 09900, "Painting."
- B. ***Clean all metal stair and walkway installations completely and remove all miscellaneous markings and debris prior to the punchlist inspection*** by the Engineer and Owner.
- C. Galvanized Surfaces
 - 1. Repair or replace metal with damaged galvanized surfaces at no additional cost to the Owner.
 - 2. Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A-780.
 - 3. The materials referred to above shall be applied in accordance with the manufacturer's instructions.

END OF SECTION

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SECTION 05520

HANDRAILS AND ACCESSORIES

1. GENERAL

1.01 Description

- A. This Section includes providing all labor, materials and equipment necessary to fabricate and install aluminum railings and accessories. All handrails shall consist of two (2) horizontal rails.
- B. Related Work Specified Elsewhere

Specification Section	Title
01300	Shop Drawings, Submittals and Samples
03300	Cast-in-Place Concrete
05025	Metal Materials, Methods, and Fastenings
05500	Metal Fabrications
05510	Metal Stairs and Walkways
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American National Standards Institute (ANSI)	
A21.1	Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
A58.1	Minimum Design Loads in Buildings and Other Structures

Standard	Description
American National Standards Institute (ANSI) - Cont'd	
A117.1	Specifications for Making Buildings and Facilities accessible to and Usable by Physically Handicapped People
Z97.1	Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Building
American Society for Testing and Materials (ASTM)	
ASTM B-26	Standard Specification for Aluminum-Alloy Sand Castings
ASTM B-108	Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B-209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B-210	Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B-214	Standard Test Method for Sieve Analysis of Metal Powders
ASTM B-221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B-247	Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM B-429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
Occupational Safety and Health Administration (OSHA)	
	OSHA Standards, latest edition
Aluminum Association (AA)	
AA 30	Specifications for Aluminum Structures
	Aluminum Construction Manual, latest edition
American Society of Civil Engineers (ASCE)	
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASCE 8	Specifications for the Design of Cold-Formed Stainless Steel Structural Members
Miscellaneous	
ABH-21	Aluminum Brazing Handbook
ASD-1	Aluminum Standards and Data
DAF-45	Designation System for Aluminum Finishes
SAA-46	Standards for Anodized Architectural Aluminum
	Life Safety Code 101
	AWS "Structural Welding Code"
	Florida Building Code (Design standards may exceed OSHA Design Standards).

- B. **Obtain each type of handrail, railing and kickplate through one source from a single manufacturer.**
- C. Welding, if required depending on the type of handrail identified in this specification section, shall be in accordance with AWS "Standard Qualification Procedure".
- D. **The Contractor shall verify handrail and railing dimensions by field measurements prior to preparation of shop drawings and fabrication.** Coordinate the fabrication schedule with the construction progress to avoid delaying the Work. Where field dimensions cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails, railing and kickplate without field measurements. Coordinate construction to ensure that the actual dimensions correspond to the established dimensions.
- E. Preassemble items in the shop to the greatest extent possible, so as to minimize splicing and assembly of units at the Project Site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinate installation.

1.03 Performance Requirements

A. Structural Performance of Handrails and Railing

- 1. Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections:
 - a. Top rail of guards shall be capable of withstanding the following loads applied as indicated:
 - 1) **Concentrated load of 200 lb_f (890 N)** applied at any point and in any direction.
 - 2) **Uniform load of 50 lb_f/ft (730 N/m) applied horizontally and concurrently with a uniform load of 100 lb_f/ft (1460 N/m) applied vertically downward.**
 - 3) Concentrated and uniform loads above need not be assumed to act concurrently.
 - b. Handrails not serving as Top Rails shall be capable of withstanding the following loads applied as indicated:

- 1) **Concentrated load of 200 lb_f (890 N) applied at any point and in any direction.**
 - 2) **Uniform load of 50 lb_f/ft (730 N/m) applied in any direction.**
 - 3) Concentrated and uniform loads above need not be assumed to act concurrently.
- c. The infill area of guards shall be capable of withstanding a **horizontal concentrated load of 200 lb_f (890 N) applied to one (1) ft² (0.09 m²) at any point in system**, including panels, intermediate rails, balusters, or other elements composing infill area.
- 1) The load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

B. Thermal Movements

1. Provide handrails, railings and kickplate that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
 - a. Temperature Change (Range): 120°F (67°C), ambient; 180°F (100°C), material surfaces.

C. Control of Corrosion

1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 Submittals

A. Materials, Shop Drawings and Product Data

1. Shop drawings, calculations and product data for aluminum handrailing and accessories shall be submitted for review in conformance with Section 01300, "Shop Drawings, Submittals and Samples". The submittal shall include, at a minimum:
 - a. Layout of fabricated sections.

- b. Removable handrailing and gate details.
 - c. Kickplate details.
 - d. Safety chain details, if used.
 - e. Expansion joint details.
 - f. Connection and joining methods and details.
 - g. Materials and finishes.
- 2. Show dimensions and reference materials of construction by ASTM designation and grade. Show design criteria.
 - 3. Submit erection drawings that indicate locations of the handrail, kickplate, safety chains, etc. Reproductions of the Contract Drawings will not be accepted for this purpose.
 - 4. ***All shop drawings and calculations shall bear the signature and seal of a Professional Engineer registered in the State of Florida.***
 - 5. Fabrication shall not begin until the Engineer's review is complete and the shop drawings are approved.

1.05 Delivery and Storage

- A. Deliver packaged materials to the site in the manufacturer's original, unopened containers. Arrange deliveries to provide sufficient quantities to permit continuity of erecting of any phase of work.
- B. Deliver such items to the Project Site in time for installation.
- C. ***Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports in a well ventilated, weather-tight place.***
- D. Keep the material free from dirt, grease, and other foreign matter and protect from corrosion.
- E. Stacking shall be done in a way which will prevent bending.
- F. Cover the handrails, railing and kickplate in protective polyethylene wrap to avoid damage to the finish. Keep handling on site to a minimum.

1.06 Coordination and Scheduling

- A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
- B. Schedule installation so that handrails, railings and kickplate are mounted only on completed walls.
- C. Do not support temporarily by any means that does not satisfy structural performance requirements.

2. PRODUCTS

2.01 Handrails

- A. Provide aluminum handrails, railings, kickplate and swing gates where indicated on the Contract Drawings. Railings shall be two-rail, non-welded, forty-two (42) inches high, and of the configurations indicated on the Contract Drawings. ***Centerlines of posts and rails shall be in the same plane.***
- B. Aluminum
 - 1. Alloy and temper recommended by the aluminum producer and finisher for the type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

Item	Material
Extruded Aluminum Bar and Tube	ASTM B-221, Alloy 6063-T5
Extruded Aluminum Structural Pipe and Tube	ASTM B-429, Alloy 6063-T6, minimum nominal diameter of 1½-inches (O.D. of 1.9 inches)
Drawn Aluminum Seamless Tube	ASTM B-210, Alloy 6063-T832
Aluminum Plate and Sheet	ASTM B-209, Alloy 6061-T6
Aluminum Die and Hand Forgings	ASTM B-247, Alloy 6061-T6
Aluminum Casting	ASTM B-108, Alloy 214
Finish	Anodized

- C. Fittings shall be fastened to pipe members by either inert gas shielded metal arc welding as per Alcoa's Welding Alcoa Aluminum, latest edition, or by internal, mechanical, self tapping screws, combined with a stainless steel, blind, rivet-locking component fastener system.
- D. ***Railings and posts shall be joined by either mechanically-fastened slip-type fittings or an inner-wedge type system.*** All fittings, elbows, wall returns, and caps shall be flush type. Exposed fasteners shall be set flush or recessed. Post spacing shall not exceed five (5) feet for horizontal railing and four (4) feet for stair railing.
- E. ***Posts and rails shall be continuous throughout their sectional lengths.*** Curved members shall be formed to true radii, free from dye marks or surface abrasions. Furnish railings in shop fabricated sections, complete with accessories, including gates, hardware, closure caps for rail terminations, base trim, and anchorages. Provide expansion joints at not greater than twenty-four (24) foot spacing.
- F. Provide drain holes in all railings and posts to prevent trapping of moisture.
- G. ***Safety Chains at openings between sections of railing will not be allowed.*** The Contractor shall provide either a removable section of handrail at these areas or fabricate a hinged swing gate with a locking hasp.
- H. Handrails attached to walls shall be mounted with Type 316 stainless steel brackets. Each bracket shall be fastened with a minimum 3/8-inch diameter stainless steel stud set into the wall and tapped into the bracket. Brackets shall have a 3-inch projection from the wall and shall be uniformly spaced approximately four (4) feet with the end brackets not more than 12-inches from the ends of the handrail.
- I. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work, include, but are not limited to, the following:
 - 1. Golden Railings
 - 2. Alumaguard
 - 3. Craneveyor Corporation
 - 4. Superior Aluminum Products
 - 5. Aluminum Tube Railings
 - 6. Moultrie Manufacturing
 - 7. Or approved equal.

2.02 Kickplates

- A. ***Aluminum kickplates, where not specifically called for on the Contract Drawings, shall be furnished and installed at the edges of all walkways and landings.***

- B. **Clear anodized aluminum kickplates** fabricated of ¼-inch angle or plate stock, depending on the specific walkway edge detail, meeting OSHA requirements and shall project four (4) inches above the walkway surface. Kickplates shall be fabricated from the same material as that of the handrailing. All mounting brackets and hardware shall be Type 316 stainless steel.
- C. **Aluminum kickplates and accessories shall be anodized with a clear architectural Class I satin finish.** The anodic coating shall be a minimum thickness of 0.7 mils and a minimum coating weight of thirty-two (32) milligrams per square inch, in accordance with the Aluminum Association Designation AA-M12-C22A41.
- D. **The kickplates shall not infringe on the minimum walkway width and shall not interfere with the removal of the grating panels.**

2.03 Removable Handrailing and Swing Gates

- A. Provide aluminum removable handrailing and swing gates where indicated on the Contract Drawings.
- B. The Contractor shall submit shop drawings of the removable handrailing and swing gates shown on the mechanical drawings. The handrailing shall be of the same material and details required by these specifications.
- C. **Aluminum removable handrailing and swing gates shall be anodized with a clear architectural Class I satin finish.** The anodic coating shall be a minimum thickness of 0.7 mils and a minimum coating weight of 32 milligrams per square inch, in accordance with the Aluminum Association Designation AA-M12-C22A41.
- D. Removable railings shall have vertical pipe supports fastened as indicated on the Contract Drawings. Unless otherwise indicated, fabricate removable railings in unit sections not over ten (10) feet long with at least three vertical supports, including one at each end.

2.04 Stainless Steel Handrail Safety Chains

- A. Handrail safety chains, where applicable, shall be fabricated from Type 316 stainless steel.
- B. Safety chains shall be of the proof coil style, $\frac{3}{16}$ -inch in diameter with at least twelve (12) links per foot and with snaphooks at each end. Snaphooks shall be fabricated from Type 316 stainless steel.

2.05 Fasteners and Anchoring

A. Anchorage of Handrails and Railing to Other Construction

1. For aluminum handrailing, use fasteners fabricated from Type 316 stainless steel.

B. Interconnecting Handrails and Railing Components

1. Use fasteners fabricated from the same basic material as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
2. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless otherwise indicated.

C. Cast-in-Place and Post-Installed Anchors

1. Anchors of the type indicated below, fabricated from corrosion resistant materials with the capability to sustain, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and equal to four (4) times the load imposed when installed in concrete, as determined by testing per ASTM E-488 conducted by a qualified independent testing agency.

2.06 Grout and Anchoring Cement

- A. Non-shrink, non-metallic grout shall be premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C-1107. Provide grout specifically recommended for this type of application.
- B. Erosion resistant Anchoring Cement shall be factory-packaged, non-shrink, non-staining, hydraulically-controlled expansion cement formulation for mixing with water at the Project Site to create pourable anchoring, patching, and grouting compound. Provide a formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by the manufacturer for exterior use.

2.07 Fabrication

- A. Fabricate handrails and railings to comply with the requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

- B. ***Assemble handrails and railings in the shop to the greatest extent possible to minimize field splicing and assembly.*** Disassemble unit only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain the structural value of joined pieces.
- C. Form changes in direction of railing members as follows:
1. As detailed.
 2. By bending.
 3. By radius bends of the radius indicated.
 4. By flush radius bends.
 5. By mitering at elbow bends.
 6. By inserting prefabricated flush-elbow fittings.
 7. By any method indicated above, applicable to the change in direction involved.
- D. ***Form simple and compound curves by bending members in jigs to produce uniform curvature*** for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- E. Welded Connections - NOT USED
- F. Non-welded Connections
1. Fabricate handrails and railings by connecting members with concealed mechanical fasteners and fittings, unless otherwise indicated.
 2. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 3. Fabricate splice joints for field connection using an epoxy structural adhesive where this is the manufacturer's standard splicing method.
- G. Welded Connections for Aluminum Pipe - NOT USED
- H. Brackets, Flanges, Fittings, and Anchors
1. Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.
- I. Provide inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

- J. ***For railing posts set in concrete, provide preset sleeves of galvanized steel not less than five (5) inches (150 mm) long with inside dimensions not less than ½-inch (12 mm) greater than the outside dimensions of post, and steel plate forming bottom closure.***
- K. For removable railing posts, fabricate slip-fit sockets from steel tube whose ID is sized for a close fit with the posts; limit movement of post without lateral load, measured at the top, to not more than one-fortieth ($\frac{1}{40}$) of the post height. Provide socket covers designed and fabricated to resist being dislodged.
1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate as indicated in Article 2.04 herein.
- L. Shear and punch metals cleanly and accurately and remove burrs from exposed edges.
- M. Ease exposed edges to a radius of approximately $\frac{1}{32}$ -inch (0.8 mm), unless otherwise indicated. Form bent-metal comers to the smallest radius possible without causing grain separation or otherwise impairing the Work.
- N. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- O. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.
- P. Fabricate joints that will be exposed to weather in a watertight manner.
- Q. Close exposed ends of handrail and railing members with prefabricated end fittings.
- R. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is $\frac{1}{4}$ -inch (6 mm) or less.
- S. Fillers
1. Provide fillers made from suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
 2. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.
- T. ***All work shall be square, plumb, straight and true, accurately fitted with tight joints and intersections.*** Exposed work shall be finished smooth. The completed work shall conform to both OSHA Standards.

2.08 Aluminum Finishes

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Handrailing, posts, kickplate, and fittings shall be **anodized with a clear architectural Class I satin finish**. The anodic coating shall be a minimum thickness of 0.7 mils and a minimum coating weight of thirty-two (32) milligrams per square inch, in accordance with the Aluminum Association Designation AA-M12-C22A41.

3. EXECUTION

3.01 Examination

- A. Examine all handrails, railing and kickplate. Any damaged materials shall be immediately returned and new materials supplied at no additional cost to the Owner.
- B. Examine the areas and conditions under which handrails, railing and kickplate are to be installed and correct any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 Dissimilar Metals

- A. 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 separated using not less than one (1) coat of methacrylate lacquer (zinc chromate) primer and one (1) heavy coat of aluminum pigmented asphalt paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, or neoprene shall be used.
- B. When bronze and aluminum components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with a heavy coat of a proper primer to be recommended/approved by the aluminum manufacturer.
- C. ***Finished works shall be cleaned and excess cement and markings removed.***

3.03 Preparation

- A. Furnish setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous

- items having integral anchors which are to be embedded in concrete or masonry construction.
- B. Set embedded metalwork accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete.
 - C. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03300, "Cast-in-Place Concrete".
 - D. Coordinate the delivery of such items to the Project site in accordance with the Project Work Schedule.

3.04 Installation

- A. Install handrails, railing and kickplate in accordance with the "approved" shop drawings and the manufacturer's instructions.
- B. Erect work horizontal or parallel to rake of steps or ramps and concrete walls, free from distortion or defects detrimental to appearance or performance.
- C. Perform cutting, drilling, and fitting required for installation of handrails, railing and kickplate. Set the work accurately in location, alignment, and elevation, plumb, level, true and free from rack, measured from established lines and levels.
- D. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
- E. Railings shall be installed by the fabricator or in strict compliance with the fabricator's instructions. Install railings plumb and within a tolerance of $\frac{1}{16}$ -inch maximum deviation either side of the longitudinal centerline.
- F. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed $\frac{1}{8}$ -inch in 12 feet.
- G. Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.
- H. ***Posts embedded in concrete shall be set in sleeves with quick-setting non-shrink grout.***

- I. Removable railing units shall be installed freestanding in close fitting pipe sleeves of the same material as the railing. Removable railings shall not be attached to walls or other railings, unless otherwise indicated.
- J. Kickplates shall be installed on all handrailing throughout the Project.

3.05 Railing Connections

A. Non-welded Connections

- 1. Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.
- 2. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

B. Welded Connections - NOT USED

C. Expansion Joints

- 1. Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement.
- 2. Provide slip-joint internal sleeve extending two (2) inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within six (6) inches (150 mm) of post.

3.06 Anchoring Posts

- A. ***Anchor posts in concrete by means of pipe sleeves set and anchored into the concrete.*** Provide galvanized steel pipe sleeves, not less than five (5) inches long and having an inside diameter not less than ½-inch greater than the outside diameter of the inserted pipe post. Provide galvanized steel plate closures secured to the bottom of the sleeve and of a width and length of not less than one (1) inch greater than the outside diameter of the sleeve. After the posts have been inserted into the sleeves, fill the annular space with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover the anchorage joint with an aluminum flange finished to match the post.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts as indicated using fittings designed and engineered for this purpose.
- D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.07 Anchoring Railing Ends

- A. Anchor railing ends into concrete and masonry with round flanges connected to railing ends and anchored into wall construction with post-installed anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces using non-welded connections.

3.08 Attaching Handrails to Walls

- A. Attach handrails to wall with wall brackets. Provide a bracket with 1½-inch (38-mm) clearance from the inside face of handrail and finished wall surface.
- B. Locate the brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 2. For hollow masonry anchorage, use toggle bolts.

3.09 Protection

- A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Project Substantial Completion.
- B. **Restore finishes damaged during installation and construction period so no evidence remains of correction work.** Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units at no additional cost to the Owner.

3.10 Cleaning

A. Aluminum Handrails, Railing and Kickplate

1. ***Clean all aluminum handrails, railing and kickplate*** by washing them thoroughly with clean water and soap and rinsing with clean water.
2. Do not use an acid solution, steel wool or other harsh abrasives.
3. ***If the stain remains after washing, the piece shall be removed and replaced at no additional cost to the Owner.***

B. ***Clean all aluminum handrails, railing and kickplate completely and remove all miscellaneous markings and debris prior to the punchlist inspection*** by the Engineer and Owner.

3.11 Repair of Defective Work

- #### A.
- Remove stained or otherwise defective work and replace with material that meets the specification requirements, at no additional cost to the Owner.

END OF SECTION

SECTION 05530

GRATING, PLATES AND FRAMES

1. GENERAL

1.01 Description

- A. Furnish all labor, materials, and incidentals required to install the aluminum grating, plates and frames, access hatches, structural supporting members, angles, connections, fastenings and concrete inserts attached to or supporting the grating, plates and frames or those structural members as shown on the Contract Drawings, or specified herein.
- B. Related Work Specified Elsewhere

Specification Section	Title
05025	Metal Materials, Methods, and Fastenings
05140	Structural Aluminum
05510	Metal Stairs and Walkways
05570	Miscellaneous Metal Assemblies
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM A-240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM) - Cont'd	
ASTM A-666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM B-209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B-210	Standard Specification for Aluminum & Aluminum-Alloy Drawn Seamless Tubes
ASTM B-221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B-308	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B-429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
National Association of Architectural Metal Manufacturers (NAAMM)	
	Metal Bar Grating Manual, latest edition
Aluminum Association	
	Aluminum Construction Manual, latest edition
Miscellaneous	
	AWS "Structural Welding Code"
	Florida Building Code

- B. ***Obtain each type of material (grating, plates, checkered plate) through one source from a single manufacturer.***
- C. Welding, if required depending on the type of handrail identified in this specification section, shall be in accordance with AWS "Standard Qualification Procedure".
- D. ***The Contractor shall verify all dimensions for grating, plates, checkered plate, etc. by field measurements prior to preparation of shop drawings and fabrication.*** Coordinate the fabrication schedule with the construction progress to avoid delaying the Work. Where field dimensions cannot be made without delaying the Work, establish dimensions and proceed with fabricating said materials without field measurements. Coordinate construction to ensure that the actual dimensions correspond to the established dimensions.

1.03 Submittals

- A. ***Submit shop drawings*** for review in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP

Supplementary Conditions” and Section 01300, “Shop Drawings, Submittals and Samples”.

- B. Submit drawings of fabricated items, such as grating, access covers, cover plates, etc. Show dimensions and reference the materials of construction by ASTM designation and grade. The Contractor shall also show the design criteria.
- C. Submit **structural calculations for the design of the supporting system for all grating, plates and materials** identified in this specification section.
- D. Submit **complete fabrication, placing and erection drawings showing the locations of all fabricated items**. Reproductions of the Contract Documents will not be accepted for this purpose.
- E. **All shop drawings and structural calculations shall bear the signature and seal of a Professional Engineer registered in the State of Florida.**
- F. Fabrication shall not begin until the Engineer’s review is complete and the shop drawings have been approved.

1.04 Design Criteria

- A. Aluminum grating, floor plates and miscellaneous cover plate systems shall be designed for a **live load of one hundred-fifty pounds per square foot (150 psf) of gross projected area** with a deflection **not to exceed $\frac{1}{360}$ of the span**.

2. PRODUCTS

2.01 Aluminum Gratings, Floor Plates, Frames and Miscellaneous Cover Plates

- A. **All bar grating, frames and miscellaneous cover plates shall be aluminum**, unless otherwise indicated on the Contract Drawings. Provide attachment anchors, bearing frames, saddle clips, and all other necessary fastening devices subject to the approval of the Engineer. The design criteria for the grating, frames and plates is detailed in Article 1.04(A) of this specification section.
- B. Provide fastening devices for all gratings adjacent to removable sections and at all locations where the lateral movement of gratings is not otherwise restrained. Sections of grating designated to be removable shall not be fastened.
- C. No single piece of grating, floor plate, etc., **shall weigh more than eighty (80) pounds**.

- D. The length of individual pieces **shall not exceed 1.5 times the width**, unless limited by the installation, and approved by the Engineer.
- E. Field measure grating and cover plates for proper cutouts and sizes.
- F. Configuration

- Grating shall be pressure locked aluminum having "I" shaped bearing bars spaced at $1\frac{3}{16}$ -inch centers with swage-locked crossbars at four (4) inches on center. The grating shall be banded on all sides and at all openings for piping and conduits. Unless otherwise indicated on the Contract Drawings, the size of bearing bars shall be as follows:

Maximum Clear Span	I-Bar Size	Rectangular Bar Size	¼" Thick Frame Angle Size	
			Vertical Leg	Horizontal Leg
3' - 6"	1¼" x ¼"	1 ¼" x ⅜"	1½"	2"
5' - 0"	1¾" x ¼"	1-¾" x ⅜"	2"	2½"
6' - 6"	2¼" x ¼"	2 ¼" x ⅜"	2½"	3"
7' - 0"	2½" x ¼"	2½" x ⅜"	2¾"	3"

- All grating surfaces shall be of the "slip-resistant" serrated type.**
- The minimum width of individual grating pieces shall be fifteen (15) inches, except for locations requiring a single piece and for designated removable sections.

G. Extruded Aluminum Grating

- In lieu of aluminum bar grating, extruded aluminum grating of the interlocking type may be used, if approved by the Engineer. Extruded grating shall be manufactured from 6063-T6 aluminum alloy and assembled into three (3) foot wide sections. The depth of extruded aluminum grating shall be as follows:

Maximum Clear Span	Grating Depth	Frame Angle Size
2' - 6"	¾"	1"
4' - 0"	1 ¼"	1½"
5' - 6"	1¾"	2"
7' - 0"	2 ¼"	2½"

H. Materials

1. Bearing bars shall be of extruded aluminum meeting all requirements of ASTM B-221-76, Alloy 6061-T6 or 6063-T6. Cross bars shall be drawn or extruded aluminum meeting all requirements of ASTM B-210-76 or B-221-76.
2. The frames and supports of gratings shall be aluminum alloy 6061-T6, 6063-T6, or Type 316 stainless steel with a mill finish. Unless otherwise indicated on the Contract Drawings, frames and supports shall be ¼-inch thick with 1-inch by ¼-inch by eight (8) inch long bent bars welded to the frame at eighteen (18) inch centers for embedment in concrete. Corners of embedded angle frames shall be mitered and welded with the welds ground smooth.
3. Fabrication shall meet all of the requirements of the NAAMM Metal Bar Grating Manual. The finish shall be mill finish.
4. Welding Electrodes
 - a. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 Series.
 - b. Welding electrodes for aluminum shall be ER4043 filler metal.
 - c. Welding electrodes for stainless steel shall conform to AWS A5.4. Use Electrodes E-308 for Type 304 stainless steel and E316 for Type 316 stainless steel.
- I. Aluminum in contact with concrete or dissimilar metals shall be protected as indicated in Article 3.04(B) of this specification section.

2.02 Aluminum Sheet

- A. Aluminum Sheet shall conform to ASTM B-209, Alloy 3003, H-14 temper.

2.03 Aluminum Shapes

- A. Aluminum shapes shall be as indicated on the Contract Drawings and as detailed in Section 3 of the Aluminum Construction Manual.
- B. All aluminum shapes shall meet the requirements of ASTM B-209 or B-308 for Alloy 6061-T6.

2.04 Aluminum Fastenings

- A. Aluminum fasteners shall not be permitted.
- B. **All connections of aluminum to aluminum shall be Type 316 stainless steel** as required under Article 2.09, "Stainless Steel Fastenings", of this Specification Section.

2.05 Access Hatches

- A. **Access hatches shall be anodized aluminum** and shall be of the size and configuration shown on the Contract Drawings. The Contractor shall also refer to Section 08350, Aluminum Access Hatch Doors".
- B. Latch and lifting mechanism assemblies, hold-open arms and guides, and all brackets, hinges, pins and fasteners shall be Type 316 stainless steel, zinc plated and chromate sealed.
- C. Locking and Latching Devices (Type supplied must be approved by Engineer)
 - 1. Lugs welded to the exterior door surface to receive a padlock.
 - 2. A hinged hasp on the exterior door surface.
 - 3. A recessed hasp covered by a hinged lid flush with the exterior surface.
 - 4. Cylinder lock with keyway protected by a threaded cover plug.
 - 5. Snap lock with a removable handle.

2.06 Aluminum Checkered Cover Plates

- A. All checkered plates shall be aluminum, mill finish, and designed for a **live load of 150 pounds per square foot of the gross projected area and a 250 pound concentrated load**, with the limits for deflections as specified in Federal Specification RR-G-6610.
- B. **All checkered plates shall be fabricated of aluminum and shall have a minimum thickness of 3/8-inch, standard pattern "non-slip"** plates of the sizes and shapes shown on the Contract Drawings. Stiffener angles (aluminum) shall be provided as required to meet the superimposed live load requirements specified above. Stiffeners, if utilized, shall be concealed. All checkered plate sections shall be cut to

the dimensions shown on the Contract Drawings. Flush type lifting handles shall be provided for each plate, unless otherwise noted on the Contract Drawings.

- C. Aluminum checkered plate shall be 6063-T6 alloy aluminum. Raised lugs shall be diamond shaped and have an angled and opposed pattern.
- D. Provide U-bolt lifting handles located on opposite ends on each removable section. Steel plates, including angle edgings, support angles, and lifting handles shall be Type 316 stainless steel.

2.07 Stainless Steel Shapes

- A. Stainless steel members supporting aluminum grating or members embedded in concrete shall be stainless steel plate AISI, Type 316, formed as indicated.
- B. Anchor straps shall be stainless steel shop welded to the stainless steel shapes.

2.08 Stainless Steel Plate and Members

- A. Except where otherwise noted, stainless steel plate and members shall be Type 316 or 316L and shall be in accordance with ASTM A-240 or ASTM A-666.

2.09 Stainless Steel Fastenings

- A. Connections of stainless steel to aluminum or concrete shall be stainless steel bolts of AISI Type 316. Nuts shall be AISI Type 430 stainless steel.

2.10 Steel Gratings and Frames - NOT USED

2.11 Checkered Floor Plate

- A. ***Checkered floor plate shall be fabricated of aluminum or Type 316 stainless steel (as noted on the Contract Drawings) and shall have a non-skid surface pattern approved by the Engineer and shall have a minimum thickness of 3/8-inch.***

- B. Plates shall be of such strength and size necessary to carry superimposed vehicular or pedestrian loads. Unless otherwise indicated, ***minimum pedestrian live load capacity shall be 150 psf and a 250 pound concentrated load.***
- C. ***Deflection under load shall not exceed $1/360$.*** Stiffeners, if utilized, shall be concealed.

3. EXECUTION

3.01 Storage of Materials

- A. Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports.
- B. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 Installation and Erection

- A. ***Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.***
- B. ***Set grating seats and frames and checkered plate frames and supports accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete.*** Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03300, "Cast-in-Place Concrete".
- C. Set seat angles for grating so that the grating will be flush with the floor. Maintain the grating and floor plates flush with the floor. Seat angles and anchors shall be stainless steel or aluminum, unless otherwise indicated in the drawings.

3.03 Welding

- A. Perform welding on steel by the shielded metal arc welding (SMAW) process. Welding shall conform to the AWS Structural Welding Code-Steel, D1.1-88, except as modified in AISC Section J2.

- B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to the AWS Structural Welding Code-Aluminum, D1.2-90.
- C. Perform welding on stainless steel by the gas tungsten arc (TIG) process. All welds shall be full penetration and smooth. Provide inert gas on the inside of pipe during welding to reduce oxidation.
- D. Provide a minimum of two (2) passes for metal in excess of $\frac{5}{16}$ -inch thickness.
- E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, non-uniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in a manner that will not gouge, groove, or reduce the base metal thickness.

3.04 Corrosion Protection of Aluminum Surfaces

- A. Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry per Section 09900, "Painting", before installation.
- B. 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 separated using not less than one (1) coat of zinc chromate primer and one (1) heavy coat of aluminum pigmented asphalt paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, or neoprene shall be used.
- C. ***Finished works shall be cleaned and excess cement removed.***
- D. All work shall be adequately anchored in place at proper elevations, planes and locations. Allow the coating to dry before the aluminum is placed in contact with the concrete.
- E. ***Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets.***

END OF SECTION

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SECTION 05570

MISCELLANEOUS METAL ASSEMBLIES

1. GENERAL

1.01 Description

A. Scope of Work

1. This Section includes providing all labor, materials and equipment to install miscellaneous metals, shapes and sheets, fittings, plates, lintels, angles, fasteners, wirework, Contractor fabricated pipe and equipment supports, frames, manual barscreens, stop plates, truck guards, etc., not specified elsewhere in these specifications.

B. Related Work Specified Elsewhere

Specification Section	Title
01300	Shop Drawings, Submittals and Samples
03300	Cast-in-Place Concrete
03600	Grout
05025	Metal Materials, Methods, and Fastenings
05120	Structural Steel
05140	Structural Aluminum
05500	Metal Fabrications
05510	Metal Stairs and Walkways
05520	Handrails and Accessories
05530	Grating, Plates and Frames
09900	Painting
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
Steel Structures Painting Council (SSPC)	
	Surface Preparation Specifications
American Society for Testing and Materials (ASTM)	
ASTM A-36	Standard Specification for Structural Steel
ASTM A-53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A-123	Standard Specification for Zinc (Hot-Dipped Galv'd) Coatings on Iron and Steel Products
ASTM A-167	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A-193	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A-194	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A-500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A-501	Std Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM B-209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B-221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B-241	Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B-308	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
American Welding Society (AWS)	
AWS A5.1	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1	Structural Welding Code - Steel
Other Standards and Building Codes	
	OSHA Standards
	AISC Specifications for the Design, Fabrication & Erection of Structural Steel for Bldgs
	Aluminum Construction Manual, latest edition, by the Aluminum Association
	Florida Building Code

1.03 Submittals

- A. **Submit shop drawings** for review in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples".
- B. Submit drawings of fabricated miscellaneous metal assemblies/items and show, at a minimum, the following:
 - 1. Assembly dimensions, sizes of members, method of assembly, anchorage, and connection to other members.
 - 2. Reference the materials of construction by ASTM designation and grade.
 - 3. Assembly design criteria.
- C. **The Contractor shall submit complete fabrication, placing and erection drawings** showing the locations of all fabricated items. Reproductions of the Contract Documents will not be accepted for this purpose.
- D. **All shop drawings and structural calculations shall bear the signature and seal of a Professional Engineer registered in the State of Florida.**
- E. Fabrication shall not begin until the Engineer's review is complete and the shop drawings have been approved.

1.04 Coordination and Scheduling

- 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 specified herein.
- B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.
- C. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry, as necessary for the miscellaneous metal assemblies.
- D. Do not support temporarily by any means that does not satisfy structural performance requirements.

1.05 Delivery, Storage and Handling

- A. Deliver packaged materials to the site in the manufacturer's original, unopened containers. Deliver materials to the site at such time intervals to insure uninterrupted progress of the Work.
- B. Deliver anchor bolts and other anchorage devices which are to be embedded in cast-in-place concrete or masonry, in sufficient time to permit their timely installation. Provide proper setting drawings, templates and directions for installation of these items.
- C. Store materials to permit easy access for inspection and identification. ***Store miscellaneous metal assemblies, either plain or fabricated, above ground on platforms, skids, or other supports in a well ventilated, weather-tight place.***
- D. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
- E. Do not store materials on the structure in a manner that may cause distortion, damage, or overload to members or supporting structures.
- F. Store all fasteners and welding electrodes in a weather-tight and dry place until ready for use.
- G. Keep the material free from dirt, grease, and other foreign matter and protect from corrosion.
- H. Store packaged materials in their original containers. ***Stacking shall be done in a way which will prevent bending or damage to the materials or their finishes.***
- I. Repair or replace damaged materials or structures as directed.

2. PRODUCTS

2.01 Structural Steel

- A. Miscellaneous steel plates, shapes, bars, etc., and connections shall conform to the requirements of ASTM Designation A-36 and shall be galvanized by the hot dip method after fabrication in accordance with ASTM Designation A-123.
- B. The Contractor shall refer to the requirements of Section 05120, "Structural Steel".

2.02 Steel Pipe

- A. Steel pipe used for miscellaneous members and connections shall conform to the requirements of ASTM Designation A-53, Schedule 40, galvanized, except as noted.

2.03 Hot-Dip Galvanizing (Zinc Coatings)

- A. Hot dip galvanizing or zinc coatings applied on products fabricated from rolled, pressed or forged steel shapes, plates, bars and strips shall comply with ASTM A-123. The weight of coatings shall be designated in the ASTM Standard for the class and thickness of material to be coated.
- B. Galvanized surfaces for which a shop coat of paint is specified shall be chemically treated to provide a bond for the paint.
- C. Except for bolts and nuts, all galvanizing shall be done after fabrication.

2.04 Stainless Steel

- A. Except where otherwise specified, use Type 316, ASTM A-167 stainless steel plate, members and washers.
- B. Use ASTM A-193, Grade B8M bolts and ASTM A-194, Grade 8M nuts.

2.05 Structural Aluminum

- A. The Contractor shall refer to the requirements of Section 05140, "Structural Aluminum".
- B. Aluminum Structural members shall conform to ASTM B-308, Alloy 6063-T6.
- C. Aluminum bars and rods shall conform to ASTM B-221, Alloy 6063-T6.
- D. Miscellaneous structural aluminum shapes and plates shall conform to ASTM B-241, Alloy 6063-T6.
- E. Aluminum sheet shall conform to ASTM B-209, Alloy 3003, H 14 temper.
- F. Aluminum seamless pipe and tubing shall conform to ASTM B-241, Alloy 6063-T6. Wall thickness shall be Schedule 80, per ANSI H35.2, unless otherwise shown on the Drawings.

2.06 Welding Electrodes

- A. Welding electrodes for structural steel shall conform to AWS A5.5, E70XX. Use 4043 filler metal for aluminum.
- B. Use a type E308 electrode where the base metal is Type 304 stainless steel and type E309 where the base metal is Type 316 stainless steel or when stainless steel is welded to carbon steel.
- C. Field welding of galvanized steel shall not be acceptable.

2.07 Materials, Fabrication, and Connections

- A. Materials, fabrication, shop coatings, and fasteners and connections shall comply with Section 05025, "Metal Materials, Methods and Fastening".
- B. Bolts for securing equipment, above grade piping and aluminum structures shall be stainless steel.
- C. Anchor Bolts and Fasteners
 - 1. Anchor bolts securing equipment or any assemblies subject to vibrations or movements, shall be stainless steel hook anchors conforming to ANSI 316 and ASTM A-193, Grade B8M, unless otherwise noted. Hook anchors shall be to the farthestmost layer of reinforcing.
 - 2. The minimum length protruding from the face of the concrete shall be six (6) inches and the minimum length of the hook shall be six (6) inches. All dimensions and sizes of anchor bolt shall comply with the manufacturer's recommendations.
 - 3. Anchor bolts and fasteners not securing equipment or assemblies subject to vibrations or movements, shall be stainless steel wedge or adhesive anchors conforming to ANSI 316 and ASTM A-193, Grade B8M, unless otherwise noted. Wedge anchors shall be as manufactured by "HILTI" or approved equal. Adhesive anchors shall consist of a self-contained vinylester adhesive cartridge and anchor rods. Adhesive anchors shall be AVA adhesive anchoring system as manufactured by "HILTI", or approved equal.
 - 4. Where steel anchors are indicated, use a one-piece design with expander ring consisting of steel zinc coated and chrome plated as manufactured by McCullough Industries, Kwik Bolt, or equal.

2.08 Caged Ladder - NOT USED**2.09 Aluminum Stairs**

- A. The Contractor shall refer to Specification Section 05510, "Metal Stairs and Walkways".

2.10 Aluminum Stair Treads and Nosings

- A. The Contractor shall refer to Specification Section 05510, "Metal Stairs and Walkways".

2.11 Castings - NOT USED**2.12 Lintels, Plates, and Miscellaneous Angles**

- A. Provide lintels, plates, and miscellaneous angles as indicated on the Contract Drawings or required.
- B. Lintels shall have a minimum eight (8) inch bearing at each end unless otherwise indicated. Weld or bolt members together to form a complete assembly.
- C. Install plates and angles as indicated on the Contract Drawings. Where bolts and straps are shown, attached to plates, angles, and lintels, provide a 1¾-inch diameter by fifteen (15) inch long anchor bolt or 2¼-inch by one (1) inch by eight (8) inch long strap anchor at each end, unless otherwise indicated on the Contract Drawings.
- D. Properly embed fasteners into concrete or masonry.

2.13 Equipment Supports

- A. Provide equipment supports as indicated on the Contract Drawings or required to support and anchor mechanical equipment, including roof-mounted items.
- B. The Contractor shall **verify with the equipment manufacturer** that the supports are ample for the equipment being supported.
- C. **A certification letter from the equipment supplier and Contractor shall be submitted** to the Engineer during the shop drawing review process.

2.14 Fabricated Frames

- A. Provide fabricated frames for openings in floors and walls as indicated on the Contract Drawings. Construct frames of channels, angles, and flat or bent plates or combinations of shapes and materials as detailed using non-corrosive materials for the environment in which they are to be constructed.
- B. Frames shall be accurately squared, mitered, butted, or coped as necessary, shall be fully welded, and all welds on exposed surfaces shall be ground smooth.
- C. Weld straps or anchors of sizes and spacing indicated to the back of frames for anchoring into concrete or masonry. Where size and spacing of anchors are not indicated, use 1/4-inch x 2" x 8" straps with ends hooked two (2) inches, and space the straps not more than eighteen (18) inches apart.
- D. Frames shall be aligned and accurately leveled to finish flush with adjacent surfaces.

2.15 Pit and Trench Covers and Frames

- A. Provide frames and non-skid plate covers where indicated on the Contract Drawings. Unless otherwise indicated, provide one (1) inch x eight (8) inch long bent bar anchors, welded to frames and spaced not more than eighteen (18) inches on center.
- B. Frames shall be aligned and accurately leveled to finish flush with adjacent surfaces. Covers shall be in sections not more than four feet long and shall abut adjacent cover leaving no discernable gaps. The covers shall have a minimum thickness of 3/8-inch.
- C. Provide hinges and suitable lift-holes near the ends of each section of cover.
- D. ***Provide H-20 loading covers where indicated*** on the Contract Documents.
- E. ***The Contractor is responsible for providing the design and structural support for all frames and covers.***

2.16 Bollards (Truck Guards)

- A. Provide truck guards (bollards) and covers where indicated on the Contract Drawings. ***The bollards shall be 7-inch (galvanized) standard weight steel pipe*** as specified in ASTM A-53.
- B. Anchor posts in concrete as indicated and fill solidly with Class B (3,000 psi) concrete conforming to Section 03300, "Cast-in-Place Concrete".

C. Bollard Covers

1. ***The bollard cover (post sleeve) shall be of the blow molded type, constructed from 1/8-inch thick High Density Polyethylene (HDPE) for weather resistant durability and long service life.***
2. ***The bollard covers shall have a bright "safety yellow" color with UV stabilizers for protection from the sun and dual 3M "red" reflective-tape bands shall be integrally provided for enhanced visibility for day and night protection.***
3. The bollard covers shall be as manufactured by Thermoprene, Inc., or approved equal.

2.17 Stainless Steel Safety Chains

- A. Safety chains shall be fabricated from ***Type 316 stainless steel, proof coil style, 3/16-inch diameter, with a minimum of twelve (12) links per foot***, and with snap hooks on each end and installed where indicated on the Contract Drawings.
- B. Snap hooks shall be boat type and eye bolts for attachment of chains shall be fabricated of Type 316 stainless steel 3/8-inch bolt with 3/4-inch eye diameter, anchored as indicated.
- C. Two (2) chains, four (4) inches longer than the anchorage spacing, shall be supplied for each guarded area and shall be mounted 3.5 feet and 2.0 feet above the floor.

2.18 Manual Barscreen - NOT USED

2.19 Drain Trays - NOT USED

2.20 Catch Basin Grating - NOT USED

2.21 Guard Rails - NOT USED

2.22 Stop Plates and Grooves

- A. Stop Plates for weirs and baffles shall be fabricated from $\frac{3}{8}$ -inch minimum aluminum alloy 6061-T6 or 6063-T6 or fiberglass, as indicated on the Contract Drawings. Corners shall be rounded approximately $\frac{1}{8}$ -inch radius for smooth sliding.
- B. Stop Plate Grooves for weirs and baffles shall be extruded aluminum alloys 6061-T6 or 6063-T6 as indicated on the Contract Drawings. Grooves shall be one piece, have integral concrete anchors and welded miter corners, and be designed for the thickness of stop plates plus $\frac{1}{8}$ -inch. Grooves shall be as manufactured by Washington Aluminum Co., Baltimore, MD; Neenah Foundry Co., Neenah, WI; or equal. All aluminum in contact with or embedded in concrete shall be protected in accordance with the AA Specification.
- C. Aluminum Angles shall be attached in pairs to form grooves on the face of existing concrete. Use 2-inch by 2-inch by $\frac{3}{8}$ -inch angles and expansion anchors, unless otherwise indicated on the Contract Drawings. Protect all aluminum in contact with dissimilar materials in accordance with AA recommendations.

3. EXECUTION

3.01 Installation

A. General

- 1. Insofar as possible, fabricated material shall be fitted and shop assembled ready for erection.
- 2. Welding and equipment shall conform to the American Welding Society's (AWS) Code for Welding in Building Construction, latest edition.
- 3. All work shall be square, plumb and true, accurately fitted with tight joints and intersections. Exposed work shall be finished smooth with welds ground smooth.

B. Fabrication and Erection

- 1. Fabricate miscellaneous metal items to straight lines and true curves. ***Drilling and punching shall not leave "burrs" or "deformations"***. Continuously weld permanent connections along the entire area of contact. Exposed work shall have a smooth finish with welds ground smooth.

2. **Joints shall have a close fit** with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded. All bolt holes shall be $\frac{1}{16}$ -inch in diameter larger than bolt size.
3. Measure cast-in-place bolt locations in the field before drilling companion holes in structural steel beam or assembly.
4. Clean the surfaces of metalwork to be in contact with concrete of any rust, dirt, grease, and other foreign substances before placing concrete.
5. Set embedded metalwork accurately in position when concrete is placed and supported rigidly to prevent displacement or undue vibration during or after the placement of concrete.
6. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with grout in conformance with Section 03600, "Grout".

C. Welding

1. Welding on steel shall be performed by the Shielded Metal Arc Welding (SMAW) process. Welding procedures shall comply with AWS B3.0.
2. Welding on aluminum shall be performed by the Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) process, per the AWS Welding Handbook.
3. Provide a minimum of two (2) passes for metal of $\frac{3}{16}$ -inch thickness plus one (1) additional pass for each additional $\frac{1}{8}$ -inch in metal thickness.
4. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal.
5. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size.
6. Accomplish repair, chipping, and grinding of welds in a manner that will not gouge, groove, or reduce the base metal thickness.

D. Anchor Bolts and Anchors

1. Preset bolts and anchors by the use of templates. Do not use concrete anchors set in holes drilled in the concrete after the concrete is placed in place of cast-in-place anchor bolts.
2. After anchor bolts have been embedded, protect their threads by applying grease and by having the nuts screwed on until the time of installation of the equipment or metalwork.

E. Control of Flame Cutting

1. Do not use flame cutting by the use of a gas-cutting torch in the field for correcting fabrication errors on any member in structural framing.
2. Use a flame-cutting torch only on minor members when the member is not under stress.

F. Repair of Galvanized Surfaces

1. ***The Contractor shall repair or replace all metal with damaged galvanized surfaces at no additional cost to the Owner.***
2. The repair of galvanized surfaces shall be affected by use of the following, or equal, applied in accordance with the manufacturer's instructions:
 - a. DRYGALV as manufactured by the American Solder and Flux Company.
 - b. Cold Galvanizing Repair Compound as manufactured by Rust-O-leum.

G. Painting and Protective Coating

1. All ferrous metal, except stainless steel and galvanized surfaces, shall be properly cleaned and given one shop coat of the fabricator's standard primer (compatible with the metal being used).
2. Anchors that are built into masonry shall be coated with asphalt paint unless specified to be galvanized.
3. Metal work to be encased in concrete shall be left unpainted unless specified or noted otherwise.

4. Where hot-dip galvanized or zinc coated metal is specified or shown, it shall be shop primed unless specifically not required.
5. Castings that are to be left unpainted shall be cleaned and coated with a coal-tar-pitch varnish.
6. Aluminum to be placed adjacent to masonry or dissimilar metals shall be protected with an isolating coating of bitumastic and/or felt.
7. The Contractor is referred to Section 09900, "Painting", for any additional painting and/or protective coating requirements.

H. Dissimilar Metal Contact

1. 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 separated using not less than one (1) coat of zinc chromate primer and one (1) heavy coat of aluminum pigmented asphalt paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, shall be used.
2. ***Finished works shall be cleaned and excess cement removed.***
3. All work shall be adequately anchored in place at proper elevations, planes and locations.

I. Installing Pipe Bollards

1. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into the sleeves, fill the annular space between the bollard and sleeve solidly with non-shrink, non-metallic grout, mixed and placed to comply with the grout manufacturer's directions.
2. ***Fill bollards solidly with concrete, mounding the top surface.***
3. ***Clean the exterior of the bollards of all concrete spoils, debris and other materials. Install the pipe bollard covers in accordance with the manufacturers instructions.***

- J. ***Clean all miscellaneous metal assemblies and remove any markings by washing them thoroughly with clean water and soap and rinsing with clean water.*** Do not use an acid solution, steel wool or other harsh abrasives. If any staining remains after washing, the piece shall be removed and replaced at no additional cost to the Owner.

- K. *Remove stained or otherwise defective work and replace with material that meets the specification requirements, at no additional cost to the Owner.*

END OF SECTION

SECTION 05810

EXPANSION JOINT COVER ASSEMBLIES

1. GENERAL

1.01 Description

A. Scope of Work

1. This Section includes the following:
 - a. Floor expansion joint cover assemblies.
 - b. Wall expansion joint cover assemblies.

B. Related Work Specified Elsewhere

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
Division	Description
1	General Requirements
7	Thermal and Moisture Protection
Contract Drawings and General Provisions of the Contract	

1.02 Submittals

- A. Submit the following information in accordance with the Conditions of the Contract and Section 01300, "Shop Drawings, Submittals and Samples".
- B. Product data for each type of expansion joint cover assembly specified, including the manufacturer's product specifications, installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

- C. Shop drawings showing fabrication and installation of expansion joint cover assemblies including plans, elevations, sections, details of components, joints, splices, and attachments to other units of Work.
- D. Samples for initial selection purposes in the form of the manufacturer's color charts, actual units, or sections of units showing the full range of colors, textures, and patterns available for each exposed metal and elastomeric material of expansion joint cover assembly indicated.
- E. Samples for verification purposes in full-size units of each type of expansion joint cover assembly indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
 - 1. Install elastomeric material for joints samples to verify color selected.

1.03 Quality Assurance

- A. Obtain expansion joint cover assemblies specified in this Section from one source from a single manufacturer. Coordinate compatibility with expansion joint cover assemblies specified in other sections.
- B. Where indicated, provide expansion joint cover assemblies identical to those assemblies whose fire resistance has been determined per ANSI/UL 263, NFPA 251, U.B.C. 43-I, or ASTM E 119, including hose stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Not less than the rating of adjacent construction.

C. Standards

- 1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American National Standards Institute (ANSI)	
ANSI/UL 263	Fire Resistance Ratings
ASTM B-209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B-221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E-119	Standard Test Methods for Fire Tests of Building Construction and Materials

STANDARD	DESCRIPTION
American National Standards Institute (ANSI) - Cont'd	
ASTM E-1399	Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
Occupational Safety and Health Administration (OSHA)	
	OSHA Standards, latest edition
Miscellaneous	
NFPA 251	Standard Methods of Tests of Fire Endurance of Building Construction and Materials, Latest Edition
	Florida Building Code

1.04 Product Delivery, Storage and Handling

- A. Do not deliver the materials until required in the general sequence of construction for the Project. Deliver the materials in the manufacturer's unopened containers or bundles fully identified with name, brand, type, and grade.
- B. ***Store all materials off of the ground, inside a dry ventilated space, and in a manner acceptable to the manufacturer.*** If any of the materials are damaged, they shall not be used in the construction and shall be replaced at no additional cost to the Owner.

2. PRODUCTS

2.01 Manufacturers

- A. Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the products by the following manufacturers:
 - 1. Balco
 - 2. Larson
 - 3. Conspec
 - 4. MM
 - 5. Erie
 - 6. Nystrom
 - 7. Or approved equal

2.02 Materials

A. Aluminum

1. Aluminum Extrusions: ASTM B-221 (ASTM B-221M), Alloy 6063-T5
2. Aluminum Sheet and Plate: ASTM B-209 (ASTM B 209M), Alloy 6061-T6
3. ***Protect aluminum surfaces to be placed in contact with cementitious materials*** with a protective coating as recommended by the manufacturer.

B. Fire Barriers

1. Designed for indicated or required dynamic structural movement without material degradation or fatigue when tested according to ASTM E-1399.
2. Tested in maximum joint width condition with a field splice as a component of an expansion joint cover per ANSI/UL 263, NFPA 251, U.B.C. 43-1, or ASTM E-119, including hose stream test of vertical wall assemblies by a nationally recognized testing and inspecting agency acceptable to authorities having jurisdiction.

C. Accessories

1. Manufacturer's standard anchors, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesive, and other accessories compatible with materials in contact, as indicated or required for complete installations.

2.03 Expansion Joint Cover Assemblies

A. General

1. Provide expansion joint cover assemblies of the design, basic profile, materials, and operation indicated.
2. Provide units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and dynamic structural movement without material degradation or fatigue when tested according to ASTM E-1399.
3. Provide hairline mitered corners where joint changes directions or abuts other materials. Include closure materials and transition pieces, tee-joints, corners, curbs, cross connections, and other accessories as required to provide continuous joint cover assemblies.

4. Furnish units in longest practicable lengths to minimize number of end joints.

B. Metal Floor-to-Floor Joint Cover Assemblies

1. Provide continuous extruded metal frames of the profile indicated with seating surface and raised floor rim or exposed trim strip to accommodate flooring and concealed bolt and anchors embedded in concrete.
2. Provide assemblies formed to receive cover plates of the design indicated and to receive filler materials, if any, between raised rim of frame and edge of plate.
3. Furnish the depth and configuration to suit type of construction and to produce a continuous flush wearing surface with adjoining finish floor surface.

4. Fixed Cover Plates

- a. Attach one side of the cover plate to a frame or finished wearing surface, with the other side resting on the other frame or finished wearing surface to allow free movement.

C. Floor-to-Wall Joints

1. Provide one frame on the floor side of the joint only. Provide a wall side frame where required by the manufacturer's design.
2. Angle Cover Plates
 - a. Attach angle cover plates for floor-to-wall joints to the wall with countersunk, flat-head exposed fasteners secured to drilled-in-place anchor shields, unless otherwise indicated, at spacing recommended by joint cover manufacturer.

D. Wall, Ceiling, and Soffit Joint Cover Assemblies

1. Provide interior wall and ceiling expansion joint cover assemblies of the same design and appearance. Provide exterior wall and soffit expansion joint cover assemblies of same design and appearance. Provide wall expansion joint cover assemblies compatible with the floor expansion joint cover assemblies design and appearance.
2. Fixed Metal Cover Plates
 - a. Provide a concealed, continuously anchored frame fastened to the wall, ceiling, or soffit only on one side of the joint.

- b. Extend cover to lap each side of the joint and to permit free movement on one side.
- c. Attach cover to frame with cover in close contact with adjacent finish surfaces.

2.04 Metal Finishes

- A. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated.
- B. ***Apply finishes to products in the factory after fabrication. Protect finishes on exposed surfaces before shipment.***
- C. Aluminum Finishes
 - 1. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

3. EXECUTION

3.01 Preparation

- A. In addition to the requirements of these specifications, comply with the manufacturer's instructions and recommendations for phases of Work, including preparing substrate, applying materials, and protecting installed units.
- B. Coordinate and furnish anchorages, setting drawings, templates, and instructions for installation of expansion joint cover assemblies to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slabs for later placement and grouting-in of frames.
- C. Fastening to In-Place Construction
 - 1. Provide anchorage devices and fasteners where necessary to secure expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete.

2. Provide fasteners of metal, type, and size to suit the type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

3.02 Installation

- A. Perform cutting, drilling, and fitting required to install expansion joint covers. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling. Set floor covers at elevations to be flush with adjacent finished floor materials. Locate wall, ceiling, roof, and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories. Locate anchors at interval recommended by the manufacturer, but not less than three (3) inches (75 mm) from each end and not more than twenty-four (24) inches (600 mm) on center.
- B. Maintain continuity of expansion joint cover assemblies with a minimum number of end joints and align metal members mechanically using splice joints. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by the manufacturer.
- C. Install fire barriers, including transitions and end joints, according to the manufacturer's instructions so that fire-rated construction is continuous.

3.03 Cleaning and Protection

- A. Do not remove protective covering until finish work in adjacent areas is complete.
- B. When the protective covering is removed, clean exposed metal surfaces to comply with the manufacturer's instructions.

END OF SECTION

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SANFORD MAIN WTP IMPROVEMENTS

SANFORD, FLORIDA



DIVISION 6

WOOD AND PLASTICS

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DIVISION 6

WOOD AND PLASTICS

Specification Section	<u>Title</u>
06100	Rough Carpentry
06200	Finish Carpentry
06600	Fabricated Fiberglass Reinforced Plastic (FRP) Products
06605	Fiberglass Reinforced Plastic (FRP) Grating
06700	Chemical Storage Tanks (HDLPE)

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SECTION 06100

ROUGH CARPENTRY

1. GENERAL

1.01 Description

- A. Furnish all labor, materials, equipment and services necessary for and incidental to the completion of all rough carpentry throughout the entire Project, as shown on the Contract Drawings, as called for in these specifications, and reasonably inferable as being necessary to complete installation, including laminated wood members, wood blocking, roof mounted curbs, mounting boards, framing with engineered metal or wood products, blocking, cants, and nailers, utility shelving, wood furring and grounds, sheathing, and plywood backing panels, temporary closures, rough hardware, anchors and bolts, not specifically included elsewhere.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
03100	Concrete Formwork
04250	Masonry Building Insulation
06200	Finish Carpentry
07600	Flashing and Sheet Metal
09900	Painting
Contract Drawings and General Provisions of the Contract	

1.02 Definitions

- A. Rough Carpentry: *Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.*

- B. Exposed Framing: *Dimension lumber or metal studs and framing not concealed by other construction.*
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

Abbreviation	Title
NELMA	Northeastern Lumber Manufacturers Association
NLGA	National Lumber Grades Authority
RIS	Redwood Inspection Service
SPIB	Southern Pine Inspection Bureau
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

1.03 Quality Assurance

A. Fit Carpentry to Other Work

1. Scribe and cope as required for accurate fit, correlate location of furring, nailing, blocking, grounds and similar supports to allow proper attachment of other Work.

- B. Factory-mark each piece of lumber and plywood to identify the type, grade, agency providing the inspection service, the producing mill and other qualities as specified herein.

C. Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Lumber Standards (ALS)	
PS 20-70	American Lumber Standards' Product Standard
U.S. Department of Commerce (DOC)	
PS 1	Structural Plywood

STANDARD	DESCRIPTION
U.S. Department of Commerce (DOC) - Continued	
PS 20	"American Softwood Lumber Standard"
PS 20	"National Grading Rule for Dimension Lumber" of the American Lumber Standards Committee"
PS 166	"Softwood Plywood/Construction and Industrial"
American Wood Protection Association (AWPA)	
AWPA LP2	Quality Control and Inspection Procedures for Softwood Lumber and Timber
AWPA C20	Structural Lumber - Fire Retardant Treatment by Pressure Processes
AWPA U1	Use Category System: User Specification for Treated Wood
Underwriters Laboratory (UL)	
UL Test 273	Test for Surface Burning Characteristics of Building Materials
American Society for Testing and Materials (ASTM)	
ASTM A-153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A-307	Standard Specification for Carbon Steel Bolts & Studs, 60 000 psi Tensile Strength
ASTM A-563	Standard Specification for Carbon and Alloy Steel Nuts
ASTM B-633	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C-954	Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM D-226	Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D-5516	Standard Test Method for Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to Elevated Temperatures
ASTM D-5664	Standard Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber
ASTM E-84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E-488	Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F-568	Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners
ASTM F-593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F-594	Standard Specification for Stainless Steel Nuts
ASTM F-738	Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs
ASTM F-836	Standard Specification for Style 1 Stainless Steel Metric Nut
ASTM F-1667	Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

STANDARD	DESCRIPTION
National Forest Products Association (NFPA)	
	National Design Specifications for Wood Construction (latest edition)
	Manual for House Framing (latest edition)
Other Standards	
	Southern Pine Association (SPA)
	Western Wood Products Association (WWPA)
	American Plywood Association (APA)
MIL-L-1914-C	Lumber and Plywood, Fire Retardant Treated

2. Provide lumber conforming to American Lumber Standards' Product Standard PS 20-70 and graded by rule of manufacturer's association (SPA, APA, etc.) under whose rules it is produced, with grade and mill marked on each piece.

3. Moisture Content

- a. Maintain the moisture content within the requirements of the association under whose grading rules it is produced.
- b. Unless otherwise indicated, provide **seasoned lumber with fifteen percent (15%) maximum moisture content at the time of dressing and shipment for sizes two (2) inches or less in nominal thickness.**

- D. Source Limitations

1. **Obtain each type of engineered wood product through one source from a single manufacturer.**
2. **Obtain each type of fire-retardant-treated wood product through one source from a single manufacturer.**

1.04 Submittals

- A. **Submit shop drawings** for review in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples".

B. Product Data

1. For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - a. Include data for wood-preservative treatment from the chemical treatment manufacturer and certification by the treating plant that treated materials comply with the requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - b. Include data for fire-retardant treatment from the chemical treatment manufacturer and certification by the treating plant that treated materials comply with the requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D-5516 and ASTM D-5664.
 - c. For products receiving a waterborne treatment, ***include a statement that the moisture content of treated materials was reduced to levels specified before shipment to the Project site.***
 - d. Include copies of all warranties from chemical treatment manufacturers for each type of treatment.

C. Material Certificates

1. ***Material certificates*** shall be submitted for dimension lumber specified to comply with minimum allowable unit stresses.
2. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

D. Engineered Metal or Wood Products

1. ***Submit calculations indicating span conditions, imposed loading reactions, and spanning members ability to successfully transfer loads to the supporting structure.***

E. Wood Trusses - NOT USED

1.05 Delivery, Storage and Handling

- A. Deliver, store and handle materials in a manner to prevent damage.
- B. **Keep materials dry and covered during delivery and storage.** Protect against exposure to weather and contact with damp or wet surfaces.
- C. **Stack lumber and plywood under cover and off of the ground and provide air circulation** within and around stacks and under temporary coverings and provide protection from the weather.
- D. **Protect installed carpentry work from damage** by the Work of other trades until Final Project Acceptance by the Owner. Advise Contractor of the required protection procedures.
- E. Protect framing, lumber, metal studs, sheathing and engineered wood or metal products from excessive humidity and moisture. Store wood I-beams and glue laminated beams and joists on edge.
- F. Split, broken, or otherwise damaged pieces will not be allowed in the work.

2. PRODUCTS

2.01 Material

- A. Lumber
 - 1. For a lumber standard, for each use, comply with the U.S. Department of Commerce, "American Softwood Lumber Standard", PS 20, and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee's (ALSC) Board of Review. **Factory mark each piece of lumber with grade stamp of grading agency.**
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on the end or back of each piece, or omit the grade stamp and provide certificates of grade compliance issued by the grading agency.
 - 3. Where nominal sizes are indicated, provide actual sizes required by the U.S. Department of Commerce, PS 20, for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. **Provide dressed lumber, S4S**, unless otherwise indicated.

5. **Provide seasoned, dry lumber with fifteen percent (15%) maximum moisture content** at time of dressing for 2-inch nominal (38-mm actual) thickness or less, and complying with the dry size requirements of PS 20, unless otherwise indicated.
 6. Where wood framing from two (2) inches to five (5) inches (but not including 5 inches in nominal thickness and 2-inches or more in nominal width) is shown or scheduled, provide lumber complying with the grading rules which conform to the requirements of the "National Grading Rule for Dimension Lumber: of the American Lumber Standards Committee established under PS 20.
 - a. For light framing (2-inches to 4-inches thick and 2-inches to 4-inches wide), provide construction grade materials.
 - b. For framing and blocking (6-inches wide and from 2-inches to 4-inches thick), provide the following:
 - 1) Any species and grade which meets or exceeds the following values:
 - a) F_b (minimum extreme fiber stress in bending): 1,200 psi
 - b) E (Minimum modulus of elasticity): 1,500,500 psi
 7. Where lumber less than two (2) inches in nominal thickness and two (2) inches or more in nominal width is shown or specified, provide boards complying with the dry size requirements of PS 20.
 8. Where boards will be exposed in the finished work, provide the following:
 - a. Maximum Moisture Content: **Fifteen percent (15%)**, mark boards "S-DRY"
 - b. For paint finish, where shown or scheduled, provide No. 1 Boards, Southern Pine (SP1B).
 9. Where boards will be concealed by other work, provide the following:
 - a. Maximum Moisture Content: **Fifteen percent (15%)**, mark boards "S-DRY"
 - b. Species and Grade: Provide No. 2 Boards, Southern Pine (SP1B).
- B. For a plywood standard, for each use, comply with the requirements for "Softwood Plywood/Construction and Industrial", PS 1 66 by the U.S. Department of Commerce.

1. Exposed Plywood

- a. Where plywood is exposed in the finished work, provide as specified for the type of exposure and finish shown or scheduled, as follows:
 - 1) For smooth plywood exposed on the interior and to receive a natural or transparent finish, provide Interior Type plywood of the species shown or scheduled.
 - 2) For smooth plywood exposed on the interior to receive a paint finish, provide Interior Type, Grade A, on exposed face; Grade D on concealed face.

2. Concealed Plywood

- a. Where plywood will be concealed by other work, provide Interior Type plywood C-D Plugged Grade, unless otherwise specified. Plywood for roof deck and siding to received metal roofing and siding shall be Grade C-C exterior index number 48/24, Exterior, Structural I sheathing, with a minimum thickness of $\frac{19}{32}$ -inch.
 - b. For backing panels for electrical and telephone equipment, provide Department of Commerce, PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in the thickness indicated or, if not indicated, not less than $\frac{1}{2}$ -inch (12.7 mm) thick.
- C. For anchorage and fastening materials for each use, select the proper type, size, material and finish complying with the applicable specification and details.

2.02 **Wood Preservative Treated Materials**

A. Preservative Treatment by Pressure Process

- 1. Where lumber or plywood is indicated as preservative-treated or is specified to be treated, comply with the actual requirements of AWPA Standards C2 (Lumber) and C9 (Plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
 - a. Preservative Chemicals acceptable to authorities having jurisdiction and one of the following:
 - 1) Chromated copper arsenate (CCA).
 - 2) Ammoniacal copper zinc arsenate (ACZA).

- 3) Ammoniacal, or amine, copper quat (ACQ).
 - 4) Copper bis (dimethyldithiocarbamate) (CDDC).
 - 5) Ammoniacal copper citrate (CC).
 - 6) Copper azole, Type A (CBA-A).
 - 7) Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
- b. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
 - c. For the Building Construction, the preservative chemical shall be Copper bis (dimethyldithiocarbamate) (CDDC) at a retention of 0.25 pcf, or equal.
- B. *Kiln-dry material after treatment to a maximum moisture content of fifteen percent (15%) for lumber and plywood. Do not use material that is warped or does not comply with requirements for untreated material.***
- C. The wood treater shall furnish the Contractor with specifications for shipping, storing, handling, erection and protection of the treated lumber.
- D. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, mark the end or back of each piece, or omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. Pressure Treatment of Above-Ground Wood Items**
1. ***Pressure treatment of above-ground wood items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content of fifteen percent (15%).*** Treat indicated items and the following:
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

- c. Wood floor plates installed over concrete slabs directly in contact with earth.
- d. Wood framing members less than eighteen (18) inches (460 mm) above grade.
- F. Pressure Treatment of Wood Members in Contact with the Ground or Fresh Water
 - 1. ***Pretreatment of wood members in contact with the ground or fresh water with water borne preservatives to a minimum retention of 0.40 pcf.***
- G. Lumber in contact with concrete, including roof nailers, shall be pressure preservative treated in accordance with AWPA Standard C9.
- H. On cut or sawed surfaces in preservative treated members apply two (2) coats of the same preservative used in the original treatment.

2.03 Fire-Retardant Treated Materials

- A. Where fire-retardant treated materials are indicated, provide materials that comply with the performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Use treatment for which the chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D-5664, for lumber and ASTM D-5516, for plywood.
 - 2. Use treatment that does not promote corrosion of metal fasteners.
 - 3. Use Exterior type for exterior locations and where indicated.
 - 4. Use Interior Type A High Temperature (HT), unless otherwise indicated.
- B. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.04 Dimension Lumber

- A. Provide dimension lumber of the grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

2.05 Miscellaneous Lumber

- A. Provide lumber for support or attachment of other construction including rooftop equipment, equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members.
- B. ***For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with fifteen percent (15%) maximum moisture content*** and any of the following species:
 - 1. Mixed southern pine; SPIB.
 - 2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
 - 3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
 - 4. Eastern softwoods; NELMA.
 - 5. Northern species; NLGA.
 - 6. Western woods; WCLIB or WWPA.

2.06 Fasteners and Hardware

- A. General
 - 1. Provide fasteners of the size and type indicated that comply with the requirements specified in this Article for material and manufacture.
 - 2. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A-153 / A-153M or of AISI Type 304 stainless steel.
- B. Nails, Brads, and Staples shall comply with ASTM F-1667 or FS FF-N-105.
- C. Power-Driven Fasteners: National Evaluation Report NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for fastening to Cold-Formed Metal Framing shall comply with ASTM C-954, except with wafer heads and reamer wings, length as recommended by the screw manufacturer for material being fastened.
- F. Lag Bolts: ASME 1378.2.1, ASME B18.2.3.8M, ANSI B18.2.1.
- G. Bolts shall be steel bolts complying with ASTM A-307, Grade A (ASTM F-568M, Property Class 4.6); with ASTM A-563 (ASTM A-563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors

1. Anchor bolt and sleeve assembly of the material indicated below with capability to sustain, without failure, **a load equal to six (6) times the load imposed when installed in unit masonry assemblies and equal to four (4) times the load imposed when installed in concrete** as determined by testing per ASTM E- 488 conducted by a qualified independent testing and inspecting agency.
 - a. Carbon-steel components, zinc plated to comply with ASTM B-633, Class Fe/Zn 5.
 - b. Stainless steel with bolts and nuts complying with ASTM F-593 and ASTM F-594, Alloy Group I or 2 (ASTM F-738M and ASTM F-836M, Grade A1 or A4).
- I. Nails shall be stainless steel common wire for exterior work.
- J. Screws shall be of standard domestic manufacture, **stainless steel for exterior use** and brass, bronze, aluminum or stainless steel when used to attach interior items made of those materials.
- K. Machine bolts (or carriage bolts if called for on Contract Drawings) shall be of **Series 300 stainless steel** with hexagon nuts, of sizes noted on Contract Drawings. For wood fascia fasteners, use galvanized steel conforming to the requirements of ASTM A-307.
- L. Steel Plates and Angles shall be carbon steel, ASTM A-36, galvanized after fabrication for temporary items and stainless steel for permanent items as shown on the Contract Drawings.
- M. Lag Screws, Shear Plates and Split Ring Connectors shall conform to the requirements of the National Design Specifications for Stress-Grade Lumber and its Fastenings of National Forest Products Association and shall be stainless steel.
- N. Powder actuated fasteners shall conform to Federal Specification GGG-D-777a, and shall be installed as per manufacturer's printed directions. Powder charge shall be powerful enough for adequate fastening but shall not cause spalling of concrete.
- O. **Neoprene Pads shall be of one piece construction**, of the thickness shown on the Drawings with a 50 to 60 durometer hardness and equal to Service Code 3340 as manufactured by W.R. Grace, with edges sheared true and holes punched.

2.07 Metal Framing Anchors

- A. Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:

1. Research/Evaluation Reports

- a. Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for the application indicated, with the Building Code in effect for this Project.

2. Allowable Design Loads

- a. Provide products with allowable design loads, as published by the manufacturer, that meet or exceed those indicated.
- b. The manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency and as required by the Florida Building Code.

2.08 Miscellaneous Materials

A. Building Paper

- 1. Asphalt-saturated organic felt complying with ASTM D-226, Type I (No. 15 asphalt felt), unperforated.

B. Water-Repellent Preservative

- 1. NWWDA-tested and accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

- C. Miscellaneous carpentry materials required for a complete and proper installation as indicated on the Contract Drawings shall be new, suitable for intended use and subject to approval of the Engineer.

D. Construction Adhesives

- 1. Construction adhesives to be utilized for construction of the Project Buildings shall be low VOC, water based products.

E. Sill Sealer

- 1. Foal sill sealer to match the width of the sill plate.

3. EXECUTION

3.01 Inspection and Preparation

A. Inspection

1. The Contractor shall examine all parts of the surrounding structure, work of other trades, and the conditions under which the carpentry work is to be installed and assure himself that all support work has been accomplished to the point that carpentry work may properly commence.
2. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner. Beginning work indicates acceptance of surfaces.

B. Preparation

1. Use only sound, thoroughly seasoned materials of the longest practical lengths and sizes to minimize jointing.
2. Use materials that are free from warp which cannot be easily corrected by anchoring and attachment.
3. Sort, cut and discard warped material and material with other defects which would impair the quality of the Work.
4. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of four (4) inches and seal.
5. Coordinate installation of rough carpentry members specified in other sections.

3.02 Installation

A. General Work

1. ***Set rough carpentry to the required levels and lines, with members plumb, true to line, cut, and fitted and meeting the required layout and details.*** Provide framing members of sizes and on spacings shown and comply with the recommendations of the "Manual for House Framing" of the National Forest Products Association. Cut, join and tightly fit framing around other work. Do not splice structural members between supports unless otherwise detailed.
2. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.

3. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction and the provisions of the Florida Building Code and other recognized standards.
 4. ***Install all work properly nailed or bolted and adequately braced, in accordance with the best practices of the trade, by men skilled in the craft.***
 5. ***Countersink nail heads on exposed carpentry work and fill holes.***
 6. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; pre-drill as required.
- B. ***Do not use materials with defects that impair the quality of rough carpentry or pieces that are too small to use with the minimum number of joints or optimum joint arrangement.***
- C. Apply field treatment complying with AWPAC M4 to cut surfaces of preservative-treated lumber and plywood (two coats).
- D. Anchors shall be installed, where indicated or required, to anchor carpentry or other items securely to masonry or concrete.
- E. Forms for structural concrete work shall be as specified under Division 3, "Concrete". Provide all other miscellaneous wood form work as may be required for the completion of the work.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. National Evaluation Report NER-272 for power-driven fasteners.
 2. Published requirements of metal framing anchor manufacturer.
 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
 4. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.
 5. Table 2306.1, "Fastening Schedule," in the Standard Building Code.
- G. Select fasteners of the size that will not penetrate members where the opposite side will be exposed.

H. ***For exterior installations, use stainless steel fasteners.***

- I. For bolted work, bore holes of the same diameter as bolts and drive bolts into place with a snug fit with washers between bolt head and wood surface. Make tight at the time of installation, bolts and lag screws, and retighten just before enclosed by other work or at completion of work. The length of the bolts shall be the required length to suit the condition. Embed bolts in concrete and solid masonry, where possible, and use expansion shields in drilled holes where not possible.
- J. Use the number and size of nails to achieve rigid connections and prevent splitting. Bore holes at least one (1) drill size smaller than the nails to prevent splitting, if necessary.
- K. Anchor nailers to the adjacent construction with bolts six (6) inches from the ends and at intervals not more than forty-eight (48) inches on center between.
- L. Install, maintain and remove all staging for all trades required to reach all work.
- M. At completion, remove all excess materials and all resultant debris from the operations of work of this Section. Leave the work in a neat, clean condition, satisfactory for receipt of other related items of work which are to be installed under other sections.
- N. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
- O. Tolerances
 - 1. Framing Members: $\frac{1}{4}$ -inch from true position, maximum.
 - 2. Variation from Plane (Other than Floors): $\frac{1}{4}$ -inch in 10 feet maximum, and $\frac{1}{4}$ -inch in 30 feet maximum.
- P. ***Protect wood surfaces to be finished from moisture and dirt until the prime coat has been applied.***

3.03 Blocking, Nailers and Supports

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim. Form to the shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and

between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1½ inches (38 mm) wide and of the thickness required to bring the face of ground to the exact thickness of the finish material. Remove temporary grounds when they are no longer required.
- G. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.
- H. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.

3.04 Roof-Related Carpentry

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 Installation of Construction Panels

- A. Communications and Electrical Room Mounting Boards
 - 1. Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

- a. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
- b. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
- c. Install adjacent boards without gaps.

3.06 Surfaces

- A. Prior to beginning carpentry work, inspect the installed work of other trades and verify that such work is complete to the point that carpentry work may properly commence.
- B. Beginning work indicates acceptance of surfaces.

3.07 Workmanship

- A. ***Joints shall be true, tight and well nailed.***
- B. ***Studs shall be doubled at openings and tripled at corners.*** Install double top plate at all partitions. Stagger joints in top plate so a continuous tie is formed. Plates and blocking shall be same width as related studs.
- C. Install blocking to support accessories, as required by the Project Work.
- D. ***Select wood members for intended use.*** Select individual pieces so that knots and defects will not interfere with placing bolts or nailing. Cut out and discard defects which will interfere with intended function.
- E. Install wood framing as shown on the Contract Drawings. Framing shall be erected true to line, levels and dimensions, squared, aligned, plumbed and adequately blocked and braced. All members shall be securely nailed or bolted to serve the purpose intended.
- F. ***Provide framing to suit the work of other trades.*** Install plates, nailers and blocking as detailed or required to complete the work.
- G. Do not allow the installation of damaged or non-complying material.

3.08 Plywood Installation

- A. Place plywood with face grain perpendicular to supports and continuously over at least two (2) supports.

- B. Center joints over supports.
- C. Nail plywood on six (6) inch centers at panel edges and on twelve (12) inch centers at intermediate supports with 6d nails for panels ½-inch thick or less and 8d for greater thicknesses.

3.09 Building Paper Application

- A. Apply building paper horizontally with a two (2) inch (50-mm) overlap and six (6) inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.
- B. Cover upstanding flashing with a four (4) inch (102-mm) overlap.

3.10 Cleaning

- A. The Contractor shall haul away all waste materials, to an off-site disposal location, and dispose of them in legal manner.
 - 1. Comply with applicable regulations.
 - 2. Burning is prohibited.
 - 3. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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SECTION 06200

FINISH CARPENTRY

1. GENERAL

1.01 Description

A. Provide necessary services, tools, equipment, material, and labor required to furnish and install millwork, interior plywood paneling, laminate covered cabinet work, plastic laminate and solid polymer counter tops and closet shelving as required. Install cabinet hardware specified. Do all finishing work in the shop.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
06100	Rough Carpentry
08710	Finish Hardware
09900	Painting
Division	Information
8	Doors and Frames
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. References

1. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM D1037-96a	Test Methods for Evaluating the Properties of Wood-Base Fiber and Particle Panel Materials
Other Standards	
ANSI/AHA	A135.4 -Basic Hardwood

- B. Built-ins and casework shall be constructed and installed to carry intended loads, not have sharp corners, splinters, or any construction features or projections that would be hazardous to occupants and users. Casework and cabinets shall be constructed in conformance with applicable state and federal accessibility requirements.
- C. Architectural woodwork quality standards and guide specifications of the Architectural Woodwork Institute (AWI) shall apply and by reference are made part of this Specification. Cabinet work shall follow minimum requirements described in the latest edition of the Architectural Woodwork Institute (AWI) following "*Custom Grade*" standards.
- D. **Particle board IS NOT allowed.**
- E. Any item not given a specific quality grade shall be "*Custom*" grade as defined in the latest edition of the AWI "*Quality Standards*".
- F. All plywood shall conform to the standards grading rules of U.S. Product Standard PS 1 and hardwood plywood conforming to PS 51.
- G. Casework shall be "*Custom Grade*" overlay design with plastic laminate finish.
- H. Only manufacturers with financial stability and five (5) years experience in casework manufacture and installations of similar scope will be considered. The installer must be a company whose primary business is the manufacturing of plastic laminate casework. The installer shall have adequate physical facilities and personnel for this size project with a qualified engineering department to provide layout and shop drawings for review before fabrication.
- I. **Use only qualified tradesmen to perform installation, with at least five (5) years experience in installations of a similar nature.**
- J. Evidence of qualifications shall include product catalog, descriptive literature, and specifications for the proposed product. Submit a sample cabinet, complete with drawer, door hardware, and corner sample of counter top with the product literature.

K. Pre-Installation Site Visit

1. Prior to delivery of finish carpentry materials, visit the project site with the installer and review coordination with other trades and environmental controls required for proper installation and ambient conditioning in areas to receive work. Proceed with finish carpentry on the interior only when the required ambient conditions can be properly attained.
2. Prior to construction of items that are to be fabricated elsewhere and required to make parts of work fit accurately together, obtain final dimensions by field measurement. Verify all measurements on which the work is dependent.

L. Source Quality Control

1. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification except for surfaces to receive transparent finishes.
2. Omit markings from surfaces to receive transparent finishes, and submit mill certificates that states that the material has been inspected and grade is in accordance with the requirements if an item cannot be marked on a concealed surface.

M. Fire-Retardant Marking

1. Mark each unit of fire-retardant treated lumber and plywood with that classification marking or other testing and inspecting agency acceptable to authorities having jurisdiction.
2. Place markings on surfaces that will not be exposed after installation.

1.03 Submittals

- A. Submit for review shop drawings, product data, certifications, fabricator qualifications, etc., in accordance with Section 01300, "Shop Drawings, Submittals and Samples".

B. Shop Drawings

1. Prior to fabrication, submit shop drawings, drawn to a large scale, for all cabinet work, storage shelving, countertops and other items furnished showing locations, dimensions, plans, elevations, large scale details, hardware schedule, attachment devices and other components for each fabricated item.
2. Show plastic laminate colors, patterns and inserts.

3. Rough blocking and other work to which finish work is to be attached, shall be indicated on the shop drawings.

C. Submit three (3) samples for each wood species and cut or pattern as follows:

1. Interior Standing and Running Trim: *2 feet long x full width board or molding width, unfinished.*
2. Hardwood Plywood: *12-inch square x thickness specified.*
3. Material for countertops: *6-inch square x thickness specified.*
4. Plastic Laminate Selections: *Each, 12-inch square on hardwood backing, submit color selection chart and/or color samples.*
5. Wall Guards: *Each, 12-inches long.*
6. Workbench Materials: *12-inch square x the thickness specified.*
7. Finish: *12 inch square of each wood, each finish.*

D. Wood Treatment

1. Submit the chemical treatment manufacturer's instructions for handling, storage, installation and finishing treated materials.
 - a. The Water Repellent Preservative shall be an NWWDA-tested and accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.
 - b. Pressure-treated above ground items with water-borne preservatives to a minimum retention of 0.40 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content of nineteen percent (19%) and fifteen percent (15%), respectively. Treat indicated items and the following:
 - 1) Wood cabinet support bases, blocking, stripping, and similar members.
 - c. Fire-Retardant Treatment: *Include certification by the treating plant, indicating the type of chemicals used and fire performance characteristics achieved.*

E. Manufacturer's (Fabricator's) Certification

1. Submit certification, stating that the fabricated work complies with quality grades and the other requirements achieved.

1.04 Product Delivery, Storage and Handling

- A. Deliver casework, if used, when the building(s) is(are) secure and weather tight.
- B. The air conditioning and ventilation systems for the building(s) to be constructed as part of the Project Work shall be operational and capable of conditioning the air in the buildings to prevent damage by moisture, dampness, excessive humidity, extreme dryness and extreme heat and cold. All wet-type construction, grinding and similar construction operations shall have been completed, prior to delivery of the electrical equipment, panels and MCC's to avoid damage, soiling or deterioration of the Work.
- C. Painting and other finish work shall be complete in all areas within the building(s) prior to millwork/cabinet work/casework, electrical equipment, panels, MCC's, equipment and fixtures, etc. being installed.
- D. Store materials and/or stack them in such a manner as to provide good ventilation, minimize warping or twisting and otherwise provide protection recommended by the fabricator.
- E. Use all means necessary to protect the materials and equipment during and after installation.
- F. ***In the event of damage make all repairs and replacement necessary, to the approval of the Engineer, and at no additional cost to the Owner.***

2. PRODUCTS

2.01 Manufacturers

- A. Acceptable manufacturers for the plastic laminate are as follows:
 1. Nevamar
 2. Formica
 3. Micarta
 4. Pionite
 5. Wilson Art
 6. Or approved equal

B. Acceptable manufacturers for the solid polymer are as follows:

1. Corian
2. Avonite
3. Surell
4. Fountainhead
5. Earthstone
6. Or approved equal

2.02 Materials

- A. Case members, tops, bottoms, sides, dividers, shelves, door fronts, and drawer fronts shall be $\frac{3}{4}$ -inch thick, 7 ply, closed grain hardwood plywood.
- B. Case backs shall be $\frac{1}{4}$ -inch thick, closed grain, hardwood plywood.
- C. Plywood shall have type II water-resistant glue.
- D. Provide manufacturer's association stamp on all plywood, except where exposed to view.
- E. Plywood exposed to view, unless otherwise specified, shall be hardwood plywood with exterior glue.

F. Plastic Laminate

1. High pressure laminate shall conform to NEMA specification LD3, latest edition. Laminate the plastic laminate sheets to the core stock under pressure with water resistant adhesive to achieve a Type II bond.

2. Material Thickness

- a. 0.050-inches: *Exposed surfaces and edges of drawer fronts, door fronts, counter tops, backsplash, and all other remaining exposed exterior horizontal and vertical surfaces.*
- b. 0.027-inches: *Exposed interior surfaces of door backs, cabinet sides, backs, and shelving and all other remaining exposed interior horizontal and vertical surfaces.*
- c. Concealed Surfaces: *Not applicable.*
- d. Solid Polymer: *$\frac{1}{2}$ -inch (13 mm).*

3. Colors and Patterns

- a. The range of color selection shall not be limited to colors stocked locally, but by the entire color line of the specific manufacturer as determined by samples submitted to the Engineer in the shop drawing review process.
4. Where hinges or other attachment requiring screws for holding power in concealed wood are required, lumber shall be one of the following:
 - a. Southern Yellow Pine
 - b. Gum
 - c. Birch
 - d. Beech
 5. Lumber used for construction of bins or shelving supports located in kitchen pantries, shops, storage rooms, or janitor closets shall be, unless otherwise shown on the Contract Drawings, finished under Painting Section with "natural finish" and shall be of one of the following:
 - a. Southern Yellow Pine
 - b. Gum
 - c. Poplar
 - d. Birch
 - e. Beech
 6. Lumber scheduled to be painted or enameled shall be one of the following. Do not use fir plywood in this application:
 - a. Southern Yellow Pine
 - b. Gum
 - c. Poplar
 - d. Birch
 - e. Beech

G. Adhesives

1. Use adhesives meeting Strength and Rate of Loading, Moisture Resistance, and Heat Resistance requirements set forth in AWI 100-G-11. Do not use glues containing formaldehyde.
2. Interior Work

Adhesive Type	Use
Modified polyvinyl acetate	For normal use except items requiring high moisture resistance
Casein glue	For normal use except waterproofed items
Contact cements (not the solvent type)	For bonding high water pressure laminates only

3. Exterior work or in Kitchens, Toilets or other Rooms with moisture

Adhesive Type	Use
Phenolic resin	Generally for moisture resistance of fully waterproof bond

H. Finish Hardware

1. Finish Hardware for all doors is presented in Section 08710, "Finish Hardware".

2. Hinges for 3/4-inch Thick Doors

a. US26D satin chrome plated steel, 5 knuckle, wrap around type allowing 270° swing at the end of cabinet work unit, mounted with minimum 4 plated No. 8 self-tapping screws per hinge leaf. Concealed European type hinges are not allowed.

b. For doors up to and including forty-eight (48) inches high, provide two (2) hinges. For doors over forty-eight (48) inches high, provide three (3) hinges.

c. Manufacturers

1) Stanley HT1592.

2) RPC 21-232.

3) Or approved equal.

3. Pulls

a. Pulls shall be $\frac{5}{16}$ -inch wire pull, four (4) inches long, solid brass, US26D satin chrome plated.

b. Manufacturers

1) Stanley 4484.

2) Epco MC.

3) Colonial 753.

4) Or approved equal.

4. Door Catches

- a. For doors up to and including thirty-eight (38) inches high, provide one (1) heavy duty magnetic type catch, slotted for adjustment. Attach with screws.
- b. For door thirty-eight (38) inches high and over, provide two (2) heavy duty magnetic type catches, slotted for adjustment. Attach with screws.

- c. Manufacturers

- 1) Stanley SP45.
 - 2) Or approved equal.

5. Surface Bolts

- a. Surface bolts for inactive doors in cabinet door pairs with locks indicated shall be:
 - 1) Ives 40 x US26D x 6 inches.
 - 2) Quality B-6 x US26D x 6 inches.
 - 3) Baldwin 0324 x US26D x 6 inches.

6. Locks

- a. Locks for $\frac{3}{4}$ -inch doors with plastic laminate finish (50% of doors shall have locks) shall be satin chrome or nickel plated steel, six (6) tumbler lock with grooved key.
- b. Manufacturers
 - 1) KV 987, with strike.
 - 2) Yale 9660, with strike.
 - 3) Corbin 0764L, with strike.

- 7. Drawer Slides shall be zinc plated cold rolled steel and shall be Grant or KV 1300 rated for 75 pound capacity.

8. Steel Standards

- a. KV 233ZC with zinc plated finish, $\frac{5}{8}$ -inch screw nails, and KV 265ZC shelf clips, surface mount.

I. ***All Lumber shall be clear, straight, select lumber, kiln-dried to fifteen percent (15%) maximum moisture content.***

- J. Miscellaneous materials indicated or required to complete the finish carpentry work shall be selected by the Contractor subject to the approval of the Engineer via the shop drawing review process.

2.03 Fabrication

A. Millwork

1. Millwork shall be assembled at the mill, insofar as practical, and delivered ready for installation. When it is necessary to cut and fit on the job, the material shall be made with ample measurements taken at the job site.
2. All exposed surfaces shall be sanded to an even, smooth surface, ready for finish.
3. Mill assemblies shall be jointed with concealed nails and screws, where possible, with mortise and tenons or with dowels, and with glued blocks. All exposed nails shall be countersunk. ***All glue shall be waterproof and of the best quality.***

B. Cabinetwork

1. Construct cabinetwork as shown on the Contract Drawings and meeting the following requirements:
 - a. Face frames, mortise and tenon, screw, glue, and make all such joints concealed.
 - b. Cabinet members, bottoms, sub-top, sides, and back shall be joined by dado and rabbeted joints secured with glue and concealed mechanical fasteners. Case backs shall have a three (3) inch anchor cleat the full width of the unit at the top.
 - c. Case construction of butt joints with dowel pins **is not** allowed.
 - d. Construct the toe space base from solid lumber and separately framed.

e. Drawers shall be lock shouldered.

f. Drawer Sides and Backs

1) Well sanded with corners rounded and natural finish of one of the following:

- a) Southern Yellow Pine
- b) Poplar
- c) Gum
- d) Birch

g. Drawer Bottoms

1) 1/4-inch tempered fiberboard with factory applied gloss surface of a color approved by the Engineer and Owner.

h. Cabinet interior sides shall be drilled to receive shelf pins leaving exposed core **is not** acceptable.

i. Shelving

1) 3/4-inch plywood for lengths less than thirty-six (36) inches.

2) One (1) inch plywood or 3/4-inch plywood with 3/4-inch x 1 1/2-inch hardwood edges at the front and rear of shelf for lengths thirty-six (36) inches or greater.

j. Adjustable Shelving

1) Use surface mounted standards and notched shelving ends.

k. Exposed Shelving

1) In storage rooms, utility rooms, kitchen pantries, shops, mechanical or electrical rooms, or in janitor closets, shall be "natural finish" constructed of plywood with edges banded of similar material and have outside face veneers of similar material of either:

- a) Gum
- b) Poplar
- c) Beech
- d) Birch

C. All Other Shelving

1. All other shelving shall be hardwood plywood with bonded edges, finished "*transparent*" and of plywood with veneers meeting the following criteria:
 - a. Cabinet and casework hardware will be supplied under the finish Hardware Section and shall be installed by the cabinet and casework fabricator. Locate hardware accurately on shop drawings.
 - b. Species
 - 1) Birch, APA grade marked MDO 1 face/2 face, interior grade.
 - c. Where normally exposed to view (behind cabinet doors)
 - 1) Birch, AWI Custom Quality.
 - d. Where normally concealed from view (behind cabinet doors)
 - 1) Birch, AWI Economy Quality.

D. When specifically called for on the Contract Drawings as laminated plastic faced cabinets doors, ends, drawer fronts, dividers, and backs (except against walls):

1. Plywood with laminated plastic on all surfaces not occurring against building walls or partitions.
2. Stiles and rails shall be of laminated plastic covered lumber.

E. All other cabinets not specifically called for on the Contract Drawings as laminated plastic faced shall be constructed of "*transparently finished*" hardwood plywood doors, ends, drawer fronts, dividers, and backs (except against walls) with lumber stiles and rails of same species, as follows:

1. Species shall be Birch or White Oak APA grade marked MDO 1 face/2 faced, interior grade.

F. Edging

1. Edgings shall be tongue and grooved into plywood and set in glue.

3. EXECUTION

3.01 Examination

- A. Examine the areas and conditions under which the millwork/cabinetwork is to be installed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of this phase of the Work. Do not proceed with this phase until all unsatisfactory conditions have been corrected. Commencement of work shall be construed as acceptance of the conditions.
- B. ***The Contractor shall take accurate field measurements and adjust the shop drawings accordingly before fabrication.*** The Engineer and Owner shall be informed, in writing, of any dimension changes resulting from such field measurement before fabrication.
- C. The casework, if to be installed as part of the Project Work, shall be set in place, leveled, and secured to walls and floors as normal and standard to the trade. Fillers shall be used between the casework and walls and shall be accurately scribed to walls for a neat installation. Casework shall be caulked where meeting walls, floors and soffits. Seal all counter joints and where backsplash meets the counter top.
- D. The casework installer shall accurately cut openings required for sinks or other equipment as indicated on the Contract Drawings and "approved" shop drawings.

3.02 Installation

- A. Prior to all work of this Section, carefully inspect related work of other trades and verify that such work is complete to the point where this portion of the work may properly commence. The beginning of work indicates acceptance of all surfaces.
- B. Cut openings in plastic laminate finished tops for equipment which is to be installed under other sections of these specifications. Verify size of openings with actual size of equipment to be used, prior to marking openings. Form inside corners to a radius of not less than 1/8-inch. After sawing, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a waterproofing material recommended by the plastic laminate manufacturer.
- C. ***Install counters and cabinets plumb, level and to required lines without distortion and shimmed, as necessary, with concealed shims.*** Accurately scribe and closely fit all face plates, filler strips and trim strips to irregularities of adjacent surfaces.
- D. All wood trim shall be given two (2) brush coats of wood preservative, and painted in accordance with this Section and Section 09900, "Painting", with a color selected by the Engineer.

- E. Prepare surfaces of all woodwork that is to be laminated by cleaning and sanding and setting all nail heads below the surface of the wood as required. Wood surfaces shall be hand sanded to a smooth finish to remove imperfections, machine and tool marks, dents, scratches, etc. prior to finish painting, staining or varnishing. Painting shall be in accordance with Section 09900, "Painting", with a color selected by the Engineer.
- F. Bond plastic laminate to surfaces with the technique and contact cement approved by the laminate plastic manufacturer.
- G. Install all members in as long of lengths as practicable. Cope internal joints and returns and miter external corners.
- H. Install wood in accordance with the final shop drawings and applicable standards of the AWI Manual.

3.03 Fire-Retardant Treated Wood

- A. Handle, store, and install in accordance with manufacturer's directions, and as required to meet required classification or rating.
- B. Provide, special fasteners, moldings, adhesives, and other accessories as tested and listed for the type of fire retardant materials indicated.

3.04 Adjustment, Cleaning and Protection

- A. ***Repair or replace damaged and defective finish carpentry work to eliminate defects functionally and visually.*** Adjust joinery for uniform appearance.
- B. Protect the installed work and maintain the conditions necessary to ensure that the work will be without damage or deterioration at time of acceptance.

3.05 Installation of Finish Hardware

- A. Install cabinet hardware according to the requirements of the finish hardware manufacturer and in accurate positions as indicated on the drawings.
- B. Doors and finish hardware will be furnished under Division 8 and shall be installed under the work of this Section, except where specifically designated otherwise herein.

- C. As soon as the hardware is delivered to the job site, receive, verify and check each set. Give notice to the hardware supplier for all such items which may be defective or missing. Provide a receipt to the hardware supplier for all such items as are found to be correct.
- D. Finish hardware, after checking, shall be the responsibility of the Contractor until it is installed and the project is accepted in its entirety by the Owner.
- E. Hardware shall be attached and placed by skilled mechanics in accordance with approved hardware templates provided with the hardware, and shall be neatly installed and accurately fitted and adjusted in accordance with best installation practices. Lever handles shall be kept covered with heavy cloth, and other hardware shall be protected from damage, rust scratches and other defects until Final Project Acceptance by the Owner.
- F. **Install all work plumb and true**, and secured with proper fasteners to make all work rigid and firm. **All screws, bolts and other fasteners used to secure finish hardware shall match the hardware in finish color and type.**
- G. For fire-rated doors, provide clearances complying with NFPA and local Fire Marshall's limitations.
- H. Set each edge and joint of threshold in a seal strip of polysulphide sealant.
- I. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with the type of lubrication recommended by the manufacturer (graphite-type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.
- J. Escutcheons and other such items shall not be applied until after finishing and painting operations are complete.
- K. Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make a final check and adjustment of all hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.06 Workmanship

- A. Provide "**first quality**" construction following best trade practices. Install trim in pieces as long as possible, jointing only where solid support is obtained.

- B. Make all joints to conceal shrinkage. Miter exterior corners. Cope interior corners. Miter end joints.
- C. ***Install all items straight, true, level, plumb and firmly anchored in place.*** Conform to the “approved” shop drawings.
- D. ***Fasteners shall be concealed wherever possible.*** Where exposed nailing is necessary nails must be small and countersunk for puttying.
- E. Wood trim shall be ***free of abrasions or dents.*** Finished wood surfaces shall be sandpapered as required to produce a uniformly smooth surface.

3.07 Clean-up

- A. Sweep working area daily. Upon completion of this portion of the Work, thoroughly clean all surfaces.

END OF SECTION

SECTION 06600

FABRICATED FIBERGLASS

REINFORCED PLASTIC (FRP) PRODUCTS

1. GENERAL

1.01 Description

A. This Section covers Fiberglass Reinforced Plastic (FRP) products for use on this Project. Applications include, but are not limited to, the following: liquid level indicators, ventilators, hatch covers, ladders, miscellaneous shapes, structural components and other specified items.

B. Related Work Specified Elsewhere

1. Equipment:

Division 11

1.02 Qualifications and Experience of the Manufacturer

A. The Manufacturer shall be a specialist in the design and fabrication of Fiberglass Reinforced Plastic (FRP) products intended for use in wastewater and biosolids applications, and ***shall have at least five (5) years experience in this specialty.***

B. The Manufacturer shall have such production facilities as will insure prompt manufacture and shipment of these fiberglass products. The Manufacturer shall continually monitor production in order to insure that the control of quality is maintained. Upon request, the Manufacturer shall furnish certified test reports on the raw materials used in fabrication.

C. ***The Manufacturer shall have on his staff a full-time registered professional engineer having no less than five (5) years experience in the design and fabrication of fiberglass reinforced plastic products, who will be in responsible engineering charge of the work to be done. All shop drawings shall carry the seal of such registered Professional Engineer.***

1.03 Quality Assurance

A. Reference Standards

1. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM D-570	Standard Test Method for Water Absorption of Plastics
ASTM D-635	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM D-638	Standard Test Method for Tensile Properties of Plastics
ASTM D-695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D-732	Standard Test Method for Shear Strength of Plastics by Punch Tool
ASTM D-790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D-792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTME-84	Standard Test Method for Surface Burning Characteristics of Building Materials
Other Standards	
	National Bureau of Standards, Voluntary Product Standard PS 15
	Florida Building Code

1.04 Shop Drawings

A. Shop Drawings and Manufacturers Literature

1. For all fiberglass reinforce plastic components and products to be furnished under this section, the Contractor shall submit all material required to establish compliance with this Section and Section 01300, "Shop Drawings, Submittals and Samples".
2. The Shop Drawings shall indicate the specific dimensions and thicknesses.
3. ***A detail of the intended support members with certification*** demonstrating their adequacy for the application and intended loads.

4. Submit color samples for selection of colors.
 5. The Shop Drawings must be approved by the Engineer before production may proceed.
- B. The Manufacturer shall secure from the appropriate regulatory agencies, approval for the use of its Fiberglass Reinforced Plastic (FRP) products for use in potable water applications, if required by the Project.

1.05 Design

- A. The assembled Fiberglass Reinforced Plastic (FRP) products, anchoring systems and each of their structural components, both laminated and prefabricated, ***shall be designed for all live and dead loads, including 140 mph winds.***
- B. Empirical designs of assembled Fiberglass Reinforced Plastic (FRP) products shall be acceptable provided they are substantiated by a satisfactory service history of ***no less than ten (10) years.***

1.06 Warranty and Guarantees

- A. ***The Manufacturer shall guarantee workmanship and materials on the finished fiberglass reinforced plastic products for a period of five (5) years from the date of Final Project Acceptance by the Owner.***
- B. If defects appear within the five (5) year period, the Manufacturer shall proceed to replace said components or equipment, upon written notice from the Owner that such defects have been found, immediately, and at no additional cost to the Owner.
- C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.
- D. Refer to the General Conditions for additional guarantee and warranty requirements as well as Section 01740, "Warranties and Bonds".

1.07 Product Delivery, Storage and Handling

- A. The manufacturer shall examine all FRP products and components prior to packaging and delivery to the Project Site and shall provide a letter to the Engineer, submitted at

- the time of shipping, indicating that the products produced meet the requirements of the specifications, were examined prior to delivery, and were shipped free of defects and of high workmanship quality.
- B. All equipment and accessories shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the equipment is ready for operation.
 - C. Upon delivery of the FRP components to the Project Site, the Contractor shall inspect the components for damage during transit. ***If damage has occurred, the FRP components shall be returned to the manufacturer and components shall be provided at no additional cost to the Owner.***
 - D. The Contractor shall handle the FRP components during delivery, storage and installation in a manner to prevent damage of any nature in accordance with the manufacturer's approved written instructions and in accordance with instructions given on-site by the manufacturer's representative.

2. PRODUCTS

2.01 Resins

A. Polyester Resin

1. The Resin shall be a polyester material, possessing inherent UV (UV-8 or greater), fire, and chemical resistance. The resin material shall be fire rated for Class I flame spread and flammability ratings as per ASTM E-84 and D-635.
2. ***The resin shall be of a commercial grade*** that has been evaluated by the testing of previous service, and found to be acceptable for the specific environment.
3. ***The resin shall be resistant to the corrosive nature and action of water and wastewater.***

B. Catalyst

1. The polyester resin shall be cured by polymerization in a hard, rigid, solid product.
2. The catalyst used for polymerization shall be MEK peroxide, Reichhold 46-700 or approved equal.

C. Gel Coat

1. Gel Coat shall consist of polyester resin, a catalyst, and a colorant. White gel coat shall be Ferro VF-4060, or approved equal.
2. Green gel coat shall be Ferro VF8640, or approved equal.

2.02 Glass Fiber Reinforcing Materials

- A. Glass fiber reinforcing materials shall be of commercial grade.
- B. To insure chemical adherence between the glass reinforcement and the polyester resin, a special silane treatment shall be applied to the glass filaments. One or more of the following glass fiber reinforcing materials shall be used:

1. Chopped Roving

- a. Multiple strands of monofilament glass fibers made into a continuous untwisted ribbon and automatically chopped to approximately one (1) inch lengths, and placed by machine in the spray-up method of fiberglass manufacture.

2. Reinforcing Mat

- a. Made from roving chopped to approximately two (2) inch lengths, then uniformly dispersed and manufactured into a smooth mat with weights ranging from $\frac{3}{4}$ oz. to $1\frac{1}{2}$ oz. per square foot, suitable for the hand lay-up method of fiberglass manufacture.
- b. In the manufacture of the reinforcing mat, the glass strands shall be bonded together into the mat shape with a styrene soluble binder.

3. Woven Roving

- a. Made from continuous roving, and woven into a heavy fabric suitable for the hand lay-up method of fiberglass manufacture.

4. Woven Cloth and Tape

- a. Made from twisted yarns of glass fiber strands, and woven into a light fabric suitable for the hand lay-up method of fiberglass manufacture.

2.03 Laminated Fiberglass Components

A. Laminate Construction

1. Laminated fiberglass components shall be manufactured by a combination of the spray-up method and the hand lay-out method.
2. The laminate shall consist of a series of resin and glass reinforcement applied upon a mold made specifically for the end product being manufactured. The surface of the mold shall be free of cracks, pits and crazing. The mold shall have a smooth surface finish.
3. ***The initial coating placed against the mold shall be a gel coat of no less than 20 to 25 mils thick.*** VF-4060 white gel coat shall be used for molded surfaces which will be exposed to the weather. VF-8640 green gel coat shall be used for molded surfaces that may be exposed to wastewater or domestic biosolids.
4. ***The second layer in the laminate shall be no less than twenty-five (25) mils thick and shall consist of polyester resin reinforced with no less than thirty percent (30%) chopped roving and reinforcing mat.***
5. The remaining thickness of the laminate shall be designed and manufactured to provide the strength necessary to meet tensile and flexural requirements and shall consist of layers of polyester resin and any one of a combination of glass fiber reinforcing materials described under Article 2.02 herein.
6. If multiple layers of woven roving or woven cloth are used, a layer of chopped roving shall be placed in alternate layers.
7. ***The glass fiber content of the completed laminate shall be no less than thirty percent (30%) by weight.*** Throughout the laminate, the resin shall thoroughly saturate the glass fiber reinforcement.

B. Laminate Appearance

1. ***The fiberglass product shall be of uniformly high quality.*** The finished mold surface shall be free of visual defects, foreign inclusions, dry spots, crazing, air bubbles, pin holes and delaminations. The edges shall be straight and true.
2. The finished lay-up surface shall be smooth and shall be thoroughly coated with gel coat. There shall be no exposed glass fibers or sharp projections. All cut edges shall be straight, and shall be coated with gel coat so that no glass fibers are exposed, and so that all voids are filled.

C. Laminate Thickness

1. The fiberglass reinforced plastic laminate shall have **a thickness of no less than ¼-inch**.
2. At no point in the laminate shall the thickness be less than this minimum.

D. Laminate Properties

1. The fiberglass reinforced plastic laminate shall have the following physical properties, and where required, shall be tested in accordance with the ASTM Standards indicated:

Physical Property	Value	ASTM Standard
Water Absorption, 24 hours	0.50%	D-570
Ultimate Tensile Strength	30,000 psi	D-638
Ultimate Compressive Strength	30,000 psi	D-695
Ultimate Shear Strength	15,000 psi	D-732
Ultimate Flexural Strength	30,000 psi	D-790
Specific Gravity	1.5	D-792

2. **The design of all components shall use a factor of safety of 4.0 based on the ultimate strength.**
3. The average Barcol hardness of the laminate shall be no less than 30. The Barcol Impressor, Model GYZJ 934-1, shall be used for the determination of the hardness. Calibration of the Barcol instrument shall be verified by comparing a blank specimen having a known hardness reading of 85 - 87. For each fiberglass component, ten (10) readings on the clean laminate surface shall be made. After eliminating the two high and two low readings, the average of the remainder shall be the reported hardness reading.

2.04 Prefabricated Fiberglass Structural Components

- A. Prefabricated structural components used in the manufacture of all fiberglass products shall be made of polyester resin reinforced with glass fibers and produced by a continuous forming process.

B. Prefabricated structural components shall have the following physical properties:

Physical Property	Value	ASTM Standard
Water Absorption, 24 hours	0.75%	D-570
Ultimate Tensile Strength	30,000 psi	D-638
Ultimate Compressive Strength	30,000 psi	D-695
Ultimate Shear Strength	4,500 psi	D-732
Ultimate Bearing Strength	30,000	
Specific Gravity	1.5	D-792
Barcol Hardness	50	

C. *The design of all components shall use a factor of safety of 4.0 based on the ultimate strength.*

2.05 Fasteners

A. Chemical Application Areas

1. All fasteners used in the assembly and erection of fiberglass reinforced plastic products, in chemical application areas, shall be **chemical and corrosion resistant fasteners**, provided by the manufacturer, for the particular type of chemical being used in an area.

B. Non-Chemical Application Areas

1. ***All fasteners used in the assembly and erection of fiberglass reinforced plastic products, in non-chemical application areas, shall be Type 316 stainless steel.***

C. A ratio of fastener diameter to fiberglass thickness (D/t) of no less than one (1) shall be used.

3. EXECUTION

3.01 Inspection

- A. ***The FRP products shall be inspected by the manufacturer prior to delivery*** and by the Contractor at time of delivery to ensure that the products are free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burrs, air bubbles and pits.
- B. ***Any defective or improperly fabricated FRP products shall either not be shipped from the manufacturer or shall be returned to the manufacturer, by the Contractor, at the time of delivery.*** All FRP products shall be “new” and any defective grating or ancillary materials shall be rejected and replaced immediately ***at no additional cost to the Owner.***

3.02 Installation

- A. The Contractor shall install all grating and ancillary materials in strict accordance with the manufacturer’s instruction and erection drawings. Fiberglass products shall be installed at the locations shown on the Contract Drawings.
- B. ***All work shall be erected level and plumb, and shall meet required heights, layout and details precisely.*** All work shall be adequately fastened, anchored or braced. All fasteners shall be corrosion resistant and compatible for use with the fluid or chemical being used in the area of erection. All fasteners shall be as indicated in Article 2.05 herein.
- C. All work shall be executed in accordance with the best practices of the trade, by persons skilled in the craft.
- D. Installation shall be in strict accordance with the manufacturer’s instructions and recommendations.

3.03 Inspection and Testing

- A. A final acceptance test shall demonstrate that the fiberglass products have been properly installed, are structurally sound and secure, are in the correct alignment and meet the loading requirements specified herein.

END OF SECTION

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SECTION 06605

FIBERGLASS REINFORCED PLASTIC (FRP) GRATING

1. GENERAL

1.01 Description

- A. Furnish all labor, materials, equipment and incidentals to fabricate and install fiberglass reinforced plastic (FRP) grating, and associated miscellaneous items specified herein, with all appurtenances, accessories and incidentals necessary to produce a complete, operable and serviceable installation as shown on the Contract Drawings and as specified herein, and in accordance with the requirements of the Contract Documents.

1.02 Quality Assurance

A. Reference Standards

1. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM D-635	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM E-84	Standard Test Method for Surface Burning Characteristics of Building Materials
Other Standards	
	National Bureau of Standards, Voluntary Product Standard PS 15
	OSHA Standards (pertaining to worker safety and walking/working surfaces)
	Florida Building Code

- B. Obtain each type of material (grating, embedding frames, plates, etc.) through **one source from a single manufacturer.**
- C. **The Contractor shall verify all dimensions for grating, plates, etc. by field measurements prior to preparation of shop drawings and fabrication.** Coordinate the fabrication schedule with the construction progress to avoid delaying the Work. Where field dimensions cannot be made without delaying the Work, establish dimensions and proceed with fabricating said materials without field measurements. Coordinate construction to ensure that the actual dimensions correspond to the established dimensions.

1.03 Qualifications and Experience of the Manufacturer

- A. The Manufacturer shall be a specialist in the design and fabrication of fiberglass reinforced plastic (FRP) grating and structural shapes intended for use in wastewater applications, and **shall have at least five (5) years experience in this specialty.**
- B. The Manufacturer shall have such production facilities as will insure prompt manufacture and shipment of these fiberglass products. The Manufacturer shall continually monitor production in order to insure that the control of quality is maintained. Upon request, the Manufacturer shall furnish certified test reports on the raw materials used in fabrication.
- C. **The Manufacturer shall have on his staff a full-time registered professional engineer having no less than five (5) years experience in the design and fabrication of fiberglass reinforced plastic products,** who will be in responsible engineering charge of the work to be done. **All shop drawings shall carry the seal of such registered Professional Engineer.**

1.04 Shop Drawings

- A. Prior to beginning fabrication, the Manufacturer shall submit a complete set of detailed shop drawings for the FRP products to be furnished in accordance with Section 01300, "Shop Drawings, Submittals and Samples". The shop drawings shall include, at a minimum, the following:
 - 1. Structural engineering calculations and a structural grating support design by a Structural Engineer registered in the State of Florida.
 - 2. Load and deflection tables.
 - 3. Material sizes, types and styles, dimensions and thicknesses.

4. ***The manufacturer shall provide color samples for selection by the Engineer and Owner.***
 5. Part or catalog numbers.
 6. The Contractor shall submit complete fabrication, placing and erection drawings showing the locations of all fabricated items including location, type and sizes of fasteners, clips, angles, member sizes and connection details. Reproductions of the Contract Documents will not be accepted for this purpose.
- B. The Contractor shall submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.
- C. The Contractor shall submit sample pieces of each item specified herein for acceptance by the Engineer as to quality and color. Sample pieces shall be manufactured by the method to be used in the Work.
- D. ***The shop drawings must be approved by the Engineer before production may proceed.***

1.05 Product Delivery and Storage

- A. The manufacturer shall examine all FRP products and components prior to packaging and delivery to the Project Site and shall ***provide a letter to the Engineer***, submitted at the time of shipping, indicating that the products produced meet the requirements of the specifications, were examined prior to delivery, and were shipped free of defects and of high workmanship quality.
- B. All equipment and accessories shall be ***properly protected so that no damage or deterioration will occur during a prolonged delay*** from the time of shipment until installation is complete and the equipment is ready for operation.
- C. Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer.
- D. Upon delivery of the FRP components to the Project Site, ***the Contractor shall inspect the components for damage during transit***. If damage has occurred, the FRP components shall be returned to the manufacturer and components shall be provided at no additional cost to the Owner.

- E. The Contractor shall handle the FRP components during delivery, storage and installation in a manner to prevent damage of any nature in accordance with the manufacturer's approved written instructions and in accordance with instructions given on-site by the manufacturer's representative. All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage.
- F. Store items in an enclosed area, **off of the ground**, and free from contact with soil and water.
- G. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility between 70 and 85°F (21 and 29°C) until they are required.

1.06 Warranty and Guarantee

- A. ***The Manufacturer shall guarantee workmanship and materials on the finished fiberglass reinforced plastic products for a minimum period of five (5) years from the date of Final Project Acceptance by the Owner.***
- B. If defects appear within the warranty/guarantee period, the ***Manufacturer shall proceed to replace said components or equipment, upon written notice from the Owner that such defects have been found, immediately, and at no additional cost to the Owner.***
- C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.
- D. Refer to the General Conditions for additional guarantee and warranty requirements as well as Section 01740, "Warranties and Bonds".

2. PRODUCTS

2.01 General

- A. Products shall be furnished by manufacturers having a minimum of five (5) years experience in the manufacture of similar items with a record of successful installations.
- B. Support members shall be as designed for the particular application by the fabricator to ensure functionality, integrity and structural stability.

2.02 Materials

A. Grating

1. Reference is made here to Division 5, "Metals", for requirements of material fastenings. All metal fastening systems and hardware shall be corrosion resistant and suitable for use with sodium hypochlorite, biosolids and raw wastewater.
2. All fiberglass grating, located where indicated on the Contract Drawings, shall be a ***minimum of 1½-inches in depth***, and able to ***withstand a 350 lb. concentrated load and a 150 lb/ft² uniformly distributed load on a four (4) foot span with a deflection no greater than 0.15 inches under the concentrated load.***
3. The depth of the fiberglass grating shall be determined by the manufacturer in accordance with the span and load requirements shown on the Contract Drawings.
4. The fiberglass grating shall be pulltruded from standard fiberglass chemical resistant vinylester resin which meets ASTM E-84, Class 1, Flame Rating, and self-extinguishing requirements of ASTM D-635.
5. Cut edges or cut openings shall be sealed.
6. The grating shall be manufactured with an integral grit molded into the surface to provide an non-skid walking surface. Color shall be selected by the Owner.
7. Grating support members shall be of similar resin material as grating, fastened to concrete as per manufacturer's recommendations.
8. FRP grating, supports and associated ancillary materials shall be as manufactured by Fibergrate Composite Structures, Inc.; American Grating; Safe-T Gate, Seasafe, Inc.; Imco Reinforced Plastics; or equal.

B. Fiberglass Structural Shapes (as applicable)

1. Structural FRP members supplied under this specification section shall be manufactured using the "*pulltrusion*" process. The composite shall consist of a glass fiber reinforced vinylester resin matrix, approximately fifty percent (50%) resin to glass ratio.
2. Glass reinforcement shall be of three varieties:
 - a. A surface mat shall be used on all exterior surfaces for maximum chemical resistance.
 - b. Continuous strand mats shall be used internally for transverse strength.

- c. Continuous glass strand rovings shall be used internally for longitudinal strength.
- 3. Resin shall be a polyester material, possessing inherent ultraviolet (UV-8), fire, and chemical resistance. Material shall be fire rated for Class I flame spread and flammability ratings as per ASTM E-84 and D-635.
- 4. The following minimum mechanical properties shall apply:

Mechanical Property	Value
Ultimate Tensile Strength (longitudinal direction)	30,000 psi
Ultimate Tensile Strength (transverse direction)	9,000 psi
Ultimate Tensile Strength (full section in bending)	25,000 psi
Ultimate Compressive Strength (longitudinal direction)	30,000 psi
Ultimate Compressive Strength (transverse direction)	18,000 psi
Ultimate Compressive Strength (full section in bending)	25,000 psi
Ultimate Shear Strength (either direction)	4,500 psi
Ultimate Bearing Strength (either direction)	30,000 psi
Modulus of Elasticity (full section in bending)	2.8 x 10 ⁶
Barcol Hardness Test	50

2.03 Fabrication

A. Measurements

- 1. Grating supplied shall meet the dimensional requirements and tolerances as shown or specified.
- 2. ***The Contractor shall provide and/or verify measurements “in the field” for work fabricated to fit field conditions as required by grating manufacturer to complete the Work.***

B. Layout

- 1. ***Each grating section shall be readily removable by a single man without any mechanical assistance***, except where indicated on Contract Drawings.

2. The manufacturer shall provide openings and holes where located on the contract drawings or as required to meet the requirements of this specification section.
3. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.
4. ***All FRP grating shall be fabricated free from warps, twists, or other defects which affect appearance and serviceability.***

C. Sealing

1. All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance.
2. All field fabricated grating cuts shall be coated similarly by the Contractor in accordance with the manufacturer's instructions.

D. Hardware

1. Chemical Application Areas

- a. Chemical and corrosion resistant hold-down clips shall be provided by the grating manufacturer, for the particular type of chemical being used in an area, and spaced at a maximum of four (4) apart with a minimum of four (4) per piece of grating, or as recommended by the manufacturer.

2. Non-Chemical Application Areas

- a. ***Type 316 stainless steel hold-down clips*** shall be provided and spaced at a maximum of four (4) apart with a minimum of four (4) per piece of grating, or as recommended by the manufacturer.

3. EXECUTION

3.01 Inspection

- A. The grating shall be inspected by the manufacturer prior to delivery and by the Contractor at time of delivery to ensure that the grating is free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin

burrs, air bubbles and pits. The surface of the grating shall have an integral grit finish so as to provide a non-skid walking surface.

- B. Any defective or improperly fabricated grating shall either not be shipped from the manufacturer or shall be returned to the manufacturer, by the Contractor, at the time of delivery. **All grating shall be "new"** and any defective grating or ancillary materials shall be rejected and replaced immediately at no additional cost to the Owner.

3.02 Installation

- A. The Contractor shall install all grating and ancillary materials in strict accordance with the manufacturer's instruction and erection drawings.
- B. All work shall be erected **level and plumb**, and shall meet required heights, layout and details precisely. **All work shall be adequately fastened, anchored or braced. All fasteners shall be corrosion resistant and compatible** for use with the chemicals (sodium hypochlorite, sodium hydroxide, sulfuric acid, etc.), domestic biosolids or raw wastewater being used in the area of erection.
- C. All work shall be executed in accordance with the best practices of the trade, by persons skilled in the craft.
- D. Fiberglass grating, fiberglass structural members and other fiberglass products shall be designed and installed at the locations shown on the Contract Drawings.

3.03 Final Inspection and Testing

- A. A final acceptance test shall demonstrate that the fiberglass products have been properly installed, are structurally sound and secure, are in the correct alignment and meet the loading requirements specified herein.

END OF SECTION

SECTION 06700

CHEMICAL STORAGE TANKS (HDLPE)

1. GENERAL

1.01 Description

A. Scope of Work

1. Furnish all labor, materials, appurtenances and accessories required to install "**new**" and "**unused**", upright, high density linear polyethylene (HDLPE) single walled, flat bottom chemical storage and day tanks for the following chemical(s) at the following locations as shown on the Contract Drawings and as specified herein.

No. of Tanks	Volume (gal)	Chemical	Location
1	1,550	Hydrofluosilicic Acid	Chemical Storage & Pumping Room
1	1,550	Corrosion Inhibitor (phosphate)	Chemical Storage & Pumping Room
2	60	Day Tank	Chemical Storage & Pumping Room

The containment tank shall be designed to hold a minimum of 115% of the normal fill capacity of the primary tank.

The tank shall be manufactured and equipped for storage and use of dewatering polymer and shall have a specific gravity of 1.9.

- B. The tank shall be molded in one-piece seamless construction by rotational molding. The tank shall be designed for above-ground, vertical installation and are capable of containing the chemical at atmospheric pressure. The tank system shall be designed to prevent rainwater from entering the containment tank.
- C. The tank(s) shall be manufactured and equipped for the storage of chemicals as noted.
- D. The chemical storage tank(s) and all associated piping shall meet the requirements of ANSI/NSF Standard 14 or Standard 61.
- E. ***All above grade chemical piping shall be insulated using polyurethane foam with a density of 2.0 - 3.0 lb/ft³ with a "R" value of 8.33/in and a nominal thickness of 1-inch.***

F. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
01650	Materials and Equipment
Division	Information
11	Equipment
15	Process and Utility Piping, Fittings, Valves and Accessories
Contract Drawings and General Provisions of the Contract	

1.02 **Quality Assurance**A. Standards

1. All work shall be executed and installed in accordance with the requirements of applicable codes. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM D-618	Conditioning Plastics and Electrical Insulating Materials for Testing
ASTM D-638	Tensile Properties of Plastics
ASTM D-790	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D-883	Definitions of Terms Relating to Plastics
ASTM D-1505	Density of Plastics by the Density-Gradient Technique
ASTM D-1525	Test Method for Vicat Softening Temperature of Plastics
ASTM D-1693	Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D-1998	Standard Specification for Polyethylene Upright Storage Tanks
ASTM D-2837	Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Mat'l's
ASTM D-3892	Practice for Packaging/Packing Plastics
ASTM F-412	Definitions of Terms Relating to Plastic Piping Systems

STANDARD	DESCRIPTION
Association of Rotational Molders (ARM) Standards	
	Low Temperature Impact Resistance (Falling Dart Test Procedure)
American National Standard Institute (ANSI)	
B-16.5	Pipe Flanges and Flanged Fittings
Occupational Safety and Health Administration (OSHA) Standards	
29 CFR 1910.106	Flammable and Combustible Liquids
Other Standards	
	Florida Building Code
	Uniform Building Code (Latest Edition)

B. Chemical Compatibility

1. Chemical compatibility shall be according to the following chemical resistance guides:
 - a. Pruett, Kenneth M., "Chemical Resistance Guide for Elastomers", Compass Publications.
 - b. Pruett, Kenneth M., "Compass Corrosion Guide II", Compass Publications.
2. These references shall be considered as general guidelines only.

C. Equipment Manufacturer

1. All chemical storage tanks required as part of this project shall be provided by one (1) manufacturer. The plastic chemical storage tanks shall be as manufactured by one of the following manufacturers:
 - a. Chem-Tainer Ind., Inc., Babylon, N.Y.
 - b. Snyder Industries, Inc., Lincoln, Nebraska.
 - c. Harrington Industrial Plastics, Chino, CA
 - d. Approved equal.

1.03 Submittals

A. Shop Drawings and Manufacturers Literature

1. For all equipment to be furnished under this Section, the Contractor shall submit all material required to establish compliance with this Section and Section 01300, "Shop Drawings, Submittals and Samples".
2. A detail of the intended support members with certification demonstrating their adequacy for the application and intended loads.
3. Submit color samples for selection of colors and manufacturer's recommendations for the chemical(s) being stored in said tank(s).

1.04 Product Marking, Packing and Packaging

- A. Each chemical storage tank shall be marked to identify the product, date (month and year) of manufacture, capacity, and serial number. Each chemical storage tank shall be shipped with a 3 of 9, HRI bar code label containing tank description, manufacturing order number, part number, serial number, manufacturer, and date.
- B. The proper caution or warning signs, as prescribed by OSHA standard 29 CFR 1910.106, shall be provided.
- C. All packing, packaging, and marking provisions of ASTM Practice D-3892 shall apply to this standard.
- D. ***Each tank shall be shrink-wrapped and bagged prior to delivery.***

1.05 Product Delivery, Storage and Handling

- A. The high density linear polyethylene tank(s) (HDLPE) and all accessories shall be factory assembled and tested and shall be delivered to the site for installation fully assembled.
- B. The high density linear polyethylene tanks shall be capable of being set in place and field erected by the Contractor with only minimal field assembly.
- C. All equipment and accessories shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the equipment is ready for operation.

- D. Upon delivery of the tank(s) to the Project Site, the Contractor shall inspect the tank(s) for damage during transit. If damage has occurred, the tank(s) shall be returned to the manufacturer and a new tank(s) shall be provided at no additional cost to the Owner.
- E. The Contractor shall handle during deliver, storage and installation in a manner to prevent damage of any nature in accordance with the manufacturer's approved written instructions and in accordance with instructions given on-site by the manufacturer's representative.

1.06 Warranty and Guarantees

- A. All equipment supplied under this Section shall be **warranted for a period of five (5) years by the manufacturer and Contractor. The warranty period shall commence upon Final Project Acceptance by the Owner.**
- B. **The equipment shall be warranted to be free from defects in workmanship, design and materials.** If any part of the equipment should fail during warranty period, it shall be replaced at no expense to the Owner.
- C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed. Refer to the General Conditions for additional guarantee and warranty requirements as well as Section 01740, "Warranties and Bonds".

2. PRODUCTS

2.01 General

- A. **The chemical storage tank(s) and all equipment, accessories and hardware shall be non-corrosive and compatible with the chemical being stored.**
- B. **The chemical storage tank(s) shall be complete including all specified accessories.** The tank(s) shall be designed and proportioned to have liberal strength, stability and stiffness and to be especially adapted to the work to be done and chemical to be stored.
- C. **The finished surfaces shall be free from visual defects** such as foreign inclusions, air bubbles, pin holes and craters.
- D. The chemical storage tank(s) shall be constructed of linear, high density polyethylene (HDLPE) with welded components, suitable for installation as shown on the Contract Drawings.

- E. Each tank shall have a diameter and height or length (straight side) and minimum capacity as specified herein. ***Flexible connections to the tanks shall be provided by the Contractor in accordance with the manufacturer's recommendations.***

F. Design Requirements

1. The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the following equation, but shall not be less than 0.40 inches thick:

$$T = P \times OD/2 SD = 0.433 \times SG \times H \times OD/2 SD$$

Where: T = Wall thickness (inches)

SD = Hydrostatic design stress (psi)

P = Pressure = $0.433 \times SG \times H$ (psi)

H = Fluid head (feet)

SG = Specific gravity (g/cm³)

OD = Outside diameter (inches)

2. The hydrostatic design stress shall be determined by multiplying the hydrostatic design basis, determined by ASTM D-2837 using rotationally molded samples, with a service factor selected for the application. The hydrostatic design stress is 600 psi at 73°F. In accordance with the formula in Article 2.01(D)(1), the tank shall have a stratiform (tapered wall thickness) wall.
3. The hydrostatic design stress shall be derated for service above 100°F and for mechanical loading of the tank.
4. The standard design specific gravity shall be 1.9.
5. The minimum required wall thickness for the cylinder straight shell must be sufficient to support its own weight in an upright position without any external support. Flat areas shall be provided to allow locating large fittings on the cylinder straight shell.
6. The top head must be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall. The tank top shall be configured to prevent rainwater from entering. The top head of tanks with 2,000 or more gallons of capacity shall be designed to provide a minimum of 1,300 square inches of flat area for fitting locations.

7. Tanks with 2,000 or more gallons of capacity shall have a minimum of three (3) lifting lugs integrally molded into the top head. The lifting lugs shall be designed to allow erection of an empty tank.
8. The tank shall be designed to provide a minimum of four (4) tie-down lugs integrally molded into the top head. The tie-down lugs shall be designed to allow tank retention in wind and seismic loading situations without tank damage. Refer to Article 2.04(I) for tank tie-down accessories.

G. Dimensions and Tolerances

1. All dimensions will be taken with the tank in the vertical position, unfilled. The tank dimensions will represent the exterior measurements.
2. The tolerance for the outside diameter, including out of roundness, shall be per ASTM D-1998.
3. The tolerance for fitting placements shall be $\pm \frac{1}{2}$ -inch in elevation and 2° radial at ambient temperature.

H. Test Methods

1. Test specimens shall be taken from fitting location areas or piggy-back test molds.
2. Low Temperature Impact Test
 - a. Test specimens shall be conditioned at -40°F for a minimum of two (2) hours.
 - b. The test specimens shall be impacted in accordance with the standard testing methods as found in ASTM D-1998.
 - c. Test specimens with a thickness less than $\frac{1}{2}$ -inch shall be tested at 100 ft.-lb.
 - d. Test specimens with a thickness greater than $\frac{1}{2}$ -inch shall be tested at 200 ft.-lb.
3. Ultrasonic Tank Thickness Test
 - a. All tanks shall be measured for tank wall thickness at 6-inches, 1 foot, 2 feet and 3 feet on the tank sidewall height at 0° and 180° around the tank circumference with 0° being the tank manway and going counter-clockwise per ANSI standard drafting specifications.

- b. ***All tanks shall meet design thickness requirements and tolerances and a test report provided upon delivery of the tank(s).***

4. Hydrostatic Water Test

- a. ***The hydrostatic water test shall consist of filling the tank to brim full capacity for a minimum of four (4) hours and conducting a visual inspection for leaks.***

I. Workmanship

1. The finished tank wall shall be free of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delaminations that will impair the serviceability of the vessel.
2. All cut edges where openings are cut into the tanks shall be trimmed smooth.

- J. ***The tank supports shall be able to withstand normal lifting and handling loads without distortion or cracking.***

- K. ***All materials shall be compatible and non-corrosive with the chemical being stored within.***

L. Tank Specifics

1. The chemical storage tank(s) required for this Project shall be ANSI/NSF 61 certified and shall meet the following specifications:
2. Hydrofluosilicic Acid Chemical Storage Tank

Property	Value
Chemical to be Stored	Hydrofluosilicic Acid
Type of Tank	Dish top, flat bottom, single-wall containment
No. of Tanks	1
Diameter	60 - 96 inches
Height	84 - 120 inches
Capacity	1,550 gallons

3. Corrosion Inhibitor Chemical Storage Tank

Property	Value
Chemical to be Stored	Corrosion Inhibitor (polyphosphate-based)
Type of Tank	Dish top, flat bottom, single-wall containment
No. of Tanks	1
Diameter	60 - 96 inches
Height	84 - 120 inches
Capacity	1,500 gallons

4. Chemical Storage Day Tanks

Property	Value
Chemical to be Stored	One for each chemical (Hydrofluosilicic Acid; Corrosion Inhibitor)
Type of Tank	Dish top, flat bottom, single-walled containment
No. of Tanks	2
Capacity (each)	60 gallons

M. The following chemical(s) and volume(s) shall be delivered and installed in each of the chemical storage tank(s), by the Contractor, as part of this Project:

Chemical	Volume (gallons)	Storage Tank Location
Hydrofluosilicic Acid*	1,250	Operation Bldg - Chem. Storage Room
Corrosion Inhibitor*	1,250	Operation Bldg - Chem. Storage Room

* The Contractor shall coordinate purchase of this chemical with the City of Sanford and shall use their chemical provider to ensure that the exact same chemical, currently being used at the Sanford Main WTP, is purchased and conveyed into the chemical storage tank to be provided as part of this improvements project.

2.02 Materials and Equipment

A. Size and Capacity

- Each tank shall have a minimum capacity, straight side height, and bottom and top construction as noted above in Article 2.01.

B. Resin

1. The resin to be used in the fabrication of the chemical storage tank(s) shall be virgin, pellet/powder, linear high density polyethylene (specific gravity = 1.9), fully formulated, with low warpage and shrinkage.
2. All polyethylene resin material shall contain the highest level of UV stabilizer manufactured as compounded by the resin manufacturer. Pigments added for tank coloring shall not exceed 0.25% (dry blended) of the total weight.
3. The chemical storage tank(s) shall be suitable for outdoor chemical storage applications, as noted on the Contract Drawings, and shall be food contact approved. The tank color shall be as selected by the Owner (manufacturer's recommendations for the chemicals being stored in said tanks shall be submitted).
4. Typical mechanical properties of the HDLPE tank material shall be as follows:

Property	ASTM	Value
1. Density (resin)	D-1505	0.94 - 0.947 g/cm ³
2. Tensile (Yield Stress 2"/min)	D-638	2,700 psi
3. Elongation at Break (2"/min)	D-638	350%
4. ESCR (100% Igepal, Condition A, F50)	D-1693	400 - 1,000 hours
5. ESCR (100% Igepal, Condition A, F50)	D-1693	200 - 500 hours
6. Vicat Softening Temperature (°F)	D-1525	235
7. Flexural Modulus	D-790	97,000 - 103,000 psi

2.03 Tank Fittings (Nozzles)**A. Threaded Bulkhead Fittings**

1. Threaded bulkhead fittings are available for below liquid installation depending on the tank diameter and the placement of the fitting in the tank. Fittings must be placed away from tank knuckle radius' and flange lines.
2. The maximum allowable size for bulkhead fittings placed on a curved cylindrical section of tanks with diameters of forty-eight (48) to one hundred forty-two (142) inches in diameter is two (2) inches in size.
3. The tank wall thickness must be considered for bulkhead fitting placement. The maximum wall thickness for each fitting size is shown:

Fitting Size (inches)	Maximum Wall Thickness (inches)
0.50	0.750
0.75	0.875
1.00	0.875
1.25	0.875
1.50	0.875
2.00	1.000
3.00	1.125 (flat surface only)

- The bulkhead fittings shall be constructed of PVC, CPVC, PP, or other specified material recommended by the manufacturer for the chemical to be stored. Gaskets shall be a minimum of ¼-inch in thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton, other material recommended by the manufacturer for the chemical to be stored.

B. Bolted Double 150 lb. Flange Fittings

- Bolted double flange fittings are required for below liquid level installation for sizes between two (2) and four (4) inches depending on the tank diameter and the placement of the fitting in the tank.
- Fittings must be placed away from tank knuckle radius' and flange lines.
- Allowable fittings sizes based on tank diameter for curved surfaces are shown in the following table:

Tank Diameter (inches)	Maximum Bolted Fitting Size Allowable (inches)
48 - 86	3
90 - 102	6
120 - 142	8

- The bolted double flange fittings shall allow tank wall thickness up to 2½ inches.
- The bolted double flange fitting shall be constructed with two (2) each, 150 lb. flanges, two (2) each 150 lb. flange gaskets, and the correct number and size of all-thread bolts for the flange specified by the flange manufacturer. The flanges shall be constructed of PVC Type I, Grade I or other material recommended by the manufacturer for the chemical to be stored. Gaskets shall be a minimum of ¼-inch

in thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton or other material recommended by the manufacturer for the chemical to be stored. There shall be a minimum of four (4) each full thread bolts. The bolts shall have either gasketed flanged metal heads or bolt heads encapsulated in Type II polyethylene material. The encapsulated bolt shall be designed to prevent metal exposure to the liquid in the tank and prevent bolt rotation during installation. The polyethylene encapsulation shall fully cover the bolt head and a minimum of ¼-inch of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material (White - Type 316 stainless steel; Yellow - Hastelloy C276; Red - Monel; Green - Titanium). Each encapsulated bolt shall have a gasket to provide a sealing surface against the inner flange.

6. The standard orientation of the bolted double flange fittings shall have bolt holes straddling the principal centerline of the tank in accordance with ANSI/ASME B-16.5 unless otherwise specified.

C. Bolted Stainless Steel Fittings

1. Bolted stainless steel fittings are available for below liquid level installation depending on the tank diameter and the placement of the fitting in the tank, and compatibility with the chemical being stored.
2. Fittings must be placed away from the tank knuckle radius' and flange lines.
3. Allowable fittings sizes based on tank diameter for curved surfaces are indicated in the table below:

Tank Diameter (inches)	Maximum Bolted Fitting Size Allowable (inches)
48	3
64 - 142	4

4. The bolted stainless steel fittings shall allow tank wall thickness up to 2½ inches.
5. The bolted stainless steel fittings shall be constructed with a minimum of four (4) fully threaded ⅜-inch studs. Each fitting shall have two (2) gaskets and two (2) flanges. One (1) gasket shall be compressed between the inside of the tank wall surface and the inside flange of the fitting. The other gasket shall be compressed between the outside tank wall surface and the outside flange of the fitting. The stainless steel fittings shall come standard with female pipe threads on both the inner and outer flanges. **The fittings shall be constructed of Type 316 stainless steel.** Gaskets shall be a minimum of ¼-inch in thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton or other material recommended by the manufacturer for the chemical to be stored.

D. Siphon Tube Fittings

1. Siphon tubes, if specified, shall allow these fittings, when used as drainage fittings, to provide better tank drainage.

E. Unitized Molded Outlet Fittings

1. The Unitized Molded Outlet fitting shall be an integral part of the tank and provide complete drainage of liquid through the sidewall of a flat bottom container without the use of a special support structure or concrete pad.
2. The standard outlet provided shall be a PVC socket which allows solvent weld PVC pipe attachments at the tank pad level. These fittings may be installed only at four (4) locations on the tank (0°, 90°, 180°, 270° around the tank) at the tank pad level. This method shall provide a metal reinforcement completely isolated from any chemical attack.
3. The tank attachment shall be constructed from a Schedule 80 PVC male adapter (provides a schedule 80 pipe socket attachment), or approved equal
4. The fitting orifice shall not be less than Schedule 80 interior pipe size per ANSI B36.10-1979.
5. O-rings shall be constructed of 70 ± 5 durometer Viton or other material recommended by the manufacturer for the chemical to be stored.

F. Self-Aligning Threaded Bulkhead Fittings

1. Self-Aligning fittings are available for installation in vapor phase applications on curved surfaces depending on the spherical dome radius and the placement of the fitting on the tank dome. Fittings must be placed away from tank radius'.
2. The maximum allowable size for self-aligning fittings placed on a spherical section of the tank is shown below.

Tank Diameter (inches)	Maximum Bolted Fitting Size Allowable (inches)
45 - 48	2
64 - 142	3

3. The maximum thickness and installation angle for fitting sizes are presented in the table below:

Fitting Size (inches)	Maximum Angle (degrees)	Maximum Thickness (inches)
1	27	1.00
2	25	0.75
3	20	1.00

4. The self-aligning fittings shall be constructed of PVC or other specified material. Gaskets shall be a minimum of ¼-inch in thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton, or other material recommended by the manufacturer for the chemical to be stored.
- G. ***All tank fitting attachments shall be equipped with flexible couplers or other movement provisions provided by the tank manufacturer.*** The tank will deflect based upon tank loading, chemical temperature, and storage time duration. ***Tank piping flexible couplers shall be designed to allow four percent (4%) design movement.*** Movement shall be considered to occur both outward in tank radius and downward in fitting elevation from the neutral tank fitting placement.

2.04 Tank Attachments and Accessories

- A. ***Flexible connections to each chemical storage tank shall be provided by the Contractor in accordance with the manufacturer's recommendations.***
- B. A tank sight level gauge, and all associated appurtenance, shall be provided with each tank provided as part of this Project.
- C. Ultrasonic Level Indicator
 1. The ultrasonic level indicator shall consist of a two (2) or three (3) inch, 4 - 20 mA output PVC sensor and a 3½-inch digit display unit.
 2. The sensor shall be equipped with male pipe threads and be connected to the tank with a PE bulkhead fitting, or the sensor may be Teflon faced and flange bolted to the tank with encapsulated Type 316 stainless steel bolts. The sensor shall be connected to a display unit that is ***mounted at a location to be designated by the Engineer and Owner.***
 3. The display unit box shall be NEMA 4 rated and factory pre-wired for 110 VAC power. All connections shall be labeled to prevent errors in field installation. The display unit shall be preprogrammed for each individual the tank required by the Project.

4. The display will read directly in ***gallons***.
5. ***The signal, level of chemical, and chemical volume (in gallons via calculation) in each tank shall be incorporated into the facility's SCADA system.***

D. Bolted Sealed Top Manway

1. Sealed manways shall be provided in the location(s) identified on the Contract Drawings.
2. The sealed manway shall be constructed of polyethylene material.
3. The bolts shall be Isoplast or other material recommended by the manufacturer for the chemical to be stored.
4. The gaskets shall be closed cell or as recommended by the manufacturer for the chemical to be stored and shall be corrosion resistant materials.

E. External Fill Pipes

1. External fill pipes shall be installed in the locations and of the sizes indicated on the Contract Drawings.
2. All external fill pipes shall be supported at three (3) foot maximum intervals with a support structure independent of the tank (ground supported).
3. All external fill pipes shall be constructed of PVC or other material recommended by the manufacturer for the chemical to be stored and shall be corrosion-resistant materials.

F. Internal Down Pipes

1. Internal down pipes shall be installed in the locations and of the sizes indicated on the Contract Drawings.
2. All internal down pipes shall be supported at five (5) foot maximum intervals with a support structure welded to the inside of the primary tank. The support design may utilize a PVC clamp or other manufacturer recommended material for the intended use, function and chemical stored.
3. All internal down pipes shall be constructed of PVC or other material recommended by the manufacturer for the chemical to be stored and shall be corrosion-resistant materials.

G. Vents

1. ***Each tank shall be properly vented for the type of material and flow rates expected.***
2. The vents must comply with OSHA 1910.106 (F) (iii) (2) (IV) (9) normal venting for atmospheric tanks or other accepted standard, or shall be as large as the filling or withdrawal connection, whichever is larger but ***in no case less than one (1) inch nominal inside diameter.***
3. ***All vents shall have a “rain-cap” and be screened with a very fine mesh, non-corrosive material*** to eliminate the possibility of pests, insects, etc. from entering the tank.
4. All vents shall be constructed of PVC or other material recommended by the manufacturer for the chemical to be stored.

H. Flange Adapters

1. Flange adapters shall be provided as indicated on the Contract Drawings or as required to adapt threaded or socket fitting outlets to 150 lb. flange connections for connection to piping system components.
2. Flange adapters are available in PVC, CPVC or other material recommended by the manufacturer for the chemical to be stored.
3. Flange adapter construction shall utilize Schedule 80 components.

I. Tank Ladders

1. Tank ladders shall be provided for each tank and be constructed of FRP or other specified material and shall be compatible and non-corrosive with respect to the material being stored within.
2. Safety cages, if required and shown on the Contract Drawings, shall be provided with ladders and shall be constructed of the same material as the ladder.
3. All ladders shall be designed to meet applicable OSHA standards (Reference: OSHA 2206; 1910.27; Fixed ladders).
4. Ladders shall be mounted to the tank in a manner to allow for tank expansion and contraction due to temperature and loading changes. All top ladder mounts shall be connected to integrally molded in attachment lugs that allow for tank movement.

J. Tie-Down Systems

1. ***The tie down system shall be designed to withstand 140 MPH wind loads.*** Tie down systems must meet Seismic Zone 4 requirements per UBC 1993 code.
2. Anchor bolts shall be provided by the Contractor per the manufacturers instructions and the base plates required for the system.
3. The tie-down system shall be provided in either Type 316 stainless steel or other material recommended by the manufacturer for the chemical to be stored. The material shall be compatible and non-corrosive with respect to the material being stored within.

K. Tank Heating Systems - NOT USED

L. Equipment Platforms - NOT USED

M. Cone Bottom Tank Stands - NOT USED

N. Certification Plates

1. A corrosion resistant, non-metallic plate, suitable for use with the stored chemical, shall be installed below the storage tank nameplate. The following data shall be included on the certification plate:
 - a. Name of tank fabricator.
 - b. Date of manufacture.
 - c. Product to be stored.
 - d. Maximum allowable concentration, specific gravity, and temperature of the specified chemical solution that can be stored safely.
 - e. Mechanical properties of the polyethylene.

O. Fastening Hardware

1. All fastening hardware used to with the tank(s) shall be ***corrosion resistant and compatible for use with the chemical to be stored.***

P. Tank Lifting Lugs

1. Bulk tanks shall be provided with a suitable means to lift the tanks during shipping and handling that prevents distortion.
2. ***Any permanent lifting system such as lifting lugs shall be made of corrosion resistant material compatible with the chemical to be stored within.***

Q. The Contractor shall be responsible for coordinating all piping and equipment connections to the tank and the tank manufacturer shall provide all adapters, fittings, connectors, etc., necessary. ***All O-rings, gaskets, etc. for fittings shall be suitable for use with the chemical being stored within the tank(s).***

R. Chemical Storage Tank Gasket/Diaphragm

1. ***The Contractor shall install a non-degradable, non-corrosive gasket, between the chemical storage tank bottom and elevated housekeeping pad.***
2. The gasket shall be the same diameter as the chemical storage tank.

3. EXECUTION

3.01 Installation

- A. Upon delivery, check the chemical storage tanks closely for defects and damage.
- B. The tanks shall be installed in strict accordance with the manufacturer's instructions, and in the location shown on the Contract Drawings.
- C. The tanks shall be anchored to the floor as directed by the tank manufacturer for this application using materials and hardware that are corrosion resistant and suitable for use with the stored chemical.
- D. ***Flexible connections to each chemical storage tank shall be provided by the Contractor*** in accordance with the manufacturer's recommendations.
- E. All chemical feed pumping systems drawing chemical from these chemical storage tank(s), installed as a part of this Project, shall be vented into the chemical storage tank(s).

3.02 Inspection and Testing

- A. The tank shall be hydrostatically tested for leaks by filling with water in the presence of the Engineer. ***The tank shall be checked for leaks after it has been filled for at least forty-eight (48) hours. No leaks are permitted.***
- B. The Engineer may request that the beginning and end of this test be performed in his presence.
- C. If the tanks do not meet the specifications, corrective measures will be taken or the piece of equipment shall be removed and replaced with equipment which satisfies the conditions specified at no additional cost to the Owner.

END OF SECTION

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SANFORD MAIN WTP IMPROVEMENTS

SANFORD, FLORIDA



DIVISION 7

THERMAL AND MOISTURE PROTECTION

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DIVISION 7

THERMAL AND MOISTURE PROTECTION

<u>Specification Section</u>	<u>Title</u>
07050	Vapor Barrier
07100	Waterproofing
07210	Building Insulation
07214	Foamed-in-Place Masonry Wall Insulation
07221	Nailbase Insulation Panels
07270	Fire Stopping
07410	Metal Roof and Soffit Panels
07542	Thermoplastic Membrane Roofing
07600	Flashing and Sheet Metal
07620	Scupper Boxes and Downspouts
07900	Joint Sealants



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SECTION 07050

VAPOR BARRIER

1. GENERAL

1.01 Description

- A. Furnish all labor, materials, equipment and incidentals required to ***install vapor barrier under all floor/structure slabs and concrete pads***, and at other locations shown on the Contract Drawings.

1.02 Quality Assurance

A. Reference Standards

1. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM E-96	Standard Test Methods for Water Vapor Transmission of Materials
ASTM D-154	Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
ASTM D-1643	Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM D-1745	Plastic Vapor Retarders Used in Contact with Soil or Granular fill under Concrete Slabs
Other Standards	
ACI 302.1R-96	Addendum Vapor Retarder Location: For slabs with vapor-sensitive floor coverings, locate retarder in direct contact with the slab (not beneath a layer of granular fill).
	Florida Building Code

- B. For each type of material required for the work of this section, provide primary materials that are the products of one (1) manufacturer.
- C. Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the manufacturer.

2. PRODUCTS

2.01 Material

- a. The vapor barrier shall be a ***ten (10) mil polyethylene film, minimum***, or approved equal.

3. EXECUTION

3.01 Installation

- A. Earth and stone substrates shall be well compacted to produce an even, solid substrate. Remove loose aggregate or sharp protrusions. Concrete substrates shall be smooth or broom finished and monolithic. Remove standing water prior to membrane applications.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.
- C. Proceed with installation of the vapor barrier only after substrate construction and penetrating work have been completed. Place, protect and repair vapor barriers in accordance with manufacturer's instructions and ASTM E-1643.
- D. ***The polyethylene vapor barrier shall be applied parallel with the direction of the concrete pour, lapping adjacent sides and ends a minimum of twelve (12) inches.***
- E. ***Seal all joints with continuous approved four (4) inch wide plastic tape.***
- F. Place concrete within thirty (30) calendar days after the installation of the vapor barrier.
- G. Inspect the membrane and repair any damage with patches of the above referenced tape prior to placement of the concrete.

END OF SECTION

SECTION 07100

WATERPROOFING

1. GENERAL

1.01 Description

A. The Contractor shall furnish all labor, materials, equipment, ancillaries and incidentals and install ***waterproofing systems for concrete and concrete structures*** that prevents the passage of liquid water under hydrostatic pressure and a ***clear, waterproof coating system on the exterior walls of all buildings*** to be constructed.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
05810	Expansion Joint Cover Assemblies
07050	Vapor Barrier
07900	Joint Sealants
09000	Finish Schedule
09820	Cementitious Coating Systems for New Concrete Surfaces
09900	Painting
Division	Information
3	Cast-in-Place Concrete
Contract Drawings and General Provisions of the Contract	

1.02 Submittals

A. Shop Drawings

1. Copies of all materials required to establish compliance with the Contract Documents shall be submitted in accordance with the provisions of Section 00700,

“General Conditions, Section 00800, “Supplementary Conditions”, Section 00805, “FDEP Supplementary Conditions” and Section 01300, “Shop Drawings, Submittals and Samples”.

2. Submit product data for each type of waterproofing specified, including manufacturer's printed instructions for evaluating, preparing, and treating the substrate, technical data, and tested physical and performance properties.
3. Submit shop drawings showing locations and extent of waterproofing, including details for substrate joints and cracks, sheet flashings, penetrations, and other termination conditions.

B. Certification

1. Submit manufacturer's certifications that the material or products meet the specification requirements and will meet their intended purpose.

C. Samples

1. If requested by the Engineer, submit samples of material for approval.

D. Alternate Materials and Methods

1. If the Contractor wishes to submit an alternate method for waterproofing, he shall submit a request for approval of the alternate method, including a complete description of the proposed method, complete data on all materials required, and a statement listing any deduction from the contract price to be made if the alternate method is accepted.

1.03 Quality Assurance

A. Installer Qualifications

1. Engage an experienced Installer who is certified, in writing, by the waterproofing manufacturer as qualified to install the manufacturer's waterproofing.
2. Engage an experienced Installer who has completed similar waterproofing to that indicated for this Project and who is acceptable to waterproofing manufacturer.

B. Manufacturer Qualifications

1. Engage a firm experienced in manufacturing waterproofing materials similar to that indicated for this Project and that has a record of successful in-service performance.

- C. **Obtain waterproofing materials from a single manufacturer** regularly engaged in manufacturing waterproofing materials.

1.04 Delivery, Storage and Handling

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

1.05 Project Conditions

- A. Environmental Limitations
 - 1. Apply the waterproofing within the range of ambient and substrate temperatures recommended by the waterproofing manufacturer.
 - 2. **Do not apply waterproofing to a damp or wet substrate, when the relative humidity exceeds eighty-five percent (85%), or when temperatures are less than 5°F (3°C) above the dew point.**
 - 3. **Do not apply waterproofing in rain, fog, mist or snow or when such weather conditions are imminent during the application and curing period.**
- B. **Maintain adequate ventilation** during application and through complete curing of waterproofing materials.

1.06 Warranty and Guarantee

- A. General Warranty
 - 1. The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty

1. The Contractor shall furnish a ***special warranty/written guarantee for a period of five (5) years from the date of Final Project Acceptance by the Owner*** to correct and repair, at his own expense, any leaks that may occur in and around surfaces that are waterproofed.

2. PRODUCTS

2.01 Waterproofing System Materials

- A. Provide waterproofing materials recommended by the manufacturer to be fully compatible with and able to develop a bond to the substrate under the conditions of service and application required, as demonstrated by the waterproofing manufacturer based on testing and field experience.
- B. The bituminous coating shall be a standard product from Tnemec, Carboline, Induron, Devoe or approved equal.
- C. ***PPG Architectural Coatings, Perma-Crete Aqua-Pel Clear Water Repellent 4-6100, (uncolored/clear), shall be used for waterproofing of the exterior of all split-face CMU walls (Main WTP Operations Building) constructed under this Project.***
- D. Apply the waterproofing materials in accordance with the manufacturer's recommendations and Section 09900, "Painting".
- E. Joint Sealants and Grout
 1. Joint sealants shall be as specified in Section 07900, "Joint Sealants".
 2. Grout shall be as specified in Section 03600, "Grout".

3. EXECUTION

3.01 General

- A. Leakage tests, if they are specified, shall have been performed and any necessary remedial actions to achieve acceptable leakage rates shall have been completed prior to commencing waterproofing work.

- B. Waterproofing and concrete and construction joint repair shall be performed by workmen who are regularly engaged and specialize in the application of the materials specified herein.
- C. The materials and methods shall be as specified herein, unless they are contrary to the manufacturer's directions or to approved trade practice; or unless the Contractor believes they will not produce a watertight job which he will guarantee as required. Where any of the above conditions occur, the Contractor shall notify the Engineer in writing. Deviation from the procedure specified will be permitted only upon the Engineer's approval and providing the work is guaranteed by the Contractor as specified.
- D. If, prior to beginning work, the Contractor does not notify the Engineer in writing of any proposed changes, it will be assumed that he agrees that the materials and methods specified will produce the desired results, and he will furnish the required guarantee.

3.02 Examination of Surfaces

- A. Examine substrates, areas, and conditions under which waterproofing systems will be applied, with the Installer present, for compliance with the Contract Document and the manufacturer's requirements. ***Do not proceed with installation until unsatisfactory conditions have been corrected.***
- B. ***Do not proceed with installation until after the minimum concrete curing period recommended by waterproofing manufacturer.***
- C. Verify that the substrate is visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D-4263.
- D. Notify Engineer in writing of anticipated problems using waterproofing over substrate.

3.03 Surface Preparation

- A. Clean and prepare the substrate according to the manufacturer's recommendations. Provide a clean, dust-free, and dry substrate for waterproofing application.
- B. ***Mask off adjoining surfaces not receiving waterproofing to prevent spillage or overspray affecting other construction.***

- C. ***All surfaces to be waterproofed shall be free from mortar drippings, oil, earth, grease, form release agents, paints, films, protective coatings, efflorescence, laitance, other penetrating contaminants, etc.*** Remove fins, ridges, and other projections and fill all holes, honeycombs, aggregate pockets, other voids, loose aggregate, or other surface conditions which prevent satisfactory application of waterproofing materials.
- D. Check all surfaces to be waterproofed and notify the Engineer, in writing, if any surfaces are not suitable to receive waterproofing. Starting of the work shall constitute acceptance of the surfaces.

3.04 Concrete and Construction Joint Repair

- A. Where repair of concrete surfaces and/or construction joints is specified or required, the extent of this repair work will be determined in the field by the Engineer.
- B. ***During construction, all tanks, structures, buildings, etc. shall be thoroughly cleaned by the Contractor*** to allow inspection by the Engineer.

3.05 Waterproofing Systems

- A. Apply the following Waterproofing Systems:
 - 1. Apply a ***two-coat system of bituminous epoxy***, per the manufacturer's recommendations, to ***all exterior below grade concrete wall surfaces***.
 - 2. Apply a ***two-coat system of PPG Architectural Coatings, Perma-Crete Aqua-Pel Clear Water Repellent 4-6100 (uncolored/clear)***, per the manufacturer's recommendations, ***to the exterior split-face CMU walls of the following:***
 - a. Main WTP Operations Building.
 - 3. ***Apply a two-coat system of bituminous coating***, per the manufacturer's recommendations, ***to all interior wall surfaces of the following structures:***
 - a. Manholes
 - b. Inlets
 - c. Meter vaults
 - d. Valve vaults
 - e. Tank drain vaults
 - f. Etc.

B. Concrete Repair, Construction Joint Repair, and Waterproofing

1. Repair concrete, construction joints, prepare surfaces and apply a two-coat system of PPG's Perma-Crete Aqua-Pel Clear Water Repellent, 4-6100 or bituminous coating, as indicated above, per the manufacturer's recommendations.
2. Construction Joint Repair
 - a. The repair of construction joints or cracks shall consist of chisel routing centered on and along the line of the specified construction joint and/or crack to a maximum depth of $\frac{3}{4}$ -inches and width of $\frac{3}{4}$ -inches unless otherwise approved by the Engineer.
 - b. ***The routed joint shall be inspected and approved by the Engineer prior to any sealing work.*** The routed joint shall then be cleaned of oil, dirt, loose concrete and other debris, primed if required, and then sealed with a polyurethane or other approved joint sealant.
 - c. The sealant shall be applied to the $\frac{3}{4}$ -inch square groove per the manufacturer's recommendations and shall be compatible with the bituminous waterproofing system.
3. Concrete Repair
 - a. The repair of "honeycombed" or other designated concrete surfaces shall consist of removing old concrete with a chisel to a ***maximum depth of two (2) inches*** unless otherwise directed by the Engineer.
 - b. The deteriorated concrete shall be removed to expose a solid sound concrete surface.
 - c. The prepared surface shall be inspected by and approved by the Engineer prior to any repair work.
 - d. The area to be repaired shall then be primed with an approved bonding agent and patched with an approved non-shrink, non-metallic, cementitious grout to provide a smooth, even concrete surface.
 - e. ***The waterproofing shall not be applied until the grout has adequately cured.***

C. Application

1. Apply all materials in strict accordance with the manufacturer's printed instructions to obtain a seamless membrane free of entrapped gases.

2. Minimum coverage shall be not less than recommended by the manufacturer of the coating, and in any event, ***not less than ten (10) mils dry thickness per coat.*** The bituminous coating may be thinned a maximum of fifteen percent (15%) to facilitate placement, if approved by the manufacturer of the waterproofing material.

D. Field Quality Control

1. ***The Contractor will engage an independent testing agency to perform field inspections, sample and test materials being used, and report whether tested Work conforms to or deviates from requirements.***
2. ***The testing agency will verify thickness of waterproofing membrane.***
3. ***The Contractor shall correct all deficiencies in or remove waterproofing that does not comply with requirements,*** repair substrates, reapply waterproofing, and repair sheet flashings.
4. Additional testing, at the Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

E. Curing, Protection and Cleaning

1. ***Cure the waterproofing according to the manufacturer's recommendations,*** taking care to prevent contamination and damage during application stages and curing.
2. Provide temporary protection as may be required to prevent injury to the waterproofing that may result from subsequent construction operations until Final Project Acceptance by the Owner.
3. All temporary protection shall be removed when directed by the Engineer.

END OF SECTION

SECTION 07210

BUILDING INSULATION

1. GENERAL

1.01 Scope of Work

- A. Furnish all labor, materials, equipment and incidentals for the complete installation of "concealed" Building Insulation and related items as shown on the Contract Drawings and specified herein.
- B. This Section includes the following:
 - 1. Concealed Building Insulation
 - 2. Loose Fill Building Insulation
 - 3. Cavity Wall Insulation
- C. Related Work Specified Elsewhere
 - 1. Related work specified elsewhere includes:

Specification Section	Title
00700	General Conditions
03300	Cast-in-Place Concrete
04050	Masonry
04230	Reinforced Unit Masonry
04250	Masonry Building Insulation
06100	Rough Carpentry
07214	Foamed-in-Place Masonry Wall Insulation
09510	Suspended Acoustical Tile Ceilings
Contract Drawings and General Provisions of the Contract	

1.02 Submittals

- A. Submit manufacturer's literature including specifications, product data, catalog cut sheets and printed installation instructions for the same in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. Submit product test reports based on the evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.
- C. Submit research/evaluation reports for foam-plastic insulation to be used, if any.

1.03 Quality Assurance

A. Source Limitations

- 1. **Obtain each type of building insulation from a single source** with resources to provide consistent quality products complying with the requirements indicated without delaying the Work.

B. Fire-Test Response Characteristics

- 1. Provide insulation and related materials with the fire-test-response characteristics indicated below, as determined by testing identical products per the test method(s) indicated below, by United Laboratories (UL) or another testing and inspecting agency acceptable to all authorities having jurisdiction.
- 2. Identify materials with the appropriate markings of all applicable testing and inspecting agencies.
 - a. Surface-Burning Characteristics: ASTM E-84
 - b. Fire-Resistance Ratings: ASTM E-119
 - c. Combustion Characteristics: ASTM E-136
- C. The manufacturer shall be one that produces building insulation as a standard product and has been engaged in the practice of producing building insulation for a minimum of five (5) years under the current company name.

1.04 Delivery, Storage and Handling

- A. Do not deliver building insulation materials to the Project Site until they are needed for installation into the Project Work.

- B. **Protect insulation materials** from physical damage and from deterioration by moisture, soiling, and other sources.
- C. **Store building insulation materials inside and in a dry location.** Comply with the manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to the extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to the project site ahead of installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.
- E. In the event of damage, immediately remove damaged materials from the site and install "new", undamaged insulation at no additional cost of the Owner.

2. PRODUCTS

2.01 General

- A. Provide insulating materials that comply with the requirements and with the referenced standards.
- B. Pre-formed units shall be of the sizes to fit the applications indicated; selected from the manufacturer's standard thicknesses, widths, and lengths.

2.02 Insulating Materials

- A. Provide insulating materials that comply with requirements and with all referenced standards.
- B. Foam Board Insulation Materials
 - 1. Extruded polystyrene (XPS) cavity wall insulation board that complies with ASTM C-578, is manufactured using carbon black technology, and meets the following requirements indicated below:

- a. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
- b. Flame Spread Index (FSI): Class A, 0 to 25, when tested in accordance with ASTM E84.
- c. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
- d. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1-inch thickness at 75°F mean temperature.
- e. Board Size: 15¾-inch by 96 inch.
- f. Board Thickness: 1.75 inch.
- g. Board Edges: Square.
- h. For the Project Buildings
 - 1) Use an HCFC free blowing agent, sized to fit between the cavity wall reinforcing in masonry cavity walls.

C. Batt Insulation Materials

- 1. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at the Contractor's option.
- 2. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - a. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 - b. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - c. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
- 3. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 - a. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

4. **Flexible Blanket Insulation:** Thin profile insulation that conforms to complex shapes, unfaced; flame spread index of 5 (five) and smoke development index of 10 (ten) or less when tested in accordance with ASTM E84.

- a. Thickness: $\frac{3}{8}$ -inch.

D. Loose-Fill Insulation

1. Use one of the following types of loose-fill insulation:
 - a. Zonolite Masonry Insulation consisting of free flowing vermiculite complying with ASTM E84-96a and UL Designs U-901, U-904, and surface treated for water repellence and limited moisture absorption as manufactured by W.R. Grace & Co.
 - b. Expanded perlite complying with ASTM C-549, Type II (surface treated for water repellence and limited moisture absorption) or Type IV (surface treated for water repellency and limited dust generation during application).
2. The insulation material shall meet the following minimum requirements/conditions:

Parameter	Value
R-value (minimum)	5.9
U-value	0.17
Density (lb/ft ³) at 75°F	4.5 - 8.0
Flame Spread Rating	0
Fuel Contributed Rating	0
Smoke Developed Rating	0
Sound Transmission Rating (STC)	51

E. Additional Requirements for the Project Buildings

1. Blown-In Cellulose
 - a. Loose blown cellulose material consisting of a minimum 80% post consumer product conforming to ASTM C-739 with borate or ammonium sulfate as a fire retardant additive.
 - b. The material shall have a Class I rating per ASTM E-84.

2. Spray Applied Cellulose

- a. Self-supporting spray applied cellulose material consisting of a minimum 80% post consumer product conforming to ASTM C-1149 with borate or ammonium sulfate as a fire retardant additive.
- b. The material shall be installed using a Type I liquid adhesive. The installed assembly shall have a Class 1 rating per ASTM E-84.

3. Nailable Roof Insulation

- a. Vented assembly equal to Atlas Roofing Corporation, Vented-R complying with ASTM C1289-98 Type V.
- b. The material shall be a closed cell polyisocyanurate board bonded to $\frac{7}{16}$ -inch APA rated OSB with $\frac{3}{4}$ -inch vent cavity. Must be approved for use in FM 1-90 assemblies and as part of a Class A roof covering.

2.03 **Auxiliary Insulating Materials**

A. Eave Ventilation Troughs

1. Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

B. Adhesive for Bonding Insulation

1. Product with demonstrated capability to bond insulation or mechanical anchors securely to substrates indicated without damaging or corroding either insulation, anchors or substrates.

C. Adhesively Attached Pin Anchors

1. Perforated plate, 2 inches square, welded to projecting pin, with self-locking washer, complying with the following requirements:
 - a. Plate: Zinc-plated steel, 0.106-inch thick.
 - b. Pin: Copper-coated low carbon steel, fully annealed, 0-106 inches in diameter, length to suit depth of insulation indicated and, with washer in place, to hold insulation tightly to substrate behind insulation.

- c. Self-Locking Washer: Mild steel, 0.016-inch thick, size as required to hold insulation securely.

D. Protection Board

- 1. Premolded, semi-rigid asphalt/fiber composition board, 1/4-inch thick, formed under heat and pressure, standard sizes.

2.04 Insulation Fasteners

- A. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Insulation-Retaining Washers

- a. Self-locking washers formed from 0.016-inch (0.41mm) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1½ inches (38 mm) square or in diameter.
- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - 1) Crawlspace
 - 2) Ceiling plenums
 - 3) Attic spaces
 - 4) Where indicated

- 2. Anchor Adhesive

- a. A product with demonstrated capability to bond insulation anchors securely to the substrates indicated without damaging the insulation, fasteners, and substrates.

3. EXECUTION

3.01 Examination

- A. Examine all substrates and conditions, adjacent materials and insulation materials with the Installer present, for compliance with the requirements for Sections in which substrates and related work are specified and to determine if other conditions affecting performance of the installation are satisfactory.

- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.
- C. ***Do not proceed with the installation of building insulation until all unsatisfactory conditions have been corrected.***

3.02 Preparation

- A. ***Clean substrates of any substances*** that are harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.
- B. ***Close off openings in cavities receiving poured-in-place insulation*** to prevent escape of the insulation. ***Provide Type 316 stainless steel screens (inside)*** where openings must be maintained for drainage or ventilation.

3.03 General Installation

- A. Comply with the insulation manufacturer's written instructions applicable to the products and application indicated. If printed instructions are not available or do not apply to project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to freezing conditions, ice and/or snow.
- C. Extend insulation the full thickness to envelop the entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with the placement of the insulation.
- D. Apply a single layer of insulation to produce the thickness indicated, unless multiple layers are otherwise shown or required to make up the total required thickness.

3.04 Board Installation at Exterior Walls

- A. Install boards vertically on walls.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

- C. Place six (6) inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.
- D. Tape insulation board joints.

3.05 Batt Installation

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.06 Installation of Cavity Wall and Masonry Cell Insulation

- A. The Contractor shall refer to Section 04250, "Masonry Building Insulation".
- B. Preparation of Wall and Method of Installation
 - 1. Mortar all block joints and fill all holes to stop insulation leakage.
 - 2. Install and apply the building insulation per the manufacturer's recommendations.
 - 3. Pour granular insulation into the cavities of the interior and exterior concrete block walls to completely fill all void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close ports after complete coverage has been confirmed.
 - 4. Limit the fall of insulation to one (1) story in height, but not to exceed twenty (20) feet.
- C. Conditions
 - 1. Install the insulation under dry conditions and cover it after installation.

3.07 Installation of General Building Insulation

- A. Apply insulation units to substrates by the method indicated, complying with the manufacturer's written instructions. If no specific method is indicated, bond units to substrate with mechanical anchorage or use adhesive to provide permanent placement and support of units.
- B. Seal joints between closed-cell (non-breathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by the insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder to the warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping. Tape joints and ruptures in the vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Set reflective, foil-faced units with not less than $\frac{3}{4}$ -inch (19-mm) air space in front of foil as indicated.
- E. Place loose-fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing in accordance with ASTM C-1015. Level horizontal applications to a uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
- F. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately forty percent (40%) of the normal maximum volume equaling a density of approximately 2.5 lb/ft³.
- G. Install cellulose insulation to achieve an R value noted on the drawings or herein and in accordance with manufacturers written instructions.
- H. Install nailable roof insulation in accordance with the manufacturers recommendations for the roof assembly to be provided as part of this Project.

3.08 Installation of Vapor Retarders

- A. Extend the vapor retarder to the extremities of the areas to be protected from vapor transmission. Secure the vapor retarders in place with adhesives or other anchorage systems as indicated. Extend the vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two (2) wall studs. Fasten vapor retarders to framing at the top, end, and bottom edges, at

- perimeter of wall openings, and at lap joints. Space fasteners sixteen (16) inches (406 mm) on-center.
- C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to the vapor retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
 - D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.
 - E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and the vapor retarder.
 - F. Repair any tears or punctures in the vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.09 Protection

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where the insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

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SECTION 07214

FOAMED-IN-PLACE MASONRY WALL INSULATION

1. GENERAL

1.01 Scope of Work

- A. The extent of insulation work is shown on the Contract Drawings and indicated by provisions of this Section.
- B. Applications of insulation specified in this Section include foamed-in-place masonry insulation for thermal, sound and fire resistance values.

1.02 References

A. Referenced Standards

- 1. 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 the Advertisement for Bids.
- 2. The publications listed in Table 07214-1 form a part of the Specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

TABLE 07214-1 : REFERENCED PUBLICATIONS

ASTME-84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E-119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E-136	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

3. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.
4. In case of a conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.

1.03 Submittals

- A. Submit manufacturer's literature including specifications, product data, catalog cut sheets and printed installation instructions for the same in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. The Contractor shall submit a product and technical presentation as provided by the manufacturer.
- C. The Contractor shall submit, along with product data, copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.
- D. Submit Material Safety Data Sheets (MSDS) complying with OSHA Hazard Communication Standard, 29 CFR 1910 1200.

1.04 Quality Assurance

- A. ***Provide insulation produced by a single and approved manufacturer.*** The product must come from the manufacturer, pre-mixed, to ensure consistency.
- B. The Contractor shall engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and which has not less than ten (10) years direct experience in the installation of the product used.
- C. ***A three (3) year product and installation warranty, from the date of Final Project Acceptance by the Owner,*** shall be provided by both the manufacturer and installer.
- D. Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by a testing agency acceptable to authorities having jurisdiction.
- E. The insulation subcontractor shall carry Products and Completed Operations Insurance with minimum liability limits of \$5,000,000.

- F. Product must be classified by Underwriters Laboratory® ("UL") as to Surface Burning Characteristics.

2. PRODUCTS

2.01 Acceptable Manufacturers

- A. Subject to compliance with requirements, provide products from the following:
1. "Core-Fill 500™", Tailored Chemical Products
 2. Tailored Foam of Florida, Inc.
 3. Air Krete, Inc
 4. CP Chemical Co. (Tripolymer)
 5. Or approved equal.

2.02 Insulating Materials

- A. Provide insulating materials which comply with the requirements indicated for materials, compliance with referenced standards, and other characteristics.
- B. For foamed-in-place masonry insulation, use a two-component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls with the following characteristics:

Characteristic	Value
Fire-Resistance Rating	A minimum four (4) hour fire resistance wall rating (ASTM E-119) for 8-inch and 12-inch concrete masonry units when used in standard two (2) hour rated CMU's shall be acceptable
Surface Burning Characteristics	Maximum flame spread, smoke developed and fuel contributed shall be 0, 5 and 0, respectively
Combustion Characteristics	Must be a noncombustible, Class A building material
Thermal Values	"R" Value of 4.91/inch @ 32°F mean (ASTM C-177)
Sound Abatement	Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8" wall assembly (ASTM E 90-90)

3. EXECUTION

3.01 Inspection and Preparation

A. Application Assemblies

1. Block walls shall be 8" or 12" concrete masonry units (CMU's).

3.02 Installation of Foamed-in-Place Insulation

- A. Install foamed-in-place insulation from the interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place and comply with the manufacturers instructions.

B. Installation

1. Fill all open cells and voids in hollow concrete masonry walls where shown on the Contract Drawings.
2. The foam insulation shall be pressure injected through a series of $\frac{5}{8}$ -inch to $\frac{7}{8}$ -inch holes drilled into every vertical column of block cells (every 8-inches on center) beginning at an approximate height of four (4) feet from the finished floor level.
3. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled.
4. Patch holes with mortar and score to resemble existing surface.

END OF SECTION

SECTION 07221

NAILBASE INSULATION PANELS

1. GENERAL

1.01 Description

- A. The Contractor shall furnish all labor, materials, equipment, ancillaries and incidentals and install a nailbase insulation panel system on the “new” Sanford Main WTP Operations Building.
- B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
03400	Precast Concrete
07410	Metal Roof and Soffit Panels
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American Society for Testing and Materials (ASTM)	
ASTM C-209	Methods of Testing Insulating Board, Structural and Decorative
ASTM C-1289	Specifications for Faced Rigid Cellular Polyisocyanurate Thermal Insulating Board
ASTM D-1621	Test Methods for Compressive Properties of Rigid Cellular Plastics
ASTM D-2126	Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM E-96	Test Method for Water Vapor Transmission of Materials

Standard	Description
Other Standards and Building Codes	
	Florida Building Code
	CAN/ULC S770 - Standard Test Method for Determination of Long Term Thermal Resistance of Closed Cell Plastic Thermal Insulating
	UL 1256 - Fire Test of Roof Deck Constructions
	PS2-92 - Performance Standard for Wood-based Structural-use Panels
	FM 4470 - Class I Roof Covers (Foam Core Only)
	FM Class 1 approval for steel roof deck constructions, Class 1 Fire and I-60 and I-90 wind storm classifications

1.03 System Description

A. Physical Properties (Foam Core)

1. Compressive Strength: ASTM D-1621 and ASTM C 1289, Type V, 20 psi (138 kPa) minimum for Grade 2 or 25 psi (172 kPa) minimum for Grade 3.
2. Dimensional Stability: ASTM D-2126, 2 percent linear change (7 days).
3. Moisture Vapor Transmission: ASTM E-96: Less Than 1 perm ((57.5ng/(Pasm²)).
4. Water Absorption: ASTM C-209 - less than 1% by volume.
5. Service Temperature: -100° - 250°F (-73°C - 122°C).
6. Foam core flame spread index of 70 or less and smoke developed of 450 or less when tested in accordance with ASTM E-84.

B. Foam Core R Values: Based on LTTR (Long Term Thermal Resistance) in accordance with ASTM C-1289.

C. UL Assemblies: Insulated metal deck assemblies - UL 1256 (No. 120, 123).

D. UL Assemblies: Insulated metal deck assemblies - UL 1256 (nos. 120, 123) TGDY. R20624 Shingle Deck Accessory; H-Shield Nail Base roof insulation is classified for use with any Class A, B, or C asphalt glass mat or asphalt organic shingles, metal or tile roof coverings.

E. FM Class 1 (Low Slope) approval for steel roof deck constructions, Class 1 Fire and I-60 and I-90 wind storm classifications.

1.04 Submittals

A. Shop Drawings

1. Copies of all materials required to establish compliance with the Contract Documents shall be submitted in accordance with the provisions of Section 00700, "General Conditions, Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples".
2. Submit product data for all components associated with the nail-base insulation panel system and fasteners, including, but not limited to, the following:
 - a. All materials and components associated with the nail-base insulation panel system.
 - b. Preparation instructions and recommendations.
 - c. Storage and handling requirements and recommendations.
 - d. Installation methods.

B. Verification Samples

1. For each finish product specified, two samples, representing actual product.
 - a. Submit 6 by 6 inch (152 mm by 152 mm) samples of each board type required.
 - b. Submit samples of each fastener type required.

C. Manufacturer's Certification

1. The manufacturer shall provide a written certification to the Engineer that the nail-base insulation panels conform to the specified performance requirements.

1.05 Quality Assurance

A. Manufacturer Qualifications

1. The manufacturer shall be a company that regularly manufactures polyisocyanurate and fully assembled nail-base insulation panels in-house with no outside fabrication operations.

1.06 Delivery, Storage and Handling

- A. Store products in accordance with the manufacturer recommendations.
- B. Store products on a solid flat foundation and elevate a minimum of four (4) inches above the finished surface.
- C. For on-site storage longer than two (2) weeks, slit packaging on 4 sides to allow the product to breathe, and then completely covered with a breathable tarpaulin.
- D. Protect the insulation from open flame and **keep dry at all times**.

1.07 Project Conditions

- A. Install only as much insulation as can be covered the same day by a completed roof covering material.

2. PRODUCTS

2.01 Acceptable Manufacturer's

- A. Acceptable manufacturer's shall include the following:
 - 1. Hunter Panels, 15 Franklin Street; Portland, ME
 - 2. Or approved equal.

2.02 Panel Construction

- A. Nail-base insulation panels shall consist of a top layer of APA exterior grade plywood laminated off-line to black fiber reinforced faced polyisocyanurate foam insulation.
 - 1. Polyisocyanurate foam insulation shall conform to ASTM C-1289, Type V with a compressive strength of 25 psi minimum (Grade).
 - 2. Plywood top layer substrate shall conform to PS2 and shall be as follows:
 - a. Type: Fire-treated sheathing grade
 - b. Thickness: 5/8-inch
 - c. Edge detail: Rabbited

2.03 Panel Types

- A. H-Shield-NB panels ($\frac{5}{8}$ -inch OSB or plywood) shall be 47½ inches by 95½ inches with an overall thickness, R-value, and flute spanability as follows:
 - 1. Thickness: 4.1 inches
 - 2. R-Value: 21.1
 - 3. Flute spanability: 4¾ inches

3. EXECUTION

3.01 Examination

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify deck, adjacent materials, and structural backing is dry and ready to receive insulation.
- C. Verify deck surface is flat, free of fins, protrusions and irregularities.
- D. If deck preparation is the responsibility of another installer, notify the Engineer of unsatisfactory preparation before proceeding.

3.02 Preparation

- A. Clean surfaces thoroughly prior to installation.
- B. Apply vapor barrier and/or retarder, as specified by the Engineer, single-ply membrane roofing manufacturer or required by the local building code, to decking prior to the installation.

3.03 General Installation

- A. Install the panels in accordance with the manufacturer's instructions.
- B. For application onto concrete decks, provide a minimum of sixteen (16) Hunter SIP/SD Fasteners, or approved equal, per 4 foot by 8 foot panel.

- C. Only install enough panels per day that can be covered the same day by a completed roof covering material.
- D. Use only UL or FM approved synthetic underlayment over nailbase insulation panels. The use of 15 or 30 pound roofing felt is not recommended.

3.04 Protection

- A. Protect installed products until project completion.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
- C. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.

3.05 Clean-up

- A. All work areas are to be kept clean, clear and free of debris at all times.
- B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.
- C. All tools and unused materials must be collected at the end of each workday and stored properly.
- D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.
- E. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

SECTION 07270

FIRESTOPPING

1. GENERAL

1.01 Scope of Work

- A. Furnish all labor, materials, equipment and incidentals for the complete installation of firestopping material, or combination of materials, at openings and voids in, or at periphery of fire-rated construction, and related items as shown on the Contract Drawings and specified herein, and in the following locations:
 - 1. Penetrations through fire-rated floor slabs, both empty holes and holes accommodating items such as cables, pipes, ducts, conduit, etc.
 - 2. Penetrations through fire-rated walls and partitions.
 - 3. Openings between tops of walls and floor or roof slabs.
 - 4. Penetrations of vertical service shafts.
 - 5. Expansion joints in walls, floors, and wall and floor assemblies.
 - 6. Openings and/or penetrations through smoke barriers, fire stops, partition top plate, partition intermediate plate at ceiling level, furring at ceiling level, or special compartmentalized areas.
 - 7. Openings between walls and the floor slab.

1.02 References

- A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the latest revision of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM E-814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM C-33	Concrete Aggregates
ASTM C-39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C-42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
Underwriter's Laboratory (UL)	
UL 1479	Fire Tests of Through-Penetration
Other Standards and Codes	
	Florida Building Code

B. 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 the Advertisement for Bids. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.
- In case of a conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.

1.03 Submittals

- Submit manufacturer's literature including specifications, product data, catalog cut sheets and printed installation instructions for the same in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- Submit manufacturer's product data for all materials and prefabricated devices. Provide descriptions sufficient for identification at the job site. Include manufacturer's installation instructions.
- Submit shop drawings showing proposed material, reinforcement, anchorage, fastenings, and method of installation. Construction details shall accurately reflect actual job conditions.

1.04 Quality Assurance

- A. Provide firestopping materials that expand to fill cavities or provide adhesion to substrates and that will maintain seal under normal expected movements of substrates.
- B. Provide firestopping materials that are currently classified with U.L. as "Fill, Void, or Cavity Materials" and "Through-Penetration Firestop Systems".
- C. Provide firestopping materials that have been tested in conformance with ASTM E-814 "Methods for Fire Tests of Through-Penetration Fire Stops" and U.L. 1479, "Fire Tests of Through-Penetration Firestops".
- D. Materials shall have been tested to provide fire rating equal to that of the construction. It shall not be water soluble to preclude washing out of the penetration hole if water is present.

1.05 Sequencing / Scheduling

- A. Coordinate the work of this Section with the Work performed under other Sections of the Project Manual.

2. PRODUCTS

2.01 Manufacturers

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Fire Products.
 - 2. Tremco X-Ferro Products.
 - 3. Or approved equal.

2.02 Materials

- A. Firestopping materials / constructions shall constitute one or more of the following products, or approved equal, and shall be compatible with the material to which it is applied.

1. 3M

- a. CP-25 Caulk.
- b. 303 Putty.
- c. FS-195 Wrap/Strip.
- d. CS-195 Composite Strip 2.

2. Tremco

- a. Fyre-Shield Sealant.
- b. Fyre-Sil and Fyre-Sil SL Sealant.

3. Damming materials shall be products compatible with the above materials as certified by the manufacturer.

- B. Firestopping materials shall be asbestos-free and capable of maintaining an effective barrier against flame, smoke, and gasses in compliance with the requirements of ASTM E-814 and U.L. 1479.
- C. On insulated pipe, the fire-rating classification must not require removal of the insulation.
- D. The rating of the firestops shall be in no case less than the rating of the time-rated floor or wall assembly.

2.03 Mixing

- A. Mix silicone components in conformance with manufacturer's instructions.

3. EXECUTION

3.01 Preparation

- A. Clean surfaces to be in contact with firestopping materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting or the required fire resistance.
- B. For exposed seals, use masking tape to protect adjacent finished substrate.

3.02 Installation

- A. Install firestopping materials in conformance with the manufacturer's instructions.
- B. Seal all holes or voids made by penetrations to ensure an effective smoke barrier.
- C. Unless protected from possible loading or traffic, install firestopping materials in floors having void openings of four (4) inches or more to support the same floor load requirements.

3.03 Field Quality Control

- A. Examine firestopped areas to ensure proper installation prior to concealing or enclosing firestopped areas.
- B. Areas of work shall remain accessible until inspection and approval by the applicable code authorities.

3.04 Adjusting and Cleaning

- A. Clean excess cured sealant, spills, and debris.

END OF SECTION

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SECTION 07410

METAL ROOF, SOFFIT PANELS, FASCIA AND COPING

1. GENERAL

1.01 Description

A. The Contractor shall furnish all labor, materials, equipment, ancillaries and incidentals and install the factory-formed metal roofing and soffits, including flashing and accessories on the "new" Sanford Main WTP Operations Building.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
05310	Metal Roof Deck
07600	Flashing and Sheet Metal
07900	Sealants
Contract Drawings and General Provisions of the Contract	

1.02 References

A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
Standards and Building Codes	
	Florida Building Code
	American Society for Testing and Materials (ASTM)

Standard	Description
	Underwriters Laboratories (UL Classified Tests)
	SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003

- B. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

1.03 System Description

A. Performance Requirements

1. Provide sheet metal roofing that has been manufactured, fabricated and installed to withstand structural and thermal movement, wind loading and weather exposure to maintain the manufacturer's performance criteria without defects, damage, failure of infiltration of water.
2. Wind-Uplift: Roof panel assembly shall comply with UL Classification 580 for UL Classified 90 rated assemblies
3. Static Air Infiltration: Completed roof system shall have a maximum of .06 cfm/sf with 6.24 kPa air pressure differential as per ASTM E283/1680.
4. Water Infiltration: No evidence of water penetration at an inward static air pressure differential of not less than 6.24 psf (43 kPa) and not more than 12.0 psf (83 kPa) as per ASTM E331/1646.

1.04 Submittals

A. Shop Drawings

1. Copies of all materials required to establish compliance with the Contract Documents shall be submitted in accordance with the provisions of Section 00700, "General Conditions, Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples".
2. Submit complete shop drawings and erection details, approved by the metal roofing manufacturer, to the Engineer for review and approval. Do not proceed with the manufacturing of roofing materials prior to review and approval of shop drawings

and field verification of all dimensions. Do not use drawings prepared by the Engineer for shop or erection drawings.

3. Shop drawings show roof plans, elevations, methods of erection, and flashing details.

B. Performance Tests

1. Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each panel system.

C. Samples: Submit selection and verification samples for finishes, colors and textures.

D. Quality Assurance Submittals

1. Submit the following:
 - a. Certificates: Product certificates signed by manufacturer certifying that all materials comply with specified performance characteristics and physical requirements.
 - b. Manufacturer's Instructions: Manufacturer's installation instructions.

E. Closeout Submittals

1. Submit the following:
 - a. Operation and Maintenance Data: Operation and maintenance data for all installed products in accordance with the requirements of the Closeout Submittals and Operation and Maintenance Data Sections in Division 1. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
 - b. Project Warranty: Warranty documents specified herein in Article 1.08.
 - c. Manufacturers Warranty: Submit, for Owners acceptance, the manufacturers standard warranty document executed by an authorized company official. The Manufacturer's warranty is in addition to and not limited of, other rights the Owner may have under the Contract Documents.
 - d. Record Documents: Project record documents for installed materials in accordance with the requirements in Section 01720, Project Record Documents.

1.05 Quality Assurance

- A. Installer Qualifications: The Installer shall be experienced in performing the type of work outlined in this section and who has specialized in the installation of work similar to that required for this project.
- B. Sheet Metal Industry Standard: Comply with Sheet Metal and Air Conditioning Contractors National Association(SMACNA) Architectural Sheet Metal Manual.
- C. Pre-Installation Meetings: Conduct pre-installation meetings with the Owner, Engineer and General Contractor to verify project requirements, substrate conditions, Manufacturer's installation instructions and manufacturer's warranty requirements. Comply with all of the requirements in the Contract Documents.

1.06 Delivery, Storage and Handling

- A. The General Contractor shall comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- B. Deliver materials in the manufacturer's original, unopened, undamaged containers with identification labels intact. Identify fabricated components with UL 90 Classified label where appropriate.
- C. Store materials in accordance with the manufacturer recommendations and keep them protected from exposure to harmful conditions. Store material in dry, above ground location.
 - 1. Stack pre-finished material to prevent twisting, bending, abrasion, scratching and denting. Elevate one end of each skid to allow for moisture to run off.
 - 2. Prevent contact with material that may cause corrosion, discoloration or staining.
 - 3. Do not expose to direct sunlight or extreme heat trim material with factory applied strippable film.
 - 4. Protect the insulation from open flame and **keep dry at all times**.

1.07 Project Conditions

- A. Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and the fabrication schedule with construction progress to avoid construction delays.

1.08 Warranty

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for the Owner's acceptance, the manufacturer's standard warranty document executed by an authorized company official. The manufacturer's warranty is in addition to and not a limitation of, other rights the Owner may have under the Contract Documents. ***A five (5) year water tightness warranty and a twenty (20)-year non-prorated finish warranty commencing on the Date of Final Project Acceptance by the Owner.***

2. PRODUCTS

2.01 Sheet Metal Roofing

- A. PAC-CLAD SNAP-CLAD panels and trim, or approved equal

Parameter	Characteristics
Seam Height	1¾-inch (44 mm) minimum seam height
Material	24 gauge G-90 Hot-dipped Galvanized Steel
Panel Dimension	16 inch (406mm) on-center
Texture	Smooth
Rating	UL Classified 90 rated (wind uplift) panel assembly
Flashing and Trim	24 gauge G-90 Steel
Fasteners	SNAP-CLAD, or approved equal, galvanized steel, non-penetrating high performance clips for roofing application and UL Classified 90 rated (wind uplift) assemblies and standard clips for mansard and fascia applications.
Sealant Bead	Factory applied sealant bead

- B. PAC-CLAD Soffit Panels, or approved equal

Parameter	Characteristics
Type	PAC-750 Soffit (Half Vent) Panel, or approved equal
Material	24 gauge G-90 Hot-dipped Galvanized Steel
Panel Dimension	12 inch (305mm) on-center, V-grooved panels
Texture	Stucco embossed

C. Roof and Soffit Panel Finish

Parameter	Characteristics
Panel Topside	PAC-CLAD finish color selected from Petersen Aluminum Corp. standard colors, or approved equal. Final color to be selected by the Engineer/Owner.
Panel Bottomside	Polyester washcoat with dry film thickness of 0.3 mils.

D. Manufacturer's standard flashing and trim profiles, fascias, copings, factory formed, gauge as recommended by manufacturer, color and finish to match metal roofing panels.

E. Manufacturer: Petersen Aluminum Corporation, or approved equal.

2.02 Related Materials

A. The scupper boxes shall in accordance with SMACNA Architectural Sheet Metal Manual and have a rectangular profile.

B. The downspouts shall have a pre-formed, rectangular profile.

C. Accessories shall be profiled to suit the gutters and downspouts.

1. Anchorage devices: In accordance with SMACNA requirements

2. Gutter and Downspout supports: Brackets

D. All metal joints shall be sealed.

2.03 Fabrication

A. Continuous Length: Fabricate panels 55 feet (16.2 m) and less in one continuous length.

B. Trim and Flashings: Fabricate trim and flashings from the same material as the roof system material.

C. Portable Roll Former: Panels shall be fabricated by portable roll former shall not be approved.

2.04 Finishes

- A. All finishes shall be factory applied in accordance with these specifications.

Parameter	Characteristics
Topside	Full-strength fluoropolymer 70% Kynar 500 system of 1.0 mil (.025 mm) total dry film thickness
Underside	Wash coat of 0.3 - 0.4 mil dry film thickness
Texture	Smooth texture, Standard E-5 stucco embossed pattern
Protective Film	Strippable vinyl film applied during panel fabrication and finishing

3. EXECUTION

3.01 Manufacturers Instructions

- A. Comply with manufacturer's product data, recommendations and installation instructions for substrate verification, preparation requirements and installation.
- B. Remove the manufacturer's protective film, if any, from surfaces of roofing panels.

3.02 Examination

- A. Verify substrate conditions, which have been previously installed under other sections, are acceptable for project installation in accordance with manufacturer's instructions.

3.03 Preparation

- A. Coordinate metal roofing with other project work (drainage, flashing and trim, deck substrates, parapets, copings, walls) and other adjoining work to provide a non-corrosive and leak-proof installation.
- B. Dissimilar Metals: Prevent galvanic action of dissimilar metals.

3.04 General Installation

- A. Install metal roofing panels to profiles, patterns and drainage indicated and required for a leak-proof installation. Provide for structural and thermal movement at work. Seal joints for leak-proof installation.

Component	Characteristics
Seams	Provide uniform, neat seams
Fasteners	Conceal fasteners where possible in exposed work. Cover and seal fasteners and anchors for a watertight and leak-proof installation
Sealant-Type Joints	Provide sealant-type joint where indicated. Form joints to conceal the sealant. Comply with Division 7 for Sealant installation

3.05 Field Quality Requirements

- A. Site Tests (Post Installation Testing): The Owner reserves right to perform post installation testing of installed sheet metal roofing.
- B. Manufacturer's Field Services: Upon Owner's request, provide the manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions

3.06 Cleaning

- A. Protect installed products until project completion.
- B. Remove temporary coverings and protection of adjacent work areas. Touch-up, repair or replace damaged products.
- C. Clean installed products in accordance with manufacturer's instructions prior to the Owner's acceptance.
- D. Remove construction debris from project site and legally dispose of debris.

3.07 Protection

- A. Protect installed products until project completion.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07542

THERMOPLASTIC MEMBRANE ROOFING SYSTEM

1. GENERAL

1.01 Description

A. The Contractor shall furnish all labor, materials, equipment, ancillaries and incidentals and install a ***thermoplastic membrane (PVC) roofing system*** on the “new” Sanford Main WTP Operations Building.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
06100	Rough Carpentry
07600	Flashing and Sheet Metal
07900	Joint Sealants
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American Society for Testing and Materials (ASTM)	
ASTM C208	Standard Specification for Cellulosic Fiber Insulating Board
ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

Standard	Description
American Society for Testing and Materials (ASTM) - Continued	
ASTM C728	Standard Specification for Perlite Thermal Insulation Board
ASTM C1289	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1371	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
ASTM C1549	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM D41	Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D312	Standard Specification for Asphalt Used in Roofing
ASTM D1079	Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4434	Standard Specification for Poly (Vinyl Chloride) Sheet Roofing
ASTM E-903	Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres
Other Standards and Building Codes	
	Florida Building Code
	National Roofing Contractors Association (NRCA)
	American Society of Civil Engineers (ASCE)
	U.S. Green Building Council (USGBC) - Leadership in Energy and Environmental Design (LEED)
	Factory Mutual (FM Global) - Approval Guide
	Underwriters Laboratories (UL) - Roofing Systems and Materials Guide (TGFR R1306)
	California Title 24 Energy Efficient Standards
	Energy Star
	Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - <i>Architectural Sheet Metal Manual</i>
	Cool Roof Rating Council (CRRC)

- B. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) *Roofing and Waterproofing Manual* for definitions of roofing terms related to this specification section.

1.03 Submittals

A. Shop Drawings

1. Copies of all materials required to establish compliance with the Contract Documents shall be submitted in accordance with the provisions of Section 00700, "General Conditions, Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples".
2. Submit product data for all components associated with the membrane roofing materials, flashing materials, insulation, surfacing, fasteners, and all accessories.
3. Indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation.

B. Certification

1. Submit manufacturer's certifications that the material or products meet or exceed the specification requirements and will meet their intended purpose.
2. The membrane roofing system installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in this section.

C. Samples

1. Provide samples of insulations, fasteners, membrane materials and accessories for verification of quality.

D. Provide membrane roofing system manufacturers installation instructions. The instructions shall indicate installation procedures, precautions and perimeter conditions requiring special attention.

E. The Contractor's certified installer shall not begin installation of the roofing system until the shop drawing submittal is approved by the Engineer.

F. Field reports to indicate the procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

G. Warranty documentation as required in Article 1.09 herein. In addition, the following shall also be submitted:

1. Submit manufacturer warranty and ensure that forms have been completed in the Owner's name and registered with the thermoplastic membrane manufacturer.

2. Submit the installer's certification that the roofing system installation complies with warranty conditions for waterproof membrane.

1.04 Quality Assurance

A. Acceptable Manufacturer's

1. GAF, Pasippany, NJ.
2. Or approved equal.

B. Installer Qualifications

1. The Installer shall be classified as a *Master or Master Select™* Contractor as defined and certified by GAF.
- C. The Contractor shall engage a manufacturer of thermoplastic membrane roofing systems, experienced in the manufacture of these types of membrane roofing systems and that can provide a roofing system that meets or exceeds all criteria contained in this specification section. The manufacturer shall have a minimum of five (5) years of experience producing the thermoplastic membrane roofing systems specified herein.
- D. **Obtain all thermoplastic membrane roofing system materials and associated components from a single manufacturer** regularly engaged in manufacturing these types of materials.
- E. A representative of the thermoplastic membrane roofing system manufacturer shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed. A final certification, from the roofing system manufacturer and installer shall be provided indicating that the roofing system has been installed in accordance with all specification requirements and meets all local, state and federal roofing standards.

1.05 Pre-Installation Conference

- A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, GAF representative, General Contractor and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions and agreements reached (or disagreements), and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.

1.06 Performance Requirements

- A. Provide an installed thermoplastic membrane roofing system and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.
- B. The thermoplastic membrane roofing system manufacturer shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

1.07 Regulatory Requirements

- A. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes.

1.08 Delivery, Storage and Handling

- A. Deliver all roofing materials to the site in original containers, with factory seals intact, labeled with manufacturer's name, product brand name and type, and date of manufacture.
- B. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by the waterproofing manufacturer. **Protect stored materials from direct sunlight.** Reference data sheets for product storage requirements.
- C. Do not expose materials to moisture in any form before, during or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
- D. Use "breathable" type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.

1.09 Project Conditions

- A. Proceed with roofing only when existing and forecasted weather conditions permit.
- B. Do not apply roofing membrane to a damp or frozen deck surface or when precipitation is expected or occurring.

- C. Ambient temperatures must be above 45°F (7.2°C) when applying hot asphalt or water based adhesives.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.10 Warranty and Guarantee

A. Water Stoppage Guarantee

- 1. The thermoplastic membrane roofing system manufacturer shall provide a “single source coverage” guarantee, with no monetary limitation, where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak or failure of roofing materials due to a failure in materials or workmanship for a ***period of twenty (20) years from the date of Final Project Acceptance by the Owner***

B. Puncture Resistance Warranty

- 1. The thermoplastic membrane roofing system manufacturer shall furnish a ***special warranty/written guarantee, for a period of twenty (20) years from the date of Final Project Acceptance by the Owner***, that they will provide puncture and tear resistance when installed and maintained in accordance with manufacturer's requirements. The thermoplastic membrane roofing system manufacturer agrees to repair or replace the portion of the roofing materials/system that have resulted in a leak due to a manufacturing defect or defects caused by ordinary wear and tear.

2. PRODUCTS

2.01 Acceptable Manufacturer's

- A. Acceptable manufacturer's shall include the following:

- 1. GAF, Pasippany, NJ.
- 2. Or approved equal.

2.02 Air and Vapor Retarder System

- A. Asphalt impregnated kraft paper with fiberglass strand reinforced edges; available in 32" X 405' (10 square) rolls and 96" X 405' (30 square) rolls, Permte Vapor Retarder shall be provided by the thermoplastic membrane roofing system manufacturer.

2.03 Insulation

- A. Rigid polyisocyanurate board, with a strong white or black fibrous glass facer conforming to or exceeding the requirements of ASTM C1289 / FS HH-I-1972. EnergyGuard Tapered Polyiso, with the following characteristics:
 - 1. Board Thickness: Tapered

2.04 Roof Board

- A. Underlayment or overlayment board with a water-resistant and silicone treated gypsum core with glass fiber facers embedded on both sides, and pre-primed on one side.
- B. The roof board shall be GP Dens-Deck Prime Roof Board, distributed by GAF® with the following characteristics:
 - 1. Board Thickness: ½-inch

2.05 Separation Membrane

- A. Non-woven polyester UV-stabilized mat, 3 oz/yd³ used as a separation sheet beneath membranes as a protection layer and used over membranes in ballast applied assemblies.
- B. Each roll shall contain thirty (30) squares (3,000 ft²) of material, 10' x 300', Poly Separation Layer (3 oz.) by GAF®.

2.06 Membrane Materials

- A. A smooth type, polyester scrim reinforced PVC membrane with a nominal 0.060 inch (60 mils) thickness, for use as a single ply roofing membrane. The PVC membrane shall meet or exceed the minimum requirements of ASTM D4434.
- B. Each full roll shall contain approximately 1,000 ft² of roofing material (10' x 100'). Each eight (8) foot roll shall contain approximately 800 ft² of roofing material (8' x 100'). Each half roll shall contain approximately 500 ft² of roofing material (5' x 100').
- C. The single-ply roofing membrane shall be EverGuard® PVC -60 membrane by GAF.

2.07 Flashing Materials

- A. A smooth type, polyester scrim reinforced PVC membrane with a nominal 0.060 inch (60 mils) thickness, for use as a single ply roofing membrane. The PVC membrane shall meet or exceed the minimum requirements of ASTM D4434.
- B. Each full roll shall contain approximately 1,000 ft² of roofing material (10' x 100'). Each eight (8) foot roll shall contain approximately 800 ft² of roofing material (8' x 100'). Each half roll shall contain approximately 500 ft² of roofing material (5' x 100').
- C. The single-ply roofing membrane shall be EverGuard® PVC -60 membrane by GAF.

2.08 Adhesives, Sealants and Primers

- A. Solvent-based Bonding Adhesive: Solvent based rubberized adhesive for use with EverGuard PVC membranes, EverGuard 2331 Bonding Adhesive, by GAF.

2.09 Bitumen

- A. Asphalt bitumen shall be in accordance with ASTM D312, Type III & IV.

2.10 Plates and Fasteners

- A. DrillTec HD Screws: Heavy gauge alloy steel fastener with CR-10 coating with a .245" (6.2 mm) diameter thread. Miami Dade and Factory Mutual Standard 4470 Approved, #3 Phillips truss head for use on wood, concrete and steel decks.

2.11 Nails and Spikes

- A. Threaded Cap Nail: Annular-threaded electro-galvanized with yellow di-chromate coating, with 1-inch round or square cap, as manufactured by the Simplex Nail Corporation.
- B. Two-Piece Tube Nail: 1-inch diameter cap; when the nail is driven down through the tube of first part that was installed, the nail hooks up to provide backout resistance, as manufactured by The Simplex Corporation

2.12 Accessories

A. Flashing Accessories

1. A smooth type, unreinforced polyvinyl chloride based membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Shall be required whenever preformed vent boots cannot be used, White/Tan in color, 0.080 inches (80 mils) nominal thickness and sheet size of 24-inches x 50 ft. Material shall be EverGuard® PVC UN-80 Detailing Membrane, by GAF.
2. An 8-inch wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs with a 0.045-inch (45 mils) nominal thickness with 100 foot length, tan color. EverGuard® PVC Flashing Membrane, by GAF.
3. Extruded aluminum termination bar with angled lip caulk receiver and lower leg bulb stiffener. Pre-punched slotted holes at six (6) inches on center or eight (8) inches on center. 3/4-inch x 10' with 0.090-inch (2.3 mm) cross section and shall be EverGuard® Lip Termination Bar, by GAF.

B. Wall and Curb Accessories

1. 0.075-inch thick molded PVC membrane designed to accommodate both inside and outside corners of base and curb flashing. Hot-air welds directly to the EverGuard® PVC membrane. 4-inch x 4-inch size with 4-inch flange. Corners shall be EverGuard® PVC Preformed Outside Corners, by GAF.

C. Penetration Accessories

1. 0.075-inch thick molded PVC membrane sized to accommodate most common pipe and conduits (1-inch to 6-inch diameter pipes), including square tube.
2. Hot-air welded directly to EverGuard® PVC membrane, supplied with stainless steel clamping rings, EverGuard® PVC Preformed Vent Boots, by GAF.

D. Field of Roof Accessories

1. Factory fabricated assemblies used to accommodate three-dimensional joints in a roof structure. A 50-foot continuous length shall be provided to minimize joints, and shall be suitable for both field and wall expansion joint in both flat-mounted and curb-mounted styles. Made of 0.060" (1.5 mm) thick reinforced membrane with foam supported bellows and shall be capable of being heat welded directly to

roofing membrane. The system described shall be equipped with metal nailing flanges and membrane welding flaps and shall be Metalastic® Prefabricated Expansion Joint Covers, by GAF.

2. 1/8-inch thick extruded and embossed PVC roll 2.5' x 50' that is capable of being heat welded directly to the roofing membrane. The material shall have a herringbone traction surface and shall be EverGuard® PVC Walkway Rolls, by GAF.

3. EXECUTION

3.01 Examination

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped to drains, valleys, eaves, scuppers or gutters and suitable for installation of the roof system.
- D. Verify that the deck surfaces are dry and free of ice.
- E. Verify that all roof openings or penetrations through the roof are solidly set, cant strips are in place, and that all flashings are tapered.

3.02 Substrate Preparation

A. Structural Concrete Deck

1. The minimum deck thickness for structural concrete is four (4) inches.
2. Only poured in place concrete decks that provide bottom side drying are acceptable. Decks that are installed over non-vented metal decks or pans that remain in place may trap moisture in the deck beneath the roof system and are not acceptable.
3. The roof deck shall be properly cured prior to application of the roofing system; twenty-eight (28) days is normally required for proper curing. Curing agents must be checked for compatibility with roofing materials. Prior to the installation of the roof assemblies, it is recommended that the Contractor and installer evaluate the surface moisture and deck's dryness through the use of ASTM D4263 or hot bitumen test.

4. The deck must be smooth, level and cannot be wet or frozen. If the deck is determined to be wet, it must be allowed to dry before installation can begin.
5. Treat cracks greater than 1/8-inch in width in accordance with the deck manufacturer's recommendations.
6. Sumps for the roof drains shall be provided in the casting of the deck.
7. When insulation or roofing is to be adhered with hot asphalt, prime the deck with asphalt/concrete primer, ASTM D41 at the rate of one (1) gallon per 100 ft². Allow the primer to dry prior to the application of the roofing system.
8. The concrete deck shall be inspected for defects prior to installation of the PVC membrane roofing system. Any defects are to be corrected per the deck manufacturer's recommendations prior to the application of the PVC membrane roofing system.

3.03 General Installation

- A. Perform work in accordance with manufacturer's instructions and all applicable roofing standards and applicable requirements.
- B. Do not apply the roofing membrane during unsuitable weather.
- C. Do not apply the roofing membrane when the ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply the roofing membrane to a damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.

3.04 Air/Vapor Barrier

A. General

1. The air/vapor barrier sheet shall be installed to address internal air pressure and humidity conditions.

2. Insulation must be installed over the air/vapor barrier sheet and mechanically attached to the deck.

B. Application

1. Install the air/vapor barrier sheet loose-applied to the deck or fire board so that wrinkles and buckles are not formed.
2. Overlap air/vapor barrier sheets a minimum of six (6) inches for side and end laps. Tape laps together with duct tape or double sided tape to be provided by the roofing manufacturer.
3. Seal the perimeter and penetration areas with foam sealant.

3.05 Insulation

A. General

1. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder must be repaired.
2. Do not install wet, damaged or warped insulation boards.
3. Install insulation boards with staggered board joints in one direction (unless taping joint).
4. Install insulation boards snug. Gaps between board joints must not exceed 1/4-inch. All gaps in excess of 1/4-inch must be filled with like insulation material.
5. Wood nailers must be 3 1/2-inch minimum width or 1-inch wider than the metal flange. They shall be of equal thickness as the insulation, and be treated for rot resistance. All nailers must be securely fastened to the deck.
6. ***Do not kick insulation boards into place.***
7. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.
8. Insulation should not be installed over new lightweight insulating concrete.

9. Roof tape, if required over insulation joints, must be laid evenly, smoothly and embedded in a uniform coating of hot steep asphalt with 4-inch end laps. Care must be taken to assure smooth application of tape, and full embedment of the tape in the asphalt.
10. Do not install any more insulation than will be completely waterproofed each day.

B. Insulation - Base Layer Application

1. The insulation must be securely attached to the roof deck. A minimum FMRC 1-60 attachment is recommended. Refer to FMRC Approval Guide for FM fastening patterns. Factory Mutual requires fastener density increased in corner areas for FM 1-60 as well as perimeter and corner area fastener density increases for FM 1-90 or greater. Refer to FM Loss Prevention Data Sheets 1-7, 1-28, and 1-49.
2. Use only fasteners with a minimum 3-inch stress plate when mechanically attaching insulation. Do not attach insulation with nails.
3. Install insulation layers, maximum 4' x 4' board size, in a full and uniform mopping of hot asphalt applied at the rate of 25 lb/ft² ± 20%. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of six (6) inches to eliminate continuous vertical gaps.
4. The substrate must be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
5. OlyBond 500 must be applied using the specially designed PaceCart dispenser. OlyBond 500 SpotShot shall be applied using one of the specially designed dual cartridge dispensers.
6. Install insulation layers applied with bands of OlyBond 500 spaced twelve (12) inches on-center. The coverage rate should be ½ - 1 gallon per 100 ft², depending on the substrate. Allow the foam to rise ¾ - 1 inch. Walk each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of six (6) inches to eliminate continuous vertical gaps.
7. The substrate must be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
8. Install insulation layers applied with ¾-inch beads of Insta-Stik spaced twelve (12) inches on-center. Press each board firmly into place. Stagger the joints

of additional layers in relation to the insulation joints in the layer(s) below by a minimum of six (6) inches to eliminate continuous vertical gaps.

9. Loose apply the base layer of insulation for subsequent layers to be simultaneously attached or for ballast applications. Minimal fastening should be performed to avoid movement of the boards.
10. Fill all flutes with a loose applied base layer of insulation. Insulation must be of equal height as metal ribs, seams or flutes to allow for subsequent layers to be applied without interference. Minimal fastening should be performed to avoid movement of the boards.
11. If subsequent layers of insulation are to be attached with insulation adhesive, the base layer must be mechanically attached with a minimum fastener density of 1 fastener every 2 ft².

C. Insulation - Subsequent Layers Application

1. The insulation must be securely attached to the roof deck. A minimum FMRC 1-60 attachment is recommended. Refer to FMRC Approval Guide for FM fastening patterns. Factory Mutual requires fastener density increases in corner areas for FM 1-60 as well as perimeter, and corner area fastener density increases for FM 1-90 or greater. Refer to FM Loss Prevention Data Sheets 1-7, 1-28, and 1-49.
2. Multiple layers of insulation of the same, non-tapered insulation material may be simultaneously mechanically fastened with approved fasteners and plates through the top layer of insulation to the structural deck. Individual layers of insulation must not exceed three (3) inches in thickness nor total thickness of all layers should not exceed five (5) inches without written approval of the thermoplastic membrane roofing system manufacturer. FM Type attachments may differ.
3. Use only fasteners with a minimum 3 inch (76 mm) stress plate when mechanically attaching insulation. Do not attach insulation with nails.
4. Install insulation layers, maximum 4' x 4' board size, in a full and uniform mopping of hot asphalt applied at the rate of 25 lb/ft² ± 20%. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of six (6) inches to eliminate continuous vertical gaps.
5. The substrate must be free of any debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

6. OlyBond 500 must be applied using the specially designed PaceCart dispenser. OlyBond 500 SpotShot shall be applied using one of the specially designed dual cartridge dispensers.
7. Install insulation layers applied with bands of OlyBond 500 spaced twelve (12) inches on-center. Approximate coverage rate should be $\frac{1}{2}$ - 1 gallon per 100 ft², depending on the substrate. Allow the foam to rise $\frac{3}{4}$ - 1-inch. Walk each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of six (6) inches to eliminate continuous vertical gaps.
8. The substrate must be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
9. Install insulation layers applied with $\frac{3}{4}$ -inch beads of Insta-Stik spaced twelve (12) inches on-center. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of six (6) inches to eliminate continuous vertical gaps.
10. Do not install any more insulation than can be completely waterproofed each day.

3.06 Protection Layer

A. General

1. A polymat protection layer shall be installed between the roofing membrane and the substrate.
2. A fire sheet 50 or 10 fiberglass sheet protection layer, as recommended by the thermoplastic PVC membrane roofing system manufacturer, shall be installed as a separator layer.

B. Application

1. Install fiberglass sheet or polymat protection layer loose-applied over the substrate surface so that wrinkles and buckles are not formed.
2. Overlap sheets a minimum of six (6) inches for side and end laps.

C. Versashield Solo Application

1. Install VersaShield Solo, loose-applied, over the substrate surface so that wrinkles and buckles are not formed perpendicular to the direction of the membrane.

2. Overlap membrane a minimum of two (2) inches at the side laps and a minimum four (4) inches at the end laps.
3. Use corrosive resistant nails with one (1) inch diameter metal head or plastic caps to fasten in place. Only use enough fasteners to hold in place until primary roof covering is in place.
4. Do not install more VersaShield Solo than can be covered in one day.

3.07 Membrane Application

A. Mechanically Attached

1. Place the membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent attachment. The roof membrane shall be mechanically fastened immediately after it is rolled out, followed by welding to adjacent sheets.
2. Overlap the roof membrane a minimum of six (6) inches for side laps and three (3) inches for end laps.
3. Install the membrane so that the side laps run across the roof slope lapped towards drainage points.
4. All exposed sheet corners shall be rounded a minimum of one (1) inch.
5. Use full width rolls in the field of roof and half width rolls in the perimeter and corner region of the roof and mechanically fastened in the side lap area to the roof deck.
6. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
7. Weld shall be a minimum of 1½-inches in width for automatic machine welding and a minimum 2-inches in width for hand welding.
8. The membrane shall be mechanically fastened in the side lap area to the roof deck with appropriate Drill-Tec fasteners and plates as required by the roof system specification and/or Factory Mutual classification requirements.
9. The metal plates must be placed within ¼" - ½" of the membrane edge. Plates shall not be placed less than ¼-inch from the membrane edge.

10. In the corner regions, additional fasteners shall be installed through the perimeter membrane to form a grid pattern, with an eight (8) inch wide EverGuard® TPO reinforced membrane flashing-strip welded over the additional fasteners. Corners include both outside and inside corners that measure 75 - 105°.
11. Membrane attachment to the roof deck is required at locations of deck angle changes in excess of 5° (1:12).
12. Supplemental membrane attachment is required at the base of all walls and curbs, and where the angle of the substrate changes by more than 10°. The roofing membrane shall be secured to the structural deck with screws and plates of the same type and spacing used for in-lap attachment. The screws and plates must be installed no less than ½-inch from the membrane edge. Alternatively, the roofing membrane may be turned up the vertical plane a minimum of three (3) inches and secured with screws and termination bar fastener spacing is the same as is used for in-lap attachment. The termination bar must be installed within 1½ - 2 inches of the plane of the roof membrane, with a minimum of one (1) inch of membrane extending above the termination bar.
13. Supplemental membrane attachment to the structural deck is required at all penetrations. Roofing membrane shall be secured to the deck with appropriate Drill-Tec screws and plates.
14. Fasteners must be installed to achieve the proper embedment depth. Install fasteners without lean or tilt.
15. Install fasteners so that the plate or termination bar is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate or termination bar to move (underdriving), but will not cause wrinkling of the membrane (overdriving).

3.08 Flashings

A. General

1. All penetrations must be at least twenty-four (24) inches from curbs, walls, and edges to provide adequate space for proper flashing.
2. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition and as recommended by the thermoplastic PVC membrane roofing system manufacturer.

3. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
4. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum two (2) inch wide hand weld or a minimum 1½-inch automatic machine weld is required.
5. All cut edges of reinforced membrane must be sealed with EverGuard® PVC Cut Edge Sealant.
6. Consult the EverGuard® Application and Specifications Manual or thermoplastic membrane roofing system manufacturer for more information on specific construction details, or those not addressed in this section.

B. Coated Metal Flashing

1. Coated metal flashings shall be formed in accordance with current EverGuard® construction details and SMACNA guidelines.
2. Coated metal sections used for roof edging, base flashing and coping shall be butted together with a ¼-inch gap to allow for expansion and contraction. Hot-air weld a six (6) inch wide reinforced membrane flashing strip to both sides of the joint, with approximately one (1) inch on either side of the joint left un-welded to allow for expansion and contraction. Two (2) inch wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
3. Coated metal used for sealant pans, scupper inserts, corners of roof edging, base flashing and coping shall be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. Hot-air weld a six (6) inch wide reinforced membrane flashing strip over all seams that will not be sealed during subsequent flashing installation.
4. Provide a ½-inch hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
5. Provide a ½-inch hem for all metal flange edges whenever possible to prevent wearing of the roofing and flashing membranes at the flange edge.
6. Coated metal flashings shall be nailed to treated wood nailers or otherwise mechanically attached to the roof deck, wall or curb substrates, in accordance with construction detail requirements.

C. Reinforced Membrane Flashings

1. The thickness of the flashing membrane shall be the same as the thickness of the roofing membrane.
2. Membrane flashing may either be installed loose or fully adhered to the substrate surface in accordance with "*Construction Detail Requirements*".
3. Where flashings are to be fully adhered, apply bonding adhesive at a rate resulting in 60 ft²/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 ft²/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 ft²/gallon (solvent-based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.
4. Apply the adhesive only when outside temperature is above 40°F. The recommended minimum application temperature is 50°F to allow for easier adhesive application.
5. The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.

D. Un-reinforced Membrane Flashings

1. Un-reinforced membrane shall be used to field-fabricate penetration or reinforcement flashings in locations where preformed corners and pipe boots cannot be properly installed.
2. Penetration flashings constructed of un-reinforced membrane are typically installed in two sections, a horizontal piece that extends onto the roofing membrane and a vertical piece that extends up the penetration. The two pieces are overlapped and hot-air welded together.
3. The un-reinforced membrane flashing shall be adhered to the penetration surface. Apply bonding adhesive at a rate resulting in 60 ft²/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 ft²/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 ft²/gallon (solvent-based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.

E. Roof Edges

1. Roof edge flashings are applicable for gravel stop and drip edge conditions as well as for exterior edges of parapet walls.
2. Flash roof edges with coated metal flanged edging with a minimum three (3) inches wide flange nailed four (4) inches on center to wood nailers, and heat weld roof membrane to metal flanges.
3. When the fascia width exceeds four (4) inches, coated metal roof edging must be attached with a continuous cleat to secure the lower fascia edge. The cleat must be secured to the building no less than twelve (12) inches, on-center.
4. Alternatively, roof edges may be flashed with a 2-piece snap on fascia system, adhering the roof membrane to a metal cant and face nailing the membrane eight (8) inches, on center, prior to installing a snap-on fascia.
5. Flash roof edge scuppers with a coated metal insert that is mechanically attached to the roof edge and integrated as a part of the metal edging.

F. Parapet and Building Walls

1. Flash walls with EverGuard® TPO membrane adhered to the substrate with bonding adhesive, loose applied (less than twenty-four (24) inches in height) or with coated metal flashing nailed four (4) inches on center to pressure-treated wood nailers.
2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened eight (8) inches on center; termination bars that are counter flashed shall be fastened twelve (12) inches on center.
3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:

System	Rate
Mechanically Attached Systems	Per in-lap on center spacing, with a 12-inch maximum
Fully / Self Adhered Systems	12-inches on center
Ballast Applied Systems	8-inches on center

4. All coated metal wall flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.

5. Metal counterflashings shall be installed (fully adhered flashings). Exposed termination bars must be sealed with Flexseal® Roofing Cement.
6. Flash wall scuppers with a coated metal insert that is mechanically attached to the wall and integrated as part of the wall flashing.

G. Curbs and Ducts

1. Flash curbs and ducts with EverGuard® PVC membrane adhered to the curb substrate with bonding adhesive, loose applied (Less than twenty-four (24) inches in height) or with coated metal flashing nailed four (4) inches on center to pressure-treated wood nailers.
2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the curb/duct surface and membrane flashing underneath all termination bars. Exposed termination bars shall be mechanically fastened every eight (8) inches on center; termination bars that are counter flashed shall be fastened twelve (12) inches on center.
3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:

System	Rate
Mechanically Attached Systems	Per in-lap on center spacing, with a 12-inch maximum
Fully / Self Adhered Systems	12-inches on center
Ballast Applied Systems	8-inches on center

4. All coated metal curb flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
5. Metal counterflashings shall be installed (fully adhered flashings). Exposed termination bars must be sealed with Flexseal® Caulk Grade Roofing Cement.

H. Roof Drains

1. Roof drains must be fitted with compression type clamping rings and strainer baskets. Original-type cast iron and aluminum drains, as well as retrofit-type cast iron, aluminum or molded plastic drains are acceptable.
2. Roof drains must be provided with a minimum 36" x 36" sump, if applicable. Slope of tapered insulation within the sump shall not exceed 4:12.

3. Extend the roofing membrane over the drain opening. Locate the drain and cut a hole in the roofing membrane directly over the drain opening. Provide a ½-inch of membrane flap extending past the drain flange into the drain opening. Punch holes through the roofing membrane at drain bolt locations.
4. For cast iron and aluminum drains, the roofing membrane must be set in a full bed of water block on the drain flange prior to securement with the compression clamping ring. Typical water block application is one 10.5 ounce cartridge per drain.
5. Lap seams shall not be located within the sump area. Where lap seams will be located within the sump area, a separate roof membrane drain flashing a minimum of twelve (12) inches larger than the sump area must be installed. The roof membrane shall be mechanically attached twelve (12) inches on center around the drain with screws and plates. The separate roof drain flashing shall be heat welded to the roof membrane beyond the screws and plates, extended over the drain flange, and secured as above.
6. Tighten the drain compression ring in place.

I. Expansion Joints

1. The membrane shall be mechanically fastened (or fully adhered based on system) along edge of expansion joint opening with appropriate Drill-Tec fasteners and plates within ¼ - ½-inch of the membrane edge, twelve (12) inches on-center.
2. When expansion joint is on the curbs, the reinforced flashing must be bonded to the curb face with Everguard® Bonding Adhesive and membrane on top of the curb face must be nailed twelve (12) inches on-center with deformed shank roofing nails with ⅜-inch wide heads.
3. The expansion joint cover bellows shall be at least 1.5 times the expansion joint opening.
4. Alternately, expansion joints may be field fabricated.

3.09 Separation Mat

- A. Apply a 3 oz poly separation slip-sheet above the roofing membrane under all ballasted installations where existing stone ballast is reused or where the underside of the paver is smooth and regular, and has integral drainage channels.
- B. Apply a 6 oz poly cushioning slip-sheet above the roofing membrane under all paver applications where pavers are used as walkways, work surfaces, or as heavyweight perimeter ballast.

- C. Loose-lay separation mat over the membrane so that wrinkles and buckles are not formed. Overlap separation mat a minimum of six (6) inches for side and end laps, and immediately install ballast or pavers over the loose laid separation mat.

3.10 Traffic Protection

- A. Install walkway rolls at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.
- B. Heat-weld walkway rolls to the roof membrane surface continuously around the perimeter of the roll.
- C. Walkway rolls may be installed with TPO primer and three (3) inch seam tape.
 - 1. Roll or brush the TPO primer on the back of the TPO pad along the edges and down the middle length of the pad.
 - 2. Clean and prime the roof membrane where the pad will be installed.
 - 3. Install tape to the back of the cleaned area of the pad and roll in with a silicone hand roller.
 - 4. Remove release paper and install the tape pads directly onto the roof membrane. Roll pads to secure in place.

3.11 Roof Protection

- A. Protect all partially and fully completed roofing work from other trades until completion.
- B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.
- C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.
- D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.12 Clean-Up

- A. All work areas are to be kept clean, clear and free of debris at all times.
- B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.
- C. All tools and unused materials must be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.
- D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.
- E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.
- F. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

SECTION 07600

FLASHING AND SHEET METAL

1. GENERAL

1.01 Description

A. Furnish all labor, materials, equipment and incidentals for the complete installation of flashing, counterflashing, gutters and downspouts, sheet metal work as shown on the Contract Drawings and as required to provide a watertight building envelope.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
03300	Cast-in-Place Concrete
04050	Masonry
04230	Reinforced Unit Masonry
06100	Rough Carpentry
07900	Joint Sealants
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts, who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

- B. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Architectural Manufacturers Association (AAMA)	
AAMA 2604	Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
AAMA 2605	Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
American Society for Testing and Materials (ASTM)	
ASTM A167	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B29	Standard Specification for Refined Lead
ASTM B32	Standard Specification for Solder Metal
ASTM B209/B209M	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1311	Standard Specification for Solvent Release Sealants
ASTM D226/D226M	Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D2178/D2178M	Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D4397	Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D4586/D4586M	Standard Specification for Asphalt Roof Cement, Asbestos-Free
Sheet Metal and Air Conditioning Contractors National Association (SMACNA)	
	Architectural Sheet Metal Manual, latest edition
Other Standards	
	Florida Building Code
	Factory (FM) I-90 Wind Uplift Requirements

- C. Comply with SMACNA's "Architectural Sheet Metal Manual" and CDA A4050. Conform to the dimensions and profiles shown unless more stringent requirements are indicated.
- D. Standard commercial items may be used for flashing, trim, reglets and similar purposes provided such items meet or exceed the quality standards specified.
- E. Fabricator and Installer Qualifications: Company(ies) specializing in sheet metal work with a minimum of five (5) years of documented experience.

- F. Install and fasten sheet metal work in compliance with Factory (FM) I-90 wind uplift requirements, Florida Building Code and all Hurricane requirements.
- G. Coordinate application of the flashings with applications of roofing, protruding materials and roof accessories, including piping, conduit, lightning protection systems, blocking, nailers, parapets, scuppers, etc., in such a manner that complete installation is weathertight and in accordance with the specified warranty requirements.

H. Pre-Installation Conference

1. **Conduct a pre-installation conference at the Project Site** to comply with the requirements of Section 01200, "Project Meetings".
2. Meet with the Owner, Engineer, Installer and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights and roof-mounted equipment.
3. Review methods and procedures related to sheet metal flashing and trim.
4. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
5. Document proceedings, including corrective measures and actions required, and furnish a copy of the record to each participant.

1.03 Performance Requirements

- A. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to the recommendations in FMG Loss Prevention Data Sheet 1-49, as per the Florida Building Code.
- C. Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base all engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss as follows:

1. Temperature Change (Range): 120°F (67°C) ambient; 180°F (100°C) material surfaces.
- D. Provide sheet metal flashing and trim that do not allow water infiltration to the building interior.

1.04 Submittals

- A. Submit shop drawings, product data, certifications, etc., in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples". The submittal(s) shall indicate compliance with the specified requirements.
- B. Product Data
1. Provide the manufacturer's product data for each type of product indicated.
 2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings
1. Show layouts of the sheet metal flashing and trim, including plan views and elevations. Distinguish between shop assembled and field assembled work. Include the following:
 - a. Identify material, thickness, weight, and finish for each item and location in the Project.
 - b. Details for forming sheet metal flashing and trim, including profiles, shapes, seams and dimensions.
 - c. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - d. Details of expansion joint covers, including showing direction of expansion and contraction.
- D. Samples
1. Samples shall be provided for each type of exposed finish required, prepared on samples of the size indicated below:

- a. Sheet metal flashing shall be twelve (12) inches long. Include fasteners, cleats, clips, closures and other attachments.
 - b. Trim shall be twelve (12) inches long. Include fasteners and other exposed accessories.
 - c. Provide full size samples of all accessories.
- E. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.05 Product Delivery, Storage and Handling

- A. ***Deliver sheet metal flashing materials and fabrications undamaged.*** Protect sheet metal flashing and trim materials and fabrications during transportation, storage and handling.
- B. Unload, store and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. ***Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering.*** Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
- D. Store products and materials in a dry secure location.
- E. ***Any damaged material will be rejected and replaced at no additional cost to the Owner.***

1.06 Coordination

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and non-corrosive installation.

1.07. Dissimilar Materials

- A. Where sheet metal abuts or joins adjacent dissimilar materials, execute juncture to prevent electrolysis between the two materials.

1.08 Warranty

- A. Furnish a **five (5) year warranty, commencing at Final Project Acceptance by the Owner**, covering material and workmanship for all flashings in conjunction with the warranty of the roofing system.
- B. The warranty shall cover the watertight integrity of the flashings for a period of **five (5) years from the date of Final Project Acceptance by the Owner**, including repair and replacement of components or system which becomes faulty or in disrepair during the warranty period, at no additional cost to the Owner.
- C. Faulty components and disrepair includes defects in manufacture and instructions, defects in material and leaks of any kind.

2. PRODUCTS

2.01 Materials

A. Stainless Steel Sheet

- 1. ASTM A167, Type 304 stainless steel, 2D finish, minimum 26 gauge unless otherwise noted, fully annealed or dead soft temper. Use flashing as manufactured by Keystone Flashing Co., or approved equal.

B. Aluminum Sheet

- 1. ASTM B209, Alloy 3003, 3004, 3105, or 5005, with a minimum 20 gauge thickness.
- 2. Temper suitable for forming and structural performance required, but not less than H14, mill finished, standard two-sides bright.
- 3. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system. Color to be selected by the Engineer and Owner from the manufacturer's standard color wheel.

C. Lead Flashing

- 1. ASTM B29, four (4) pound sheet lead.

D. Solder

1. ASTM B32, Sn 50.

E. Fasteners

1. Nails shall be of the flat head type, annular ring, 12 gauge minimum, of sufficient length to penetrate backing at least $\frac{3}{4}$ -inch and of stainless steel or the same material as flashing metal to prevent dielectric action.
2. Bolts, screws and rivets shall be stainless steel or the same material as flashing metal to prevent dielectric action and of sufficient size and strength to accomplish the task.

F. Polyethylene Sheet

1. Six (6) mil thick polyethylene sheet complying with ASTM D4397.

G. Felts

1. ASTM D226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.

H. Slip Sheet

1. Rosin-sized paper, minimum 3 lb/100 ft².

I. Roofing Cement

1. Plastic roofing cement conforming to ASTM D4586 and Federal Specification SS-C-153, Type 1, asphalt base, asbestos free, of the consistency required for application, or as otherwise recommended by the roofing manufacturer.

J. Sealing Tape

1. Pressure-sensitive, one hundred percent (100%) solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape.

K. Elastomeric Sealant

1. The elastomeric polyurethane polymer sealant shall conform to ASTM C-920 and be of the type, grade, class and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

L. Butyl Sealant

1. The butyl sealant shall be a single-component, solvent release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hook type expansion joints with limited movement and shall conform to ASTM C-1311.

M. Epoxy Seam Sealer

1. The epoxy seam sealer shall be a two-part, non-corrosive, aluminum seam-cementing compound, recommended by the aluminum manufacturer for exterior non-moving joints, including riveted joints.

2.02 Fabrications**A. General**

1. Fabrication of materials shall be scheduled in accordance with the approved shop drawings. Skilled fabricators working with suitable equipment shall be provided to produce high quality fabrications.
2. If no specific details are required, comply with the recommendations of the Architectural Sheet Metal Manual of SMACNA that apply to design, dimensions, metal, and other characteristics of the item. Shop fabricate items where practicable. Obtain field measurements for an accurate fit before shop fabrication.
3. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of Work.
4. Form work to fit all substrates.
5. Fabricate sheet metal flashing and trim in the thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
6. Form non-expansion but moveable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

7. Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep, filled with elastomeric butyl sealant concealed within joints.
8. Locate expansion joints within two (2) feet of each corner or intersection of sheet metal flashing and trim.
9. ***Provide for thermal expansion on running trim in items exposed for more than fifteen (15) feet continuous length at a minimum of one joint every ten (10) feet.***
10. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
11. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal.
12. The thickness shall be as recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.
13. Corners shall be mitered and welded with nominal six (6) foot legs. At the Contractor's option, other methods of fabricating corners may be submitted subject to the Engineer's approval of physical sample.
14. Separate dissimilar metals from each other by painting each metal surface in the area of contact with a bituminous coating or by other permanent separation as recommended by the manufacturers of the dissimilar metals.
15. Fabricate and install work with lines and corners of exposed units true and accurate with clear, sharp and uniform sizes.
16. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks, considering the temper and reflectivity of the metal.

B. Seams

1. ***Finish flat lock seams not less than one (1) inch wide. Finish solder-lap seams not less than one (1) inch wide.***
2. Lap unsoldered Plain-Lap Seams not less than three (3) inches unless otherwise specified.
3. Fabricate sheet metal flashing and trim without excessive oil canning, buckling and tool marks and true to line and levels indicated, with exposed edges folded back to from hems.

- a. Seams for Aluminum: *Fabricate non-moving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.*
- b. Seams for Materials other than Aluminum: *Fabricate non-moving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.*
- c. Provide uniform, neat seams with a minimum of solder, welds, sealants, etc.
- d. Except as otherwise shown, fold back the sheet metal to form a hem on the concealed side of exposed edges.

C. Cap and Counter Flashing

- 1. Overlap base flashings not less than three (3) inches unless concealed or otherwise indicated.
- 2. Lap end joints three (3) inches.
- 3. Where bituminous base flashings are provided extend counter flashing down as close as practicable to the top of the cant strip.
- 4. Form to provide spring action against base flashing.
- 5. Fold under not less than ½-inch lower edge or provide longitudinal V-type crimp at lower edge.
- 6. Do not solder or weld joints.

D. Bitumen Dams

- 1. Fabricate tubular sleeve bitumen dams using 26 gauge aluminum of proper diameter for close fit over sanitary vents and with a dam height of not less than 1½-inches.
- 2. Provide four (4) inch roof flanges on dams soldered bitumen tight to dam sleeve.

E. Reglets

- 1. Reglets shall be of the type, material and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and factory welded corners and junctions.

2. Acceptable Manufacturers

a. Cheney Flashing Company, Inc.	d. Hickman, W.P. Company
b. Fry Reglet Corporation	e. Keystone Flashing Company, Inc.
c. Heckman Building Products, Inc.	f. Sandell Manufacturing Company, Inc.

3. Surface Mounted Type

- a. Provide with slotted holes for fastening to the substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at the top edge.

4. Stucco Type

- a. Provide with upturned fastening flange and extension leg of the length to match the thickness of applied finish materials.

5. Concrete Type

- a. Provide temporary closure tape to keep the reglet free of concrete materials, special fasteners for attaching the reglet to concrete forms, and guides to ensure alignment of reglet section ends.

6. Masonry Type

- a. Provide with offset top flange for embedment in masonry mortar joint.

7. Flexible Flashing Retainer

- a. Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where the clearance does not permit use of standard metal counterflashing or where the Drawings show reglet without metal counterflashing.

8. Counterflashing Wind-Restraint Clips

- a. Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.

9. Miscellaneous

- a. Fabricate using sheet stainless steel to detail indicated, in not over ten (10) foot sections.

- b. Form two (2) inch top portion as indicated to receive sealant.
- c. Form bottom edge outward at an angle and hood under to retain counterflashing.
- d. Shop punch top edge for fastenings at not over twelve (12) inches on center.

F. Fabrication of Flashing for Pipes, Conduits and Round Equipment Supports Penetrating Roofing or Resting on Roofing

- 1. Form tubular base flashing sleeves not less than eight (8) inches high to fit pipes, conduit and round equipment support and with four (4) inch wide roof flanges soldered watertight.
- 2. Form split tubular counterflashing to provide slip fit over base flashing, with two (2) inch minimum loose edge lap, of 5½-inch minimum height and with a four (4) inch lap over base flashings.
- 3. Provide stainless steel hose clamps for split type cap flashings.

G. Fabrication of Curb to Duct Flashing and Counterflashing

- 1. Fabricate to fit duct curbs and ducts projecting from curbs.
- 2. Provide four (4) inch vertical flange to cover top edge of bituminous base flashings. Form flange bottom towards curb; with ¼-inch bottom edge bent, ¼-inch out and hemmed.
- 3. At top of curbs bend metal 90° and extend horizontally over to duct, then bend upward and extend vertically not less than three (3) inches. Form top edge of flashing out ⅜-inch to receive sealant.
- 4. Provide for field soldered lap joints at comers and one (1) inch lap joint at horizontal miter splices.

H. Formed Aluminum Copings

- 1. Fabricate to profile and detail indicated, in not over ten (10) foot sections with minimum six (6) inch lap joints, with exterior bottom edges extended down two (2) inches as indicated, bottom drip formed and hooked over continuous sheet metal cleats to retain bottom edge. Extend the interior vertical flange 2½ inches, minimum, down on the inside of curb and hem.

2. Provide prefabricated prefinished corner units with watertight joints, extending six (6) inches each way.
3. Factory prefinished copings including corner units shall match other white prefinished metal.

2.03 Roof Drainage Sheet Metal Fabrications

A. Gutters

1. Fabricate to the cross section indicated, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch (2400-mm) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of the size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
 - a. Gutter Style: *Match the existing gutters on the "existing" Reclaimed Water Facility Building.*
 - b. Expansion Joints: *Lap type Built in.*
 - c. Accessories: *Continuous removable leaf screen with sheet metal frame and hardware cloth screen Wire ball downspout strainer Valley baffles.*
 - d. Gutters with girth up to 15-inches: *Fabricate from aluminum.*
 - e. Splash Pads: *Precast concrete type, of size and profiles indicated; minimum 3,000 psi at 28 days, with minimum 5 percent air entrainment.*

B. Downspouts

1. Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as the downspouts and anchors.
 - a. Manufactured Hanger Style: *Scrap*
 - b. Fabricate downspouts from aluminum, 0.024 inch (0.6 mm) thick.

C. Scuppers

1. Fabricate scuppers of the dimensions required with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
2. Lock seam corners, solder watertight and hem outer exposed edges.
3. Fabricate scuppers from aluminum sheet.

D. Conductor Heads

1. Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows.
2. Fabricate conductor heads from aluminum, 0.0320 inch (0.8 mm) thick.

2.04 Low-Slope Roof Sheet Metal Fabrications

A. Copings

1. Fabricate in minimum ninety-six (96) inch long, but not exceeding ten (10) foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 - a. Joint Style
 - 1) Butt, with twelve (12) inch wide concealed backup plate and six (6) inch wide exposed cover plates.
 - b. Fabricate copings from aluminum, 0.050 inch (1.2 mm) thick.

B. Splash Pans

1. Fabricate splash pans from the aluminum, 0.040 inch (1.0 mm) thick.

C. Roof-Drain Flashing

1. Fabricate roof-drain flashing from Lead, 4.0 lb/ft² (1.6 mm thick), hard tempered.

2.05 Finishes

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work
 - 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable.
 - 2. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

3. EXECUTION

3.01 Examination

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Examine substrates, areas, and conditions, with the Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Installation

- A. General
 - 1. Form sheet metal accurately and to the dimensions and shapes required, finishing molded and broken surfaces with true, sharp, and straight lines and angles and, where intercepting other members, coping to an accurate fit and soldering securely.
 - 2. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners,

solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system. Torch cutting of sheet metal flashing and trim is not permitted.

3. Unless otherwise specifically permitted by the Engineer, turn exposed edges back ½-inch.
4. ***Finish watertight and weathertight.*** Make all lock seams work flat and true to line, sweating full of solder. Make lock seams and lap seams, when soldered, at least ½-inch wide. Where lap seams are not soldered, lap according to pitch, but in no case less than three (3) inches. Make flat and lap seams in the direction of flow.
5. Install the work in accordance with the approved shop drawings.

B. Metal Protection

1. ***Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action*** by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - a. Coat side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - b. Underlayment
 - 1) Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - c. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

- F. Join parts with rivets or sheet metal screws where necessary for strength or stiffness. Provide for thermal expansion.

- G. Cleats

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners.
2. Bend tabs over fasteners.

- H. Expansion Provisions

1. Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of ten (10) feet with no joints allowed within twenty-four (24) inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep, filled with elastomeric sealant concealed within joints.

- I. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than one (1) inch into sealant. Form joints to completely conceal the sealant. When ambient temperature at time of installation is moderate, between 40°F and 70°F (4 and 21°C), set joint members for fifty percent (50%) movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40°F (4°C).
2. Prepare joints and apply sealants to comply with requirements in Section 07900, "Joint Sealants,"

- J. Aluminum Flashing

1. Rivet or weld joints in uncoated aluminum where necessary for strength.

- K. Nailing

1. Sheet metal items shall be fastened as indicated or as required to provide rigid, secure installation free of warp or twist.
2. Whenever possible, secure metal by means of clips or cleats, without nailing through the exterior metal.

3. Space all nail, rivets and screws not more than eight (8) inches apart and where exposed to the weather, use lead washers.
4. For nailing into concrete, use drilled plugholes and plugs. For nailing into wood, use barbed roofing nails 1¼ inches long by 11 gage. Exposed face nailing will not be permitted.

L. Embedment

1. Embed mill metal in connection with roofs in a solid bed of sealant, using materials and methods described in Section 07900, "Joint Sealants".
2. Embed metal flashing flanges in roofing a minimum of four (4) inches.

M. Soldering

1. Thoroughly clean and tin all joint materials prior to soldering.
 - a. Perform all soldering slowly, in order to heat the seams thoroughly and to completely fill them with solder.
 - b. Perform soldering with a heavy soldering copper of blunt design, properly tinned for use.
 - c. Make all exposed soldering on finished surfaces neat, full flowing, and smooth.
 - d. After soldering, thoroughly wash acid flux with a soda solution.
2. Isolate dissimilar materials to prevent electrolysis.

N. Bitumen Dams

1. Install before installation of roofing.
2. Place bitumen dams over roof penetrations.
3. Set dam roof flanges on roof dock with asphalt base roofing cement and fasten in place with appropriate fasteners.

O. Surface Applied Reglets

1. Set on masonry and concrete walls over base flashing where indicated.

2. Secure to wall with No. 10 x 1-inch minimum Tap-Con screws at twelve (12) inches on-center maximum. Provide sealant washers and stainless steel washers under screw heads.
3. Seal Joint Sealants". Slope the top of the sealant to drain.

P. Counterflashings

1. At surface applied reglet locations, snap counterflashings in surface type reglets over base flashings.
2. Lap splices four (4) inches minimum and seal with sealant.

Q. Provide sheet metal base and counterflashing at pipes, conduits and round equipment supports.

1. Set flashing roof flanges in full bed of roofing cement.
2. Cover flashing with two (2) layers of roofing felt stripping set in solid coats of hot pitch or roofing cement.
3. Wrap pipe, conduit and round equipment support with one or more layers of $\frac{3}{8}$ -inch by 1-inch wide neoprene foam tape, with tight fitting butt joints.
4. Install counterflashing over base flashing and seal weathertight at top edge with elastomeric sealant.
5. Seal counterflashing lap with elastomeric sealant.
6. Secure counterflashings with stainless steel hose clamps.

R. Installation of Curb to Duct Flashing and Counterflashing

1. Install flashings after ducts through curbs are in place and after base flashings are completed.
2. Place flashings in place on curbs and solder corners and corner miter laps watertight.
3. Secure counterflashings to vertical edge of curb nailers with No. 10 stainless steel shad metal screws through sealants washers at not over 12 inches on-center.

4. Secure vertical upturned duct flashing to duct with No. 10 stainless steel sheet metal mews through sealants washers at not over six (6) inches on-center.
5. Seal joint between flashings and ducts with sealant as specified in Section 07900, "Joint Sealants".

S. Installation of Splash Blocks

1. Where scuppers or downspouts empty onto lower roofs or on to the surfaces other than concrete or asphalt, provide precast concrete splash blocks.

3.03 Roof Drainage System Installation

- A. Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters

1. Join sections with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets straps spaced not more than thirty-six (36) inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
2. Fasten gutter spacers to front and back of gutter.
3. Loosely lock straps to front gutter bead and anchor to roof deck.
4. Anchor and loosely lock back edge of gutter to continuous cleat eave or apron flashing.

C. Downspouts

1. Join sections with 1½-inch telescoping joints. Provide fasteners designed to hold downspouts securely one (1) inch away from walls; locate fasteners at the top and bottom and at approximately sixty (60) inches, on center, in between.
2. Provide elbows at the base of the downspout to direct water away from the building.
3. Connect downspouts to underground drainage system, where indicated.

D. Scuppers

1. Install scuppers where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
3. Loosely lock front edge of scupper with conductor head.
4. Seal or solder exterior wall scupper flanges into back of conductor head.
5. Secure to masonry walls and concrete docks with stainless steel sheet metal screws in lead shields at six (6) inches on center.

E. Conductor Heads

1. Anchor securely to wall with elevation of conductor head rim one (1) inch below the scupper and/or gutter discharge.

F. Expansion-Joint Covers

1. Install expansion-joint covers at the locations and of the configuration indicated. Lap joints a minimum of four (4) inches in the direction of water flow.

G. Splash Pans

1. Install splash pans where downspouts discharge on low-sloped roofs.
2. Set in asphalt roofing cement compatible with roofing membrane.

3.04 Roof Flashing Installation

A. General

1. Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual".
2. Provide concealed fasteners where possible, set units true to line, and level as indicated.

3. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing

1. Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
2. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at twenty-four (24) inch centers.

C. Copings

1. Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
2. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at twenty-four (24) inch centers.
3. Anchor interior leg of coping with screw fasteners and washers at twenty-four (24) inch centers.

D. Pipe or Post Counterflashing

1. Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of four (4) inches over base flashing.
2. Install stainless-steel draw band and tighten.

E. Counterflashing

1. Coordinate the installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing four (4) inches over the base flashing. Lap counterflashing joints a minimum of four (4) inches and bed with elastomeric sealant.
2. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant or interlocking folded seam or blind rivets and sealant.

F. Roof-Penetration Flashing

1. Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

- a. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
- b. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.05 Wall Flashing Installation

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing
 1. Installation of manufactured formed through-wall flashing shall be in accordance with the manufacturer's instructions and Division 4, "Masonry".
- C. Reglets
 1. Installation of reglets shall be in accordance with the manufacturer's recommendations, Section 03300, "Cast-in-Place Concrete, and Division 4, "Masonry".
- D. Openings Flashing in Frame Construction
 1. Install continuous head, sill, jamb, and similar flashings to extend four (4) inches beyond wall openings.

3.06 Miscellaneous Flashing Installation

- A. Overhead-Piping Safety Pans
 1. Suspend pans from pipe and install drain line to plumbing waste or drain line, as required.
- B. Equipment Support Flashing
 1. Coordinate installation of equipment support flashing with the installation of roofing and equipment.
 2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.07 Cleaning and Protection

- A. Clean exposed metal surfaces of substances that might cause corrosion of metal or deterioration of finishes.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.

3.08 Testing

- A. The Installer and Contractor shall demonstrate by hose or standing water, in the presence of the Engineer, that ***all flashing, sheet metal and the roof drainage system is completely watertight.***

END OF SECTION

SECTION 07620

SCUPPER BOXES AND DOWNSPOUTS

1. GENERAL

1.01 Description

A. The Contractor shall furnish all labor, materials, equipment, ancillaries and incidentals and install flashing, counterflashings, gutter and downspouts on the “new” Sanford Main WTP Operations Building.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
Division 4	Masonry
Division 5	Miscellaneous Metals
Contract Drawings and General Provisions of the Contract	

1.02 Quality Assurance

A. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American Society for Testing and Materials (ASTM)	
ASTM B-209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2004
Other Standards and Building Codes	
	Florida Building Code
	SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003

- B. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

1.03 Submittals

A. Shop Drawings

1. Copies of all materials required to establish compliance with the Contract Documents shall be submitted in accordance with the provisions of Section 00700, "General Conditions, Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples".
2. Submit product data for all components associated with the scupper box and downspout system, including, but not limited to, the following:
 - a. All materials and components associated with the scupper box and downspout system. Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
 - b. Preparation instructions and recommendations.
 - c. Storage and handling requirements and recommendations.
 - d. Installation methods.

B. Manufacturer's Certification

1. The manufacturer shall provide a written certification to the Engineer that the scupper boxes, downspouts and sheet materials conform to the requirements of this specification section.

1.04 Delivery, Storage and Handling

- A. Store products in accordance with the manufacturer recommendations.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.
- D. Protect the insulation from open flame and **keep dry at all times**.

2. PRODUCTS

2.01 Sheet Materials

A. Pre-Finished Aluminum

1. ASTM B-209 (ASTM B 209M); 0.032 inch (0.8 mm) thick; plain finish shop pre-coated with fluoropolymer coating of color as selected by the Engineer and Owner.
2. The fluoropolymer coating shall be a high performance organic finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system. The color shall be selected by the Engineer and Owner from the manufacturer's color wheel.

2.02 Gutter and Scupper Box Fabrication

- A. The scupper boxes shall in accordance with SMACNA Architectural Sheet Metal Manual and have a rectangular profile.
- B. The downspouts shall have a pre-formed, rectangular profile.
- C. Accessories shall be profiled to suit the gutters and downspouts.
 1. Anchorage devices: In accordance with SMACNA requirements
 2. Gutter and Downspout supports: Brackets
- D. All metal joints shall be sealed.

3. EXECUTION

3.01 Examination

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 Preparation

- A. Install starter and edge strips, and cleats before starting installation.

- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 General Installation

- A. Installation shall conform to construction and erection drawing details and manufacturer's installation instructions.
- B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Secure gutters and downspouts in place using concealed fasteners.
- F. Slope gutters ¼-inch per foot, minimum.

3.04 Protection

- A. Protect installed products until project completion.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 Clean-up

- A. All work areas are to be kept clean, clear and free of debris at all times.
- B. Do not allow trash, waste, or debris to collect. These items shall be removed on a daily basis.
- C. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.
- D. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

SECTION 07900

JOINT SEALANTS

1. GENERAL

1.01 Description

A. The work specified under this Section relates to providing caulking and sealants as required, in the locations indicated on the Contract Drawings and specified herein. The caulking and sealant systems used shall achieve moisture and air tight joint seals.

B. Terminology

Term	Definition
Caulking	The term used to denote the process of filling the joints, without regard to type of material.
Caulking Compound	A material used in filling joints and seams, having properties of adhesion and cohesion, shall not be required to have extensibility and recovery properties; usually applied at joints as the interior of structures. Material shall be applied in joints no subject to movement or weathering.
Sealant	A weatherproof elastomer used in filling and sealing joints, having properties of adhesion, cohesion, extensibility under tension, compressibility and recovery properties, designed to make joints air and watertight, designed generally for application to joints at the exterior of structures and to other joints subject to movement.

C. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
00700	General Conditions
01600	Materials and Equipment
07100	Waterproofing
09260	Gypsum Wallboard Assemblies
09311	Ceramic Tile

Division	Title
3	Joints in Concrete
4	Masonry
5	Metals
9	Finishes
Contract Drawings and General Provisions of the Contract	

D. This Section includes joint sealants for the following applications:

1. Exterior joints in the following vertical surfaces and horizontal non-traffic surfaces:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - e. Control and expansion joints in ceilings and other overhead surfaces.
 - f. Joints in vertical surfaces and horizontal non-traffic surfaces.
 - g. Other joints as indicated.
2. Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls, and partitions.
 - e. Joints on underside of plant-precast structural concrete beams and planks.
 - f. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.

- g. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - h. Other joints as indicated.
3. Interior joints in the following horizontal traffic surfaces:
- a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated.
- E. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- F. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.02 Quality Assurance

A. Reference Standards

1. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM C661	Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011)
ASTM C834	Standard Specification for Latex Sealants (2014)
ASTM C919	Standard Practice for Use of Sealants in Acoustical Applications (2012)
ASTM C920	Standard Specification for Elastomeric Joint Sealants (2014)
ASTM C1193	Standard Guide for Use of Joint Sealants (2013)
ASTM C1248	Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012)
ASTM C1311	Standard Specification for Solvent Release Sealants (2014)
ASTM D2240	Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010)

STANDARD	DESCRIPTION
Sealant, Waterproofing and Restoration (SWR) Institute	
SWRI (VAL)	SWR Institute Validated Products Directory; Current Listings at www.swrionline.org
SWRI (VAL)	SWR Institute Validated Products directory; Sealant, Waterproofing and Restoration Institute; online at http://www.swrionline.org/ValidatedSealants

- B. Prior to installation of sealants and caulking and at Engineer's direction, meet at the Project Site to review material selections, joint preparations, installation procedures, and work sequencing.
- C. Examine sample application to determine and record whether all parties agree proposed installations are likely to perform as required.
- D. Products included under this Section shall be acceptable to manufacturers of adjoining materials.
- E. Use products by manufacturers regularly engaged in manufacturer of similar with items and with a history of successful production.
- F. Perform installation using workman thoroughly trained and certified with the specified products. The Contractor shall provide the services of an installer/applicator who has at least five (5) years satisfactory, continuous experience in the application of the types of materials required.
- G. Schedule caulking work so that joints will be approximately normal size when caulked. Follow the manufacturer's instructions and recommendations.

1.03 Submittals

- A. Submittals shall be in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions and Section 01300, "Shop Drawings, Submittals and Samples".
- B. The Contractor shall submit to the Engineer for approval, at least the following:
 - 1. Published data or manufacturer's letter, clearly indicating that each product to be furnished complies with specifications, recommended for the application shown, and compatible with each other material in the joint system.
 - 2. Submit manufacturer's technical data sheets for each product to be used, that includes the following:

- a. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - b. Instructions for handling, storage, mixing and priming.
 - c. List of backing materials approved for use with the specific product.
 - d. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - e. Substrates the product should not be used on.
 - f. Substrates for which use of primer is required.
 - g. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - h. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - i. Protection of each type of compound, caulking and sealant.
 - j. Applicable cleaning solvents.
 - k. Sample product warranty.
 - l. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.
3. ***A five (5) year guarantee on sealant or caulk type work against joint failure.*** Joint failure is defined as leaks of air or water, evidence of loss of adhesion between the sealant and the joint edge, evidence of loss of cohesion, fading of sealant material, or migration of sealant. The Contractor is directed to the provisions of Section 01740, "Warranties and Bonds".
- C. ***A notarized Certificate of Compliance*** stating that all sealant and caulking materials and installations conform to all codes, ordinances, regulations and standards specified herein and otherwise having jurisdiction over this aspect of the Project and that the product complies with specification requirements.

1.04 Project Conditions

- A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by the joint-sealant manufacturer or are below 40°F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by the joint-sealant manufacturer for the applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

B. Joint-Width Conditions

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by the joint sealant manufacturer for the applications indicated.

C. Joint-Substrate Conditions

1. Do not proceed with the installation of joint sealants until contaminants capable of interfering with adhesion are removed from the joint surfaces.

1.05 Product Delivery, Storage and Handling

- A. Materials shall be delivered in original, sealed containers, labeled with, at a minimum, the following:
1. Manufacturer.
 2. Product name and product designation.
 3. Color.
 4. Expiration date.
 5. Pot life.
 6. Curing time.
 7. Mixing instructions for multi-component materials.
- B. Materials shall be stored and handled in accordance with the manufacturer's recommendations so as to prevent the inclusion of foreign matter or the damage of materials by water, heat, sunlight or breaking, and shall be stored in original containers until ready for use.
- C. Material showing evidence of damage shall be rejected and replaced with new material at no additional cost to the Owner.

1.06 Cleanup

- A. Cleanup such trash and debris generated by the work and leave the completed work in a clean, undamaged and finished condition, ready to receive without further preparation, unless so specified in other Sections, any adjacent or abutting work to be performed by others.
- B. Use manufacturer approved cleaning solvents to clean and remove excess sealant and caulking materials.

1.07 Warranty and Guarantee

A. General Warranty

- 1. Special warranties specified in this Article shall:
 - a. Not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents.
 - b. Be in addition to, and run concurrent with, other warranties made by the Contractor under the requirements of the Contract Documents.

B. Special Installer's Warranty

- 1. A written warranty, signed by the installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period, fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
- 2. The warranty period shall be **five (5) years and shall commence from the date of Final Project Acceptance by the Owner.**

C. Special Manufacturer's Warranty

- 1. A written warranty, signed by the manufacturer in which the elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
- 2. The warranty period shall be **five (5) years and shall commence from the date of Final Project Acceptance by the Owner.**

- D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.
- E. The Contractor shall refer to Section 01740, "Warranties and Bonds", for additional requirements.

2. PRODUCTS

2.01 General

- A. For horizontal joints, use self-leveling compounds and, for all other joints, use non-sag compounds, unless otherwise indicated or specified.
- B. Before purchase, the Contractor shall confirm that the specified sealants are compatible with the materials of the joint surfaces, joint fillers and other materials in the joint system where they are to be applied.

2.02 Manufacturers

- A. Non-Sag Sealants: *Permits application in joints on vertical surfaces without sagging or slumping.*

1. Acceptable Manufacturers

Manufacturer	Website
BASF Construction Chemicals-Building Systems	www.buildingsystems.basf.com.
Bostik Inc	www.bostik-us.com

Manufacturer	Website
Dow Corning Corporation	www.dowcorning.com/construction/#sle
Hilti, Inc	www.us.hilti.com/#sle
Pecora Corporation	www.pecora.com
The QUIKRETE Companies	www.quikrete.com
Tremco Global Sealants	www.tremcosealants.com
Sika Corporation	www.usa-sika.com
W.R. Meadows, Inc	www.wrmeadows.com

- B. Self-Leveling Sealants: *Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.*

1. Acceptable Manufacturers

Manufacturer	Website
BASF Construction Chemicals-Building Systems	www.buildingsystems.basf.com
Bostik Inc	www.bostik-us.com
Dow Corning Corporation	www.dowcorning.com/construction/#sle
Pecora Corporation	www.pecora.com
The QUIKRETE Companies	www.quikrete.com
Tremco Global Sealants	www.tremcosealants.com
Sika Corporation	www.usa-sika.com
W.R. Meadows, Inc	www.wrmeadows.com

2.03 Joint Sealant Applications

A. Scope

1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items:
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.

- 1) Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings.
 - 2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
- c. Other joints indicated below.
2. Do not seal the following types of joints:
- a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints

1. Use non-sag, non-staining silicone sealant, unless otherwise indicated.

Joint	Material
Lap Joints in Sheet Metal Fabrications	Butyl rubber, non-curing
Lap Joints between Manufactured Metal Panels	Butyl rubber, non-curing
Control and Expansion Joints in Concrete Paving	Self-leveling polyurethane "traffic-grade" sealant
Wiring Slots in Concrete Paving	Self-leveling epoxy sealant

C. Interior Joints

1. Use non-sag polyurethane sealant, unless otherwise indicated.

Joint	Material
Wall and Ceiling Joints in Non-Wet Areas	Acrylic emulsion latex sealant
Wall and Ceiling Joints in Wet Areas	Non-sag polyurethane sealant for continuous liquid immersion.
Floor Joints in Wet Areas	Non-sag polyurethane "nontraffic-grade" sealant suitable for continuous liquid immersion

Joint	Material
Wall, Ceiling, and Floor Joints Where Tamper-Resistance is Required	Non-sag tamper-resistant silyl-terminated polyurethane sealant
Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings	Mildew-resistant silicone sealant; clear
In Sound-Rated Assemblies	Acrylic emulsion latex sealant
Narrow Control Joints in Interior Concrete Slabs	Self-leveling epoxy sealant
Other Floor Joints	Self-leveling polyurethane "traffic-grade" sealant

- D. Interior Wet Areas: Restrooms; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".
- F. Areas Where Tamper-Resistance is Required: As indicated on the drawings.

2.04 Joint Sealants - General

- A. Provide products with levels of volatile organic compound (VOC) content.
- B. Colors to be selected by the Engineer and Owner to match application.

2.05 Non-Sag Joint Sealants

A. Non-Staining Silicone Sealant

- ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
- Movement Capability: , minimum.
- Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
- Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

B. Silicone Sealant

1. ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
2. Movement Capability: ± 25 percent, minimum.
3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
4. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.
5. Cure Type: Single-component, neutral moisture curing.
6. Service Temperature Range: -65 to 180°F.

C. Mildew-Resistant Silicone Sealant

1. ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
2. Color: White.

D. Tamper-Resistant, Silyl-Terminated Polyurethane (STPU) Sealant

1. ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
2. Movement Capability: ± 12.5 percent, minimum.
3. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
4. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.

E. Polyurethane Sealant

1. ASTM C920, Grade NS, Uses M and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.
2. Movement Capability: ± 25 percent, minimum.
3. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.

4. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.
5. Service Temperature Range: -40 to 180°F.

F. Polyurethane Sealant for Continuous Water Immersion

1. ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
2. Movement Capability: ± 35 percent, minimum.
3. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.
4. Service Temperature Range: -40 to 180°F.

G. Tamper-Resistant Polyurethane Sealant

1. ASTM C920, Grade NS, Uses M, G, and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.
2. Movement Capability: ± 12.5 percent, minimum.
3. Hardness Range: 50 to 60, Shore A, when tested in accordance with ASTM C661.
4. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.
5. Service Temperature Range: -40 to 180°F.

H. Acrylic Emulsion Latex

1. Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
2. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.
3. Grade: ASTM C834; (Grade: -18°C).

I. Non-Curing Butyl Sealant

1. Solvent-based; ASTM C1311; single component, nonsag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

2.06 Self-Leveling Sealants

A. Self-Leveling Polyurethane Sealant

1. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
2. Movement Capability: ± 25 percent, minimum.
3. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
4. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.
5. Service Temperature Range: -40 to 180°F.

B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion

1. Polyurethane; ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
2. Movement Capability: ± 25 percent, minimum.
3. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
4. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.

C. Semi-Rigid Self-Leveling Epoxy Joint Filler

1. Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.

2. Composition: Multi-component, 100% solids by weight.
3. Hardness: Minimum of 85 (Shore A) or 35 (Shore D), when tested in accordance with ASTM D2240 after 7 days.
4. Color: To be selected by the Engineer and Owner from the manufacturer's standard range.
5. Joint Width, Minimum: 1/8-inch.
6. Joint Width, Maximum: 1/4-inch.
7. Joint Depth: Provide product suitable for joints from 1/8-inch to 2 inches in depth excluding space for backer rod.

2.07 Primer

- A. Where a primer is required by the sealant manufacturer, it shall be a compound designed to insure the adhesion of sealant.
- B. Material shall be provided by the sealant manufacturer and shall be selected for compatibility with the sealant and substrate and shall be non-staining.

2.08 Miscellaneous Materials

A. Joint Cleaner

1. Provide cleaner recommended by manufacturer of sealant for specific joint surface and condition.

B. Joint Primer and Sealer

1. Provide compounds recommended by manufacturer of sealant for specific joint surface and condition.

C. Bond Breaker Tape

1. Pressure-sensitive polyethylene tape.

D. Accessory Materials for Fire-Stopping Sealants

1. Provide Forming, joint fillers, packing and other accessory materials required for installation of fire-stopping sealants as applicable to installation conditions indicated.

3. EXECUTION

3.01 Inspection of Surfaces

- A. Examine all surfaces and joints to be sealed and correct all conditions preventing the proper installation of the sealant. Ensure compliance with all requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance.
- B. Verify that backing materials are compatible with sealants.
- C. Application of the joint sealant or caulking shall constitute acceptance of the surface.

3.02 Surface Preparation

A. General

1. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
2. Do not apply sealants to joint surfaces previously painted or treated with sealer, curing compound, or other coating unless laboratory durability test of bond-cohesion has been performed to demonstrate that bond will be durable. Comply with test method procedures applicable to the particular sealant.
3. ***Do not apply paint and other coatings or substances to surfaces adjoining joint surfaces until sealants are installed and nominally cured*** to prevent impairment by migration of such substances into joint surfaces.
4. Prepare surfaces to receive sealant or caulking in strict compliance with the manufacturer's recommendations. Joints shall be raked out and cleaned to full width and depth required to accommodate back-up and sealant materials. Remove dirt, oil, grease, and all loose materials that would inhibit bond.

5. Metal and non-porous surfaces shall be solvent cleaned and wiped dry to remove residue.
6. Concrete and masonry surfaces shall be sound and fully cured. Remove form oils, curing compounds, water repellents, and laitance. Test for sealant adhesion; if required the surfaces shall be completely cleaned by chemical or mechanical means.
7. Joints
 - a. ***All joints shall be thoroughly cleaned to remove loose particles and foreign matter that could impair adhesion of the sealant.*** Material to be contacted by sealant shall be dry, fully free of laitance, loose aggregate, form release agents, curing compounds, water repellents and other surface treatments.
 - b. Joint packing shall be installed in all joints to receive sealant where required. Packing shall be sized to require 20 to 50 percent (20% - 50%) compression upon insertion, and shall be placed so that sealant depth is approximately one-half ($\frac{1}{2}$) joint width. In joints not of sufficient depth to allow packing, polyethylene bondbreaking tape shall be installed at the back of the joint. Lengthwise stretching of packing materials shall be avoided.
 - c. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable. Unmask said areas immediately after the joints have been sealed and tooled.
 - d. Joints shall be primed where required by sealant manufacturer, to receive sealant in accordance with manufacturer's instructions. Primer shall be brushed uniformly upon all surfaces of joint. Sufficient drying time shall be allowed before caulking.
 - e. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
8. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
9. Install bond breaker backing tape where backer rod cannot be used.

B. Coated Metal Joint Surfaces

1. Clean bonding surfaces unless coated metal joint surfaces have been successfully tested for bond-cohesion of sealant.

2. Clean bonding surfaces to base, non-oxidized metal by sanding, wire brushing, or clean with toluol, xylol, xylene, methyl ethyl ketone (MEK), or other process recommended by sealant manufacturer.
3. Do cleaning immediately before sealant installation.

C. Concrete and Masonry Joint Surfaces

1. Etch bonding surfaces with five percent (5%) solution of muriatic acid to remove excess alkalinity.
2. Rinse thoroughly with diluted ammonia solution and then with clean water.
3. Insure surfaces are dry before sealant installation.
4. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

D. Ceramic Tile and Similar Joint Surfaces

1. Abrade edge surfaces to be bonded with sealants to remove glassy surface.

3.03 Installation

A. Joint Sealants - General

1. Follow the manufacturer's instructions regarding mixing, surface preparation, primer, application and curing of sealants. Apply sealants and caulking in strict accordance with the manufacturer's timing and temperature requirements.
2. Prime or seal bonding joint surfaces as recommended by sealant manufacturer, taking care to avoid migration of primer or sealer onto adjoining surfaces; remove spillage promptly.
3. Install bond breaker to prevent bonding of sealant to surfaces where such bond might impair performance of sealant.
4. Do not puncture surface of skin of compressible rod type bond breaker.
5. Material which has exceeded the manufacturer's recommended potential open time (POT Life) shall not be used.

6. Perform installation in accordance with ASTM C1193.
7. Perform acoustical sealant application work in accordance with ASTM C919.
8. Joint sealant material shall be applied under pressure to fill joints completely with prevention of air pockets or voids. Tooling shall be performed with a solvent recommended by manufacturer. Joints shall be tooled concave.
9. Remove masking tape, if used, immediately after tooling sealant surface.

B. Depth of Application

1. Apply sealant to depth shown or, if not shown, apply to manufacturer's recommendations and following general proportions and limitations.
2. The depth of application in "non-traffic" or "non-abrasion" surfaces shall be equal to fifty percent (50%) of the joint width, minimum, maximum.

C. Placement

1. Apply compounds in continuous beads or rivers, filling joint from bottom without openings, voids, or air pockets.
2. Force compounds to the sides of joint so as to carefully and thoroughly "wet" opposite joint bond surfaces, forming equal areas of contact with sealant.
3. Confine the compound to joint areas indicated by use of masking tapes or other precautions to prevent spillage or migration onto adjoining surfaces.
4. Compress joints accurately so that excess compound will not exude from joint.
5. Tool exposed surfaces to compress sealant to profiles indicated, or if none is shown, tool surface slightly concave except provide a slight wash on horizontal joints where horizontal and vertical surfaces meet.
6. Pour self-leveling grade compounds in horizontal joints to level indicated, or if none is shown, to level $\frac{1}{16}$ -inch below adjoining surface.
7. Against rough surfaces or in joints of uneven widths, avoid appearance of excess sealant by locating sealant well back into joint where possible.
8. Remove excess sealant promptly as the work progresses.
9. Clean adjoining surfaces as necessary to eliminate any evidence of spillage.

D. Curing and Protection

1. ***Cure sealants and caulks in accordance with the manufacturer's instructions*** to obtain the maximum bond to surfaces, cohesive strength, and durability at earliest possible date.
2. Follow the manufacturers advise concerning the proper procedures for the protection of sealants and caulks during remainder of construction period.
3. Temporarily cover or protect joints from injury until the compound has set and protective surface films have formed.
4. ***Repair and replace sealants and caulks damaged or showing evidence to deterioration before Final Project Acceptance by the Owner.***

E. Thresholds

1. Thresholds shall be set in full bed of caulking sealant with excess material removed.

F. Cleaning

1. ***Adjacent surfaces shall be cleaned free of sealant or caulk and soiling resulting from this work and as work progresses, using a solvent or cleaning agent as recommended by the sealant/caulk manufacturer.***
2. Where any sealant or caulking material will permanently stain surfaces, these surfaces shall be masked out to prevent such staining. Stained or damaged adjacent work shall be repaired or replaced by the Contractor at no additional cost to the Owner.
3. All finished work shall be left in a neat, clean condition.

G. Locations of Application - General

1. Sealant shall be applied around penetrations of floor slabs and exterior walls for piping, conduits, ductwork and similar items, at top of slabs and exterior face of walls, around exterior perimeter of door frames and windows, louvers and vents, and at other exterior locations shown on the Contract Drawings.
2. Sealants shall be applied at interior locations shown on the Contract Drawings.

END OF SECTION

SANFORD MAIN WTP IMPROVEMENTS

SANFORD, FLORIDA



DIVISION 8

DOORS AND WINDOWS

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DIVISION 8

DOORS AND WINDOWS

<u>Specification Section</u>	<u>Title</u>
08000	Door Schedule
08120	Aluminum Doors and Frames
08210	Wood Doors
08305	Access Panels
08330	Aluminum Overhead Coiling Doors
08350	Aluminum Access Hatch Doors
08370	Roof Access Hatch Doors
08410	Aluminum-Framed Storefront Door System
08500	Window Schedule
08520	Aluminum Windows
08710	Finish Hardware
08800	Glass and Glazing

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SECTION 08000

DOOR SCHEDULE

1. GENERAL

1.01 Description

A. Scope of Work

1. The work included in this Section consists of furnishing all labor, materials, equipment and incidentals required to provide and install the doors in the following "new" Sanford Main WTP Operations Building to be constructed as part of this Contract, indicated herein and as shown on the Contract Drawings.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
08120	Aluminum Doors and Windows
08210	Wood Doors
08330	Aluminum Overhead Coiling Doors
08710	Finish Hardware
08800	Glass and Glazing

1.02 Finish Schedule

- A. The door schedule for the building(s)/structures to be constructed as part of this Contract shall be as follows:

SANFORD MAIN WTP IMPROVEMENTS PROJECT: DOOR SCHEDULE¹

Door No.	Room Name	Door Size W x H x T	Door Finish	Door Material	Door Type	Frame Finish	Frame Material	HDW Set	Comment
101	Reception Area ³	3' x 7' x 1¾"	Anodized	Aluminum	A	Anodized	Aluminum	16	Impact Rated Door
101A	Reception Area	3' x 7' x 1¾"	Stain	SWC ²	B3	Painted	Steel	09	---
102	Unisex Restroom	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	02	Undercut 1"
103	Unisex Restroom	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	02	Undercut 1"
104	Meeting / Breakroom ³	3' x 7' x 1¾"	Anodized	Aluminum	D1	Anodized	Aluminum	12	Impact Rated Door
106	Stairs ³	3' x 7' x 1¾"	Anodized	Aluminum	D1	Anodized	Aluminum	12	Impact Rated Door
106A	Stairs	3' x 7' x 1¾"	Anodized	Aluminum	D1	Anodized	Aluminum	07	45 min Fire Rated Door
107	Mechanical/Electrical Room	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	05	Undercut 1"
108	Unisex Restroom	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	02	Undercut 1"
109	Storage	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	03	Undercut 1"
110	Ops Center Control Room	3' x 7' x 1¾"	Stain	SWC ²	D2	Painted	Steel	08	---
111	High Service Pump Room	3' x 7' x 1¾"	Anodized	Aluminum	D1	Anodized	Aluminum	10	---
111A	High Service Pump Room ³	3' x 7' x 1¾"	Anodized	Aluminum	D1	Anodized	Aluminum	13.1	Impact Rated Door
111B	High Service Pump Room	14' x 14' x 2"	Anodized	Aluminum	---	Anodized	Aluminum	15	Overhead Door, Elec Op
112	Electrical Room ³	(2) 3' x 7'-10" x 1¾"	Anodized	Aluminum	C	Anodized	Aluminum	14	Impact Rated Door
112A	Electrical Room ³	3' x 7' x 1¾"	Anodized	Aluminum	B1	Anodized	Aluminum	13.1	Impact Rated Door
112B	Electrical Room	3' x 7' x 1¾"	Anodized	Aluminum	E	Anodized	Aluminum	11	90 min Fire Rated Door
113	Polyphosphate Area	3' x 7' x 1¾"	Anodized	Aluminum	D1	Anodized	Aluminum	13	Impact Rated Door
114	Fluosilicic Area	3' x 7' x 1¾"	Anodized	Aluminum	D1	Anodized	Aluminum	13	Impact Rated Door

SANFORD MAIN WTP IMPROVEMENTS PROJECT: DOOR SCHEDULE¹

Door No.	Room Name	Door Size W x H x T	Door Finish	Door Material	Door Type	Frame Finish	Frame Material	HDW Set	Comment
201	Stairs ³	3' x 7' x 1¾"	Anodized	Aluminum	D1	Anodized	Aluminum	07.1	45 min Fire Rated Door
203	Office	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	01	---
203A	Office	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	03	Undercut 1"
204	Mechanical / Electrical	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	04	Undercut 1"
205	IT Closet	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	06	---
206	Storage	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	03	Undercut 1"
207	Unisex Bathroom	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	02	Undercut 1"
208	Office	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	01	---
209	Office	3' x 7' x 1¾"	Stain	SWC ²	B2	Painted	Steel	01	---

¹ Signage, Head and Jamb Details identified on the Contract Drawings

² SWC - Solid Wood Core

³ This door requires a security card reader/access device. See Division 8 for further details.

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

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SECTION 08120

ALUMINUM DOORS AND FRAMES

1. GENERAL

1.01 Description

A. The work specified in this Section includes furnishing all labor, materials, equipment and incidentals required to deliver and install aluminum doors, frames, panels and appurtenances as indicated on the Contract Drawings, as scheduled, and as specified herein.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
03600	Grout
07900	Joint Sealants
08710	Finish Hardware
08800	Glass and Glazing
Division	Information
5	Miscellaneous Metals
Contract Drawings and General Provisions of the Contract	

1.02 References and Standards

- A. All work shall be executed and installed in accordance with the requirements of all applicable codes.
- B. The following publications, listed below, form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- C. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM B209/B209M	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221/B221M	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
American National Standards Institute (ANSI)	
ANSI/SDI A117.1	Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People
Florida Building Code (FBC)	
FBC TAS 201	Impact Test Procedures; Testing Application Standard
FBC TAS 202	Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure; Testing Application Standard
FBC TAS 203	Criteria for Testing Products Subject To Cyclic Wind Pressure Loading
Other Standards	
	ADA Standards - Americans with Disabilities Act Standards for Accessible Design
ICC A117.1	Accessible and Usable Buildings and Facilities
Miami (APD)	Approved Products Directory; Miami-Dade County

1.03 Quality Assurance

- A. Provide stock aluminum work manufactured by a **single firm** specializing in the production of this type of work, unless otherwise acceptable to the Engineer.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five (5) years documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five (5) years of documented experience.
- D. Submit a warranty for all aluminum doors and frames in accordance with Section 01740, "Warranties and Bonds". The manufacturer shall warrant each separate door installation against manufacturing defects for the "lifetime of original installation", including the cost of refinishing and rehanging if doors do not comply with specified tolerances.

1.04 Submittals

- A. Copies of all materials required to establish compliance with the specifications shall be submitted in accordance with the provisions Section 00700, "General Conditions", Section 00800, "Supplementary Conditions, and Section 01300, "Shop Drawings, Submittals and Samples".
- B. ***All equipment and materials shall be "new" and shall be specially designed or selected for the function and service specified.*** No equipment or materials may be used in the Project that has not been approved by the Engineer.
- C. Submittals shall include, but are not limited to, the following:
 - 1. Elevations of each door type.
 - 2. Size of doors and frames.
 - 3. Metal thickness.
 - 4. Details of door and frame construction, including reinforcement.
 - 5. Assembly methods.
 - 6. Methods of anchorage and fastening.
 - 7. Finishing and glazing details.
 - 8. Provisions for and location of hardware.
 - 9. Schedule showing each door, frame and swing of the door.
- D. Hardware templates shall be furnished to the door manufacturer by the Contractor for correct hardware location.
- E. The manufacturer's descriptive literature shall include detailed specifications, door configurations and swing angle.
- F. Samples of the required colored finish shall be submitted for approval of the Engineer prior to fabrication of the work.
- G. Submit two (2) samples of metal, 2-inch by 2-inch in size showing factory finishes, colors, and surface texture.
- H. Manufacturer's published instructions, including any special installation instructions relating to this project.

- I. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- J. Manufacturer's Qualification Statement.
- K. Installer's Qualification Statement.

1.05 Performance Requirements

- A. Framing products furnished herein shall meet or exceed the following performance requirements and shall be certified in writing by an independent testing laboratory:
 - 1. Resistance to Air Infiltration
 - a. When tested in accordance with ASTM E283, the air infiltration shall not exceed 0.06 ft³/min per ft² of fixed area.
 - 2. Resistance to Water Infiltration
 - a. No water shall pass the interior frame of the system when tested at 8 psf in accordance with ASTM E331 at a test pressure of 7.5 psf.
 - 3. Performance Under Uniform Loading
 - a. When tested in accordance with ASTM E330, the maximum stress shall not exceed 12.929 psi and the maximum deflection of any member shall not exceed $\frac{1}{175}$ of its span.
 - b. When the load is removed, there shall be no evidence of permanent deformation or damage. The test shall be conducted under a load of 25 psf.
 - 4. ***Aluminum frames and doors shall be designed to withstand a 150 mph wind.***
 - 5. ***Provide hurricane shelter design considerations at all applicable areas.***

1.06 Product Delivery, Storage and Handling

- A. ***Inspect materials delivered to the Project Site for damage.*** Unload and store with minimum handling.

- B. Provide storage space in a dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Store all materials neatly, properly stacked in a manner to prevent metal to metal contact and any other type of damage.
- C. ***Protect finish surfaces during shipping, handling, storage and installation until Final Project Acceptance by the Owner. Any damaged doors shall be replaced at no additional cost to the Owner.***
- D. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

1.07 Warranty

- A. Submit a warranty for all aluminum doors and frames in accordance with Section 01740, "Warranties and Bonds".
- B. Submit written agreement in door manufacturer's standard form signed by manufacturer, Installer and Contractor, agreeing to repair or replace defective doors which have separated from the core, expansion of the core, or otherwise failed due to defects in material and workmanship, improper installation or corrosion from a specified environment, ***for a period of not less than ten (10) years from the date of Final Project Acceptance by the Owner.***

2. PRODUCTS

2.01 Flush Aluminum Doors

- A. Swing type aluminum doors and frames shall be provided of the size, design and location indicated on the Contract Drawings. Provide doors complete with frames, framing members and all accessories. All materials, equipment and accessories shall conform to the following specifications.
- B. Aluminum Alloy for Doors and Frames
 - 1. ASTM B221, Alloy 6063-T5 for extrusions.
 - 2. ASTM B209, alloy and temper best suited for aluminum sheets and finish required.
- C. Fasteners
 - 1. All screws and miscellaneous fasteners shall be stainless steel, or other corrosion resistant material.

D. Materials for Flush Aluminum Doors

1. **Doors shall be 1¾-inch thick aluminum flush doors.** The door core shall be a fire retardant closed cell urethane foam with a minimum insulation R-value of 9.8. The urethane foam shall pass UL 13369 requirements for non-combustible construction systems. A 1¾-inch by 4-inch by ⅛-inch thick 6063-T5 aluminum Alloy tube shall be provided on all four sides of the door. The door facing shall be 0.063-inch thickness, smooth surface finish, aluminum sheet laminated to a 0.125-inch thick tempered hardboard. The face sheets and insulated core shall be bonded together with a two-part thermosetting adhesive, to form a waterproof, heat and chemical resistant bond. The entire perimeter of door shall be furnished with a special beveled design using 6063-T5 aluminum alloy extrusions.
2. **Aluminum reinforcing plate, ¼-inch thick, for attaching door hardware except hinges and door closers shall be provided.** Reinforcement on doors for hinges and door closers shall be provided using a ⅝-inch thick aluminum reinforcing plate. Door hinges shall be stainless steel. All tapped holes for mortised hardware shall be made at the factory. There shall be an adhesive joint, as well as the mechanical joint, for rigid connection of the reinforcing bar and door panel lamination. Hinges shall be attached using machine screws directly into the reinforcing bar. All standard hinges shall be flush with the door cap. No wood blocks shall be used for hinge attachment.
3. Screws, nuts, washers, bolts, rivets, clips and other miscellaneous fastening devices shall be stainless steel. Pairs of doors shall be equipped with an astragal with weather stripping. Vinyl used for glazing or weather-stripping shall have color to match aluminum as closely as possible and shall be elastomeric type conforming to Federal Specifications CS-230-60.
4. Sealants shall be fully compatible with all other materials, shall be non-staining and in accordance with Federal Specification TT-C-598, Caulking Compound Plastic, and Section 07900, "Joint Sealants".
5. **Facings shall be monolithic.** No pieces with lap joints, butt joints, lock joints or other types of manufactured joints shall be permitted. All cutouts shall be made from the solid sheet and shall be made without distorted edges. Facing shall be large enough so that it will be concealed under the door edging ½-inch aluminum.
6. All edging shall be cut to the proper door size. Lock and hinge edging shall be die notched to receive the top and bottom edging. The hinge side edge shall be die cut as needed to give clearance for 4-inch or 4½-inch standard duty hinges. The edging shall be fitted to the door with adhesive and shall be nonremovable and watertight. After sizing, the edging and facing joint shall be sealed with the appropriate sealant.

7. Lamination shall be done under controlled production conditions and shall consist of applying adhesive through serrated spreader rolls to proper thickness. The serrations on the rolls shall be such as to apply a "tooth" edge to the core to increase contact surfaces without deleterious cracking of the cells. All units of the "sandwich" shall be, placed on a continuous conveyor and go through solvent draw off equipment and a temperature controlled oven so as to reader units, to optimum conditions for bonding. Bonding shall be accomplished on alignment jigs equipped for proper register of all parts in accordance with the door type. After bonding, lamination of the "sandwich" shall take place using rubber covered rolls hydraulically actuated to maintain 100 psi uniform pressure for the proper reactivation of the adhesive. Thereafter, the "sandwich" shall go through a thermostatic temperature control oven to complete the advance and cross-linking of the reactivated adhesive. At the conclusion of this operation, the "sandwich" shall proceed, through additional rubber covered rolls hydraulically actuated as the previous operation. Adhesive preparation, heating, bonding and laminating must take place as a continuous operation to assure proper glue line temperature and pressure control. Edging shall lap over "sandwich" edge to control finished dimensions of assembled doors.
8. Complete "sandwich" shall be slabbed on a perfectly flat surface for proper aging. The completed "sandwich" shall be a structural laminate which meets or exceeds the U.S. Forest Products -Laboratory HHFA test, performed in compliance with the ASTM D-1037 test procedure.

2.02 Aluminum Door Frames

- A. ***Aluminum door frames shall be furnished by the door manufacturer.***
- B. Door frame member material shall be of an extruded aluminum shape. The aluminum alloy shall be 6063-T5 and of a nominal wall thickness of $\frac{1}{8}$ -inch. The minimum wall thickness for glazing beads, moldings and trim shall be 0.05-inch. Shapes shown are representations of the design, function, and required profile. Dimensions shown are minimum. Shapes of equivalent design, dimensions, profile, and function may be used subject to engineers approval.
- C. Door frame members shall be of size and shape as shown on the Contract Drawings. Door rabbetts shall allow for a $1\frac{3}{4}$ -inch door and weather-stripping. Weatherstripping shall be self-locking in integrally extruded grooves in the door stop. ***Weatherstripping shall create a weathertight seal when the door is installed properly.***
- D. Door frame members shall be notched to provide a neat joint at header ends and square cut at threshold ends. Notch sections shall be connected by $\frac{1}{8}$ -inch aluminum angles drilled and tapped for $\frac{1}{4}$ -inch machine screws. Corner angles shall be invisible on erected frames. One-eighth aluminum angle floor knees shall be flush riveted to bottom of jambs for anchoring to floor.

- E. Hinge reinforcements shall be of ¼-inch aluminum plate drilled and tapped to receive template hinges. Latch plates shall be recessed unless otherwise specified. Frame members shall have ¾-inch return legs at open back of frame.
- F. Weatherstripping used for glazing shall be Santoprene Thermoplastic Black Rubber type conforming to Government Specifications, ASTM C864, ASTM C542 and NAAMA SG-I-70, and with a Duramador of at least 67 per ASTM D-2240 Hardness (Shore A), and must meet or exceed the following: ASTM D297 Specific Gravity ASTM; D412 Tensile Strength, Ultimate Elongation, and 100% Modulus; ASTM D746 Brittleness Temp; ASTM D395B Compression Set Percent; ASTM D624 Tear Resistance.
- G. **Provide anchors of stainless steel, or other corrosion resistant material** to secure frames to adjacent construction. Place anchors near top and bottom of each jamb and at intermediate points not more than twenty-five (25) inches apart.
- H. **The aluminum frame and door system shall be designed to withstand a 150 mph hurricane force wind at the Project Site.** Provide all additional internal reinforcing members as recommended by the manufacturer.
- I. The aluminum frame system shall be designed in accordance with all local, state and federal codes affecting this type of installation.

2.03 Vision Panel

- A. Vision panel openings, if required, shall be cut to the proper size to allow the window to fit so that it will conceal ½-inch under the window flange. Glass mouldings shall be non-removable on the outside of the door. Mouldings shall be square cut with butt joints.
- B. Weatherstripping used for moulding shall be of the thermoplastic rubber type, conforming to Government Specifications, ASTM C864, ASTM C542 and NAAMA SG-1-70. Inside mouldings shall be of the thermoplastic rubber and shall be removable. Inside of the window shall be trimmed with an angle that covers cutout opening edges by ½-inch .
- C. Glass for vision panels shall be clear, tempered safety glass conforming to Federal Safety Standard 16CF-R1201, and **shall be designed, fabricated and glazed to withstand hurricane force winds of 150 mph.**
- D. Setting blocks and spacer shims shall be fabricated from neoprene. The sealant to be used for glazing shall have a color to match aluminum color.

2.04 Provisions for Hardware

- A. Hardware is specified in section 08710, "Finish Hardware". Hardware templates and hardware shall be delivered to the door manufacturer for use in fabrication of aluminum doors and frames. All hardware must be approved by the Engineer prior to delivery or installation. Numerous doors to be installed in the building shall have electronic strikes and access card readers. See Section 08000, "Door Schedule" and the Contract Drawings for details.
- B. Cut, reinforce, drill, and tap doors and frames in accordance with hardware manufactures recommendations.
- C. Surface-applied hardware, push plates, kick plates, and mop plates shall be drilled and tapped in the field.
- D. Provide hinge reinforcements of ¼-inch aluminum flat bar and secure to door edge or frames with stainless steel machine screws. **Hardware reinforcements shall be provided for hinges, door closers, locks and bolt locations.**
- E. All tapped holes for mortised hardware shall be made in the factory and plaster guards provided to protect holes in reinforcing plates.
- F. Screws, bolts and fasteners shall be stainless steel.
- G. **Aluminum closers shall be provided on all doors.**

2.05 Provisions for Glazing

- A. Provide extruded aluminum snap-in glazing beads on the interior sides of door, provide extruded aluminum, theft-proof, snap-in glazing beads or fixed glazing beads on exterior or security side of door. Glazing beads shall have vinyl insert glazing gaskets.
- B. Design glazing beads to receive glass of thickness indicated or specified. Glazing is specified in Specification Section 08800, "Glass and Glazing."

2.06 Fabrication

- A. Glazing channels for fixed sash transoms and sidelights shall be furnished as detailed on the Contract Drawings and shall match door frames.
- B. Spreaders
 - 1. Spreaders shall be provided across the bottom of all door frames.

2. Frames that become dented, bent, twisted or broken in transit to the job or while stored at the job site shall not be used. Repaired frames will not be acceptable.

2.07 Finishes

- A. Comply with the NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. Frame coating at masonry or concrete surfaces shall be a fibered asphalt emulsion with a minimum thickness of $\frac{1}{16}$ -inch.
- D. **Aluminum door and frame finish color shall be selected by the Engineer** from the manufacturer's standard colors and shall be clear anodized in accordance with AAM12G22A31, Class II.
- E. All exposed aluminum surfaces and hardware shall be free of scratches and other serious surface blemishes or the materials shall be removed and replaced at the Contractor's cost.

3. EXECUTION

3.01 Examination

- A. The Contractor shall verify wall opening sizes and tolerances are acceptable.
- B. The Contractor shall verify the substrate.

3.02 Installation

- A. Aluminum Door Frames
 1. Frames shall be installed in correctly prepared openings according to the manufacturer's recommended installation instructions.
 2. They shall be **set plumb, square and level in correct alignment with floors, ceilings, walls and other work.**

3. They shall be securely anchored and completely ready for operation to produce a ***watertight job***.
4. All joints between frames and masonry shall be tightly caulked and neatly pointed. ***Excess caulking material shall be removed.***
5. ***It shall be the Contractor's responsibility to protect aluminum frame members from damage during construction.*** Damaged frames are unacceptable and shall not be repaired. New frames shall be ordered from the manufacturer at ***no additional cost to the Owner.***

B. Door Installation

1. ***Doors shall be installed plumb, level and true to line.*** Hardware shall be applied and adjusted to achieve quiet and smooth operation. Hardware shall be as specified in Section 08710, "Finish Hardware".
2. ***Door clearances shall not exceed 1/8-inch*** at jambs, heads, and meeting stiles at pairs of doors. Clearance between the bottom of door and the finished floor material or threshold shall not exceed 1/4-inch. Frames shall be manufactured and machined to within 1/32-inch for all dimensions.

3.03 Protection from Dissimilar Materials

A. Dissimilar Metals

1. Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, the Contractor shall provide protection from direct contact by one or a combination of the following methods:
 - a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.
 - b. Apply a good quality caulking material between the aluminum and dissimilar metal.
 - c. Use a non absorptive tape or gasket in permanently dry locations.

B. Masonry and Concrete

1. The Contractor shall provide an aluminum surface in contact with mortar, concrete, or other masonry materials with one (1) coat of heavy-bodied bituminous paint.

3.04 Protection

- A. The Contractor shall protect the installation from damage and touch up scratched areas with the same type primer used for shop coats.
- B. **Damaged work shall be unacceptable** and shall be repaired or replaced based strictly and entirely on the Engineers determination.
- C. New doors, frames, etc., shall be ordered from the manufacturer and installed by the Contractor at **no additional cost to the Owner**.

3.05 Cleaning

- A. Upon completion of installation and again at Final Project Acceptance by the Owner, the **metal surfaces of doors and frames shall be cleaned on both the inside and outside**.
- B. **Doors and frames shall be washed and cleaned in accordance with the manufacturer's instructions**. Do not use abrasive, caustic or acid cleaning agents.
- C. **Where the aluminum has become stained, or discolored, it shall be replaced by the Contractor at no additional cost to the Owner**.

END OF SECTION

SECTION 08210

WOOD DOORS

1. GENERAL

1.01 Description

- A. The work specified in this Section includes furnishing and installing wood doors, frames, and transom panels, listed in the door schedule on the Contract Drawings and specified herein.
- B. Provide factory preparation of wood doors for hardware as specified in Section 08710, "Finish Hardware".
- C. Doors shall be factory finished.
- D. Related Work Specified Elsewhere

Specification Section	Title
03600	Grout
06100	Rough Carpentry
07900	Joint Sealants
08710	Finish Hardware
08800	Glass and Glazing
Division	Information
5	Miscellaneous Metals
Contract Drawings and General Provisions of the Contract	

1.02 References

- A. All work shall be executed and installed in accordance with the requirements of all applicable codes.

- B. The following publications, listed below, form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- C. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
American Society for Testing and Materials (ASTM)	
ASTM E90	Measurements of Airborne Sound Transmission Loss of Building Partitions
ASTM E152	Methods of Fire Tests of Door Assemblies
ASTM E-13	Classification for Determination of Sound Transmission Class
American Woodwork Institute (AWI)	
	Quality Standards of the Architectural Woodwork Institute
Underwriters Laboratory (UL)	
UL 10B	Fire Tests of Door Assemblies
National Fire Protection Service (NFPS)	
NFPS A80	Fire Doors and Windows
National Fire Prevention Association (NFPA)	
NFPA 252	Standard Method of Fire Tests for Door Assemblies
Other Standards	
	Florida Building Code
	Uniform Building Code (Latest Edition)
	Department of Commerce Commercial Standard (CS)
	Industry Standards (ISI)
	"Wood Flush Doors" - National Wood Window and Door Assn (NWWDA)
	Local Codes and Regulations

1.03 Submittals

- A. Copies of all materials required to establish compliance with the specifications shall be submitted in accordance with the provisions Section 00700, "General Conditions", Section 00800, "Supplementary Conditions, and Section 01300, "Shop Drawings, Submittals and Samples".

- B. ***All equipment and materials shall be “new” and shall be specially designed or selected for the function and service specified.*** No equipment or materials may be used in the Project that has not been approved by the Engineer.
- C. The Contractor shall submit the door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
- D. Shop Drawings
1. Shop drawing submittals shall include, but are not limited to, the following:
 - a. Elevations of each door type.
 - b. Size of doors and frames.
 - c. Wood thickness.
 - d. Details of door and frame construction.
 - e. Assembly methods.
 - f. Methods of anchorage.
 - g. Glazing details.
 - h. Provisions for and location of hardware.
 - i. Fire ratings.
 - j. Requirements for factory finishing
 - k. Schedule showing each door, frame and swing of the door using the same reference numbers for details and openings as those on Contract Drawings and Schedules.
 - l. All other pertinent data.
 2. For factory-premachined doors, indicate the dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings, as specified.
 3. Hardware templates shall be furnished to the door manufacturer by the Contractor for correct hardware location.
 4. The manufacturer's descriptive literature shall include detailed specifications, door configurations and swing angle.

5. Samples of the required colored finish shall be submitted for approval of the Engineer prior to fabrication of the work.

E. Samples

1. Submit samples, 12" x 12", for the following:
 - a. Doors for Transparent Finish: Door faces with solid wood edging representing the typical range of color and grain for each species of veneer and solid lumber required.
 - b. Factory-Finished Doors: Each type of factory finish required.
 - c. Metal Louvers: Blade and frame in 6-inch lengths, for each material and finish required.
 - d. Metal Frames for Light Openings: Metal light frames in 6-inch lengths; for each material, type and finish required.

- F. Submit a warranty for all wooden doors in accordance with Section 01740, "Warranties and Bonds".

1.04 **Quality Assurance**

- A. The Contractor shall comply with the following Quality Standards:

1. NWWDA Quality Standard

- a. I.S.1 "Industry Standard for Wood Flush Doors", of National Wood Window and Door Association (NWWDA).

2. AWI Quality Standard

- a. "Architectural Woodwork Quality Standards"; including Section 1300 "Architectural Flush Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

B. NWWDA Quality Marking

1. Mark each wood door with a NWWDA Wood Flush Door Certification Hallmark certifying compliance with applicable requirements of NWWDA I.S. 1 Series.

2. For manufacturers not participating in NWWDA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.

C. Fire-Rated Wood Doors

1. Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per ASTM E152 and which are labeled and listed for ratings indicated by UL, Warnock Hersey or other testing and inspection agency acceptable to authorities having jurisdiction.
2. Oversize Fire-Rated Wood Doors
 - a. For door assemblies exceeding sizes of tested assemblies, provide manufacturer's certificate stating that doors conform to all standard construction requirements of tested and labeled fire door assemblies except as to size.

D. ***Obtain all wood doors from a single manufacturer.***

- E. Submit a warranty for all wood doors and frames in accordance with Section 01740, "Warranties and Bonds". The manufacturer shall warrant each separate door installation against manufacturing defects for the "lifetime of original installation", including the cost of refinishing and rehanging if doors do not comply with specified tolerances.

1.05 Product Delivery, Storage and Handling

- A. Polybag protect each door for shipment and handling.
- B. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with the requirements of the referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.
- C. ***Inspect materials delivered to the Project Site for damage.*** Return all damaged doors to the manufacturer and replace with a "new", undamaged door.
- D. Identify each door with individual opening numbers which correlate with the designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.
- E. ***Protect finish surfaces during shipping, handling, storage and installation until Final Project Acceptance by the Owner.***
- F. Any damaged doors shall be replaced at no additional cost to the Owner.

1.06 Project Conditions

A. Conditioning

1. *Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized* and will be maintained in storage and installation areas during the remainder of the construction period to comply with the following requirements applicable to the Project's geographical location:
 - a. Referenced AWI quality standard including Section 100-S-3 "Moisture Content".

B. Field Measurements

1. Verify actual measurements/openings by field measurements before fabrication of doors and accessories. Show all recorded measurements on the shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.07 Warranty

- A. Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Submit a warranty for all wooden doors in accordance with Section 01740, "Warranties and Bonds" **for a period of not less than ten (10) years from the date of Final Project Acceptance by the Owner.**
- C. The manufacturer shall warrant each separate door installation against manufacturing defects for the "lifetime of original installation", including the cost of refinishing and rehanging if doors do not comply with specified tolerances. This shall include coverage for delamination, warping beyond specified installation tolerances, defective materials and telegraphing core construction.
- D. The Contractor shall replace all doors where the Contractor's work contributed to rejection or to voiding of the manufacturer's warranty or where doors have been damaged due to construction activities.

1.08 Manufacturers

- A. Products of the following manufacturers are acceptable, providing their products equal or exceed the quality specified, and they can provide products of the type, size, function, and arrangement required:

1. Algoma Hardwoods, Inc., Algoma, Wisconsin.
2. Weyerhaeuser, Marshfield, Wisconsin.
3. Eggers Hardwood Products Corporation, Neenah, Wisconsin.
4. Oshkosh Architectural Wood Door Company. Oshkosh, Wisconsin.
5. VT Industries, Inc., Holstein, Iowa.
6. The Maiman Company, Springfield, Missouri
7. Or Approved Equal.

2. PRODUCTS

2.01 Materials and Components

A. Provide interior flush wood doors conforming to following requirements:

1. Faces: Plain Sliced Red Oak veneer.
2. Grade: "A" Grade per AWI Quality Standards, 7th ed., Version 1.0. 1997.
3. Core Construction: SLC stave lumber core. No particleboard will be acceptable.
4. Edges: Provide **solid hardwood edges - 5/8-inch thick** over mill option hardwood stiles.
5. Face Panels: Manufacturer's standard 2-ply hot pressed panels with Type I glue (waterproof).
6. Matching: Pairs of doors shall be bookmatched grain as pairs on both sides. Provide end matched transoms.
7. Thickness: 1³/₄-inches, unless noted otherwise.
8. Louvers: Extruded aluminum with clear anodic finish, where indicated.
9. Door Frames: 1³/₄-inch (Fire-rated)

B. ***Provide a lifetime guarantee/warranty on all wooden doors.***

- C. All doors shall carry identification markings.
- D. Provide solid blocking in doors whether or not scheduled to receive closers. Throughbolt attachment of hardware is not allowed.
- E. Door Accessories
 - 1. Door Accessories shall be as follows:
 - a. The door supplier shall provide wood stops for glass. Metal stops shall be provided where fire-rated doors are required and have wire glass.
 - b. Metal stops for glass shall be factory primed and field painted by Section 09900, "Painting".
 - c. All doors shall be equipped with aluminum door closers.
- F. Fire-Rated Solid Core Doors
 - 1. Faces and AWI Grade
 - a. Provide faces and grade to match non-rated doors as specified above.
 - 2. Core Construction
 - a. The manufacturer's standard core construction are required to provide the fire-resistance rating indicated: 32 lb density (min.) particleboard.
 - 3. Stile Construction
 - a. The manufacturer shall provide stiles that will provide the maximum screw withdrawal rate for use with full mortise hinges. Withdrawal rate shall not be less than 740 lbs.
 - b. Stiles shall be the manufacturer's standard, SLM (special laminated material) or superstile.
 - c. Stiles constructed with Maranite Interstile are not acceptable Test results for screw withdrawal shall be submitted to the Engineer.
 - 4. Edges
 - a. Provide solid hardwood edges, approximately 5/8-inch thick. Species shall match the face veneer.

5. Lock Blocks

- a. The manufacturer shall provide lock blocks for mortise and bored locks, a minimum of five (5) inches by ten (10) inches, or manufacturer's standard, 2 lock blocks for RIM mortise and vertical rod exit devices.
 - b. Provide a top rail that is suitable for attachment of closers and bottom rail (height as required) for attachment of a vertical rod exit device bottom latch automatic flush bolts. Through-bolts are not allowed.
6. Pairs of wood doors with a 20, 30, 45, 60, and 90 minute rating shall be supplied with the manufacturer's standard steel edges and steel astragal, factory applied and factory prepared for hardware as scheduled. Where pairs of labeled doors are used in a means of egress with two (2) vertical rod exit devices, the doors shall be provided with the manufacturer's standard edges (metal or treated) as tested without the steel astragal.
 7. For labeled wood doors to receive glass, the door supplier shall provide the manufacturer's standard frame formed of eighteen (18) gauge cold-rolled steel, factory primed, and approved for use in door of fire rating indicated.

G. Sound Doors

1. Faces and AWI Grade: Provide faces and grade to match rated and non-rated doors in same area of building.
2. Core Construction: Manufacturer's standard acoustical damping material which will provide an STC of 40.
3. Door thickness shall be 1¾-inch.
4. Double glazed with ¼-inch laminated glass by Section 08800, "Glazing".
5. Drop seals and sound gasketing shall be in accordance with Section 08710, "Finish Hardware".
6. Doors shall have **solid hardwood edges**.

2.02 Prefitting and Preparation for Hardware

- A. Pre-fit and pre-machine wood doors at the factory, including beveling both edges ⅛-inch in two (2) inches.

- B. Comply with the tolerance requirements of AWI for pre-fitting. Machine doors for hardware requiring cutting doors. Comply with the final hardware schedules and door frame shop drawings and with the hardware templates and other essential information required to ensure the proper fit of doors and hardware.
- C. Coordinate with the metal frame supplier the locations of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in the factory.
- D. Light openings and other detail work shown shall be in accordance with manufacturer's standard detail or as detailed by the Engineer. Exception to details, as shown on Drawings, that may affect the manufacturer's warranty of these doors shall be brought to the attention of the Engineer in writing at the time of submission of the shop drawings and the manufacturer's statement of conformity to the specification requirements.

2.03 Performance Characteristics

- A. NWWDA TM-7 Cycle-Slam Test, minimum 1,000,000 cycles with no sign of failure.
- B. NWWDA TM-8 Hingeloading Test, minimum 1150 lbs.
- C. NWWDA TM-10 Screwholding Test (Edge of door), minimum 750 lbs.
- D. Face of door must be chemical and abrasion resistant as specified by LMA, Laminating Materials Association.
- E. Glazing Stops: Compatible Wood Species with mitered corners; manufactured in accordance with requirements for component of a twenty (20) minute fire rated door and positive pressure label.
- F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions.
- G. Per NFPA 80-1-3.5, All fire doors must be machined in factory or by an authorized machining distributor.
- H. Thru-bolts to be used for surface hardware attachment.
- I. Fabrication Tolerances Doors machined for Hardware
 - 1. Thickness: $\pm 1/32$ -inch (0.8 mm)
 - 2. Length and Width: $\pm 1/32$ -inch (0.8 mm)
 - 3. Squareness: Diagonally measured, not to exceed $1/16$ -inch (1.6 mm).

2.04 Louvers and Light Frames

A. Metal Louvers (Where Indicated)

1. Size, type and profile shown and fabricated from the following:
 - a. Aluminum: 20-gage, galvanized and factory primed for paint finish.
 - b. Provide fire-rated metal louvers with fire-dampers for fire-rated doors.

B. Metal Frames for Light Openings in Fire Doors (Where Indicated)

1. Manufacturer's standard frame formed of 18-gage cold-rolled steel, factory-primed, and approved for use in door of fire-rating indicated.
2. Field painted metal light frames with the color as selected by the Engineer and Owner.

2.05 Fabrication

A. Fabricate flush wood doors to produce doors complying with following requirements:

1. Factory-prefit and pre-machine doors to fit frame opening sizes indicated with the following uniform clearances and bevels:
 - a. Comply with tolerance requirements of AWI for pre-fitting. Comply with final hardware schedules and door frame shop drawings and with hardware templates.
 - b. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory pre-machining.

B. Metal Astragals

1. Pre-machine astragals and formed steel edges for hardware where required for pairs of fire-rated doors.

C. Transom Panels

1. Fabricate matching panels with the same construction, exposed surfaces and finish as specified for associated doors.

2. Fixed Transom Panels

- a. Fabricate fixed panels with solid lumber transom bottom rail and door top rail, both rabbeted as indicated, and factory-installed springbolts for concealed attachment into jambs of metal door frames.

D. Openings

1. Cut and trim openings through doors to comply with all applicable requirements of the referenced standards for the kind(s) of doors required.
 - a. Light Openings: Trim openings with moldings of the material and profile indicated, where required.
 - b. Louvers: Factory install louvers in prepared openings, where required .

2.06 **Factory Finishing**

- A. Comply with the referenced AWI quality standard including Section 1500, "Factory Finishing".
- B. Prefinish all wood doors at the factory.
- C. Transparent Finish
 1. Comply with the requirements indicated for grade, finish system, staining effect and sheen.
 - a. AWI Grade: Premium.
 - b. Finish: Manufacturer's standard finish with performance requirements comparable to AWI System s3 alkyd urea conversion varnish.
- D. ***Factory finished doors damaged after installation shall be replaced with factory finished doors at no additional cost to the Owner.***

2.07 **Fasteners and Hardware**

- A. Hardware for all wood doors shall be provided by the door manufacturer in accordance with Section 08710, "Finish Hardware". All hardware must be approved by the Engineer prior to delivery or installation. Screws, bolts and fasteners shall be stainless steel.

- B. Provide hinge reinforcements of ¼-inch aluminum flat bar and secure to door edge or frames with stainless steel machine screws. **Hardware reinforcements shall be provided for hinges, door closers, locks and bolt locations.**
- C. **Aluminum closers shall be provided on all doors.**

3. EXECUTION

3.01 Examination

- A. Examine doors and installed door frames prior to the hanging door.
- B. Verify that door frames comply with the indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
- C. **Reject all doors with defects, regardless of how minor they may be.**
- D. Verify that opening sizes and tolerances are acceptable.
- E. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.
- F. Do not proceed with the installation until unsatisfactory conditions have been corrected to the satisfaction of the Engineer and Owner.

3.02 Installation

- A. Unload, protect, store, and install wood doors in strict accordance with the manufacturer's written installation instructions. Acclimate the doors to the site conditions for a minimum of twenty-four (24) hours before installation.
- B. Install the wood doors to comply with the manufacturer's instructions and the referenced AWI standard and as indicated.
- C. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80. Do not remove labels from fire-rated doors.
- D. Prefit Doors
 - 1. Fit to frames for uniform clearance at each edge.

E. Factory-Finished Doors

1. Restore the door finish before installation if fitting or machining is required at the job site.

3.03 Wood Door Installation

A. Handling and Protection

1. Upon delivery to Project site, unload the wood doors and place them in a safe, dry, and secure storage area.
2. Protect the wood doors from damage and improper storage and handling, both before and after installation.

B. Inspection

1. The door installer shall examine the door frames and verify that the frames are of the correct type and have been installed as required for proper hanging of corresponding doors.
2. The door installer shall notify the Contractor, in writing, of conditions detrimental to the proper and timely installation of wood doors.
3. Do not proceed with installation until all unsatisfactory conditions have been corrected in a manner acceptable to installer, Engineer and Owner.

C. Installation

1. Pre-fit Doors

- a. Fit doors to the frames and machine them for hardware, to whatever extent not previously worked at the factory, as required for proper fit and uniform clearance at each edge.
- b. Install non-rated wood doors in accordance with manufacturer's instructions and as shown.
- c. Install fire rated doors in corresponding fire rated frames in accordance with the requirements of NFPA No. 80.

2. **Doors shall be installed plumb, level and true to line.** Hardware shall be applied and adjusted to achieve quiet and smooth operation. Hardware shall be as specified in Section 08710, "Finish Hardware".

3. Clearance

- a. For non-rated doors, provide clearances of 1/8-inch at jambs and heads; 1/8-inch at meeting stiles for pairs of doors; and 1/8-inch from the bottom of the door to the top of the decorative floor finish or covering.
 - b. Where the threshold is shown or scheduled, provide 1/4-inch clearance from the bottom of the door to the top of the threshold.
4. Bevel non-fire-rated doors 1/8-inch in two (2) inches (3.5°) at lock and hinge edges.
 5. Align in frames for uniform clearance at each edge.

D. Quality Assurance

1. Wood doors having any of the following defective conditions **will not** be accepted:
 - a. Not operating properly, such as swinging, sliding, latching, etc.
 - b. Damaged face or edge.
 - c. Unsealed edges, tops and bottoms.
 - d. Irregularities in surface finish, such as roughness, "skips", "runs" or other blemishes in color or gloss.
2. If operational defects cannot be corrected by repairing or rehanging, the Contractor shall replace the door with a new door at no additional cost to the Owner
3. ***Doors damaged prior to or during installation shall be replaced with a new door at no cost to the Owner.***

3.04 Adjusting and Protection

- A. Replace or rehang doors which do not swing or operate freely.
- B. ***Replace doors that are damaged or do not comply with the requirements.***
- C. Finished doors shall be refinished or replaced if damaged during installation. Doors may only be repaired or refinished if the work complies with the requirements and shows no evidence of repair or refinishing.

- D. Protect doors, as recommended by the door manufacturer, to ensure that wood doors will be without damage or deterioration at time of Final Project Acceptance by the Owner.

3.05 Cleaning

- A. Upon completion of installation and again at Final Project Acceptance by the Owner, the ***wood surfaces of doors and frames shall be cleaned on both the inside and outside.***
- B. ***Doors and frames shall be washed and cleaned in accordance with the manufacturer's instructions.***

END OF SECTION

SECTION 08305

ACCESS PANELS

1. GENERAL

1.01 Description

A. This section includes providing all labor, materials and equipment necessary to install access panels including all necessary accessories in the locations shown on the Contract Drawings or as required in the construction of the “new” Operations Building at the Sanford Main WTP.

B. Related Work Specified Elsewhere

1. Joint Sealants:	Section 07900
2. Gypsum Wallboard Assemblies:	Section 09260
3. Ceramic Tile:	Section 09311
4. Painting:	Section 09900
5. Plumbing:	Section 15400

1.02 Quality Assurance

- A. All work shall be executed and installed in accordance with the requirements of all applicable codes.
- B. Access panels shall be manufactured by a single firm specializing in the production of this type of work, unless otherwise acceptable to the Engineer.
- C. Acceptable manufacturer's include:
1. Milcor Limited Partnership, Lima, OH
 2. Nystrom Inc., Minneapolis, MN
 3. Or approved equal.

1.03 Submittals

- A. Submit shop drawings, descriptive literature product data, the manufacturer's recommended installation, operating and maintenance instructions and procedures for the access panels, certifications, etc., in accordance with the Section 00700, "General Conditions", Section 00800, "Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples" prior to fabrication of the access panels.
- B. Shop drawings shall indicate materials, elevations, construction details, sizes, connections, hardware reinforcement and locations, metal thicknesses and wall conditions, installation details, and other required details to illustrate a complete operating access panel.

1.04 Product Delivery, Storage and Handling

- A. Protect the access panels and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name on the packaging.
- B. Store the access panels in dry locations with adequate ventilation, free from dust and water, and in such a manner as to permit access for inspection and handling.
- C. Handle access panels carefully to prevent damage. Remove damaged items that cannot be restored to "like-new" condition and provide new items at no additional cost to the Owner.

1.05 Warranty and Guarantees

- A. The manufacturer shall guarantee the aluminum access hatch doors against defects in material and workmanship for a ***period of ten (10) years from the date of Final Project Acceptance by the Owner.***
- B. Refer to Section 01740, "Warranties and Bonds" for additional requirements.

2. PRODUCTS

2.01 Access Panels

- A. Access panels shall be as shown on the Contract Drawings or as required to provide sufficient access for the proper operation and maintenance of equipment, appurtenances, and components.

- B. The minimum size of the access panels shall be twelve inches (12") square.
- C. The access panels shall include a 14 gauge steel door and 16 gauge steel frame with baked enamel finish coat. The finish coat color shall be selected by the Engineer and Owner.
- D. All hardware shall be made of stainless steel, Type 316.
- E. Access Panels for Plastered Surfaces
 - 1. Milcor "K"
 - 2. Nystrom "Flush PW"
 - 3. Or approved equal.
- F. Access Panels for Masonry and Tile Surfaces
 - 1. Milcor "M"
 - 2. Nystrom "Flush TM"
 - 3. Or approved equal.
- G. Access Panels for Gypsum Wallboard
 - 1. Milcor "DW"
 - 2. Nystrom "Flush WB"
 - 3. Or approved equal.

3. EXECUTION

3.01 Installation

- A. The access panels and associated equipment and accessories shall be installed as recommended by the manufacturer and adjusted for proper operation.

- B. Install plumb and level in suspended metal lath and stucco ceilings, metal lath and Portland cement plaster, gypsum wallboard, or tile side walls.
 - 1. Leave surfaces clean and ready for final painting.
 - 2. Adjust to operate properly and replace damaged units.

3.02 Cleaning and Protection

- A. The Contractor shall clean all surfaces of the access panels, remove all markings and protect the surface until Final Project Acceptance by the Owner.
- B. Any damage to the access panels shall be repaired by the Contractor in accordance with the recommendations and instructions of the manufacturer.
- C. The Engineer will determine whether the repair is acceptable. If it isn't acceptable, the Contractor shall replace the access panel and appurtenances with new materials at no additional cost to the Owner.

END OF SECTION

SECTION 08330

ALUMINUM OVERHEAD COILING DOORS

1. GENERAL

1.01 System Description

- A. Furnish and install electrically operated aluminum overhead coiling doors as shown on the Contract Drawings.
- B. Related Work Specified Elsewhere
1. Related work specified elsewhere includes:

Specification Section	Title
05500	Metal Fabrications
06100	Rough Carpentry
08710	Finish Hardware
Division	Information
16	Electrical
Contract Drawings and General Provisions of the Contract	

C. Design Requirements

- The aluminum overhead coiling doors shall be designed to withstand hurricane force winds up to 150 mph.***
- The aluminum overhead coiling doors shall be designed in accordance with ASCE 7-98, "Minimum Design Loads for Buildings and Other Structures"
- The aluminum overhead coiling doors shall be designed for normal use of up to twenty (20) cycles per day, maximum.***

1.02 Quality Assurance

- A. Aluminum overhead coiling doors shall be manufactured by a single firm specializing in the production, fabrication and installation of aluminum overhead coiling doors.
- B. The manufacturer shall be ISO 9002 registered and have a minimum of five (5) years experience in the production, fabrication and installation of aluminum overhead coiling doors.
- C. The manufacturer shall submit, in accordance with Section 01300, "Shop Drawings, Submittals and Samples", evidence of the ability to meet the performance and fabrication requirements specified, and include a list of five (5) projects of similar design, size and complexity completed within the past five (5) years.
- D. ***Installation of the aluminum overhead coiling door shall be performed by the authorized representative of the manufacturer.***
- E. Single-Source Responsibility
 - 1. Provide the aluminum overhead coiling door, guides, motors, and related primary components from a ***single manufacturer*** for each type of door. The equipment shall be UL listed.
 - 2. Provide secondary components from a source acceptable to manufacturer of primary components.
- F. ***The Contractor shall schedule and convene a pre-installation conference*** of the aluminum overhead coiling door just prior to commencement of field operations, to establish the procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- G. Reference Standards
 - 1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American Society for Testing and Materials (ASTM)	
ASTM A36/A36M	Standard Specification for Carbon Structural Steel
ASTM A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM B221/B221M	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

Standard	Description
National Electrical Manufacturers Association (NEMA)	
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 2	Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts
NEMA MG 1	Motors and Generators
Underwriters Laboratories (UL)	
UL (DIR)	Online Certifications Directory
UL (EAUED)	Electrical Appliance and Utilization Equipment Directory
UL 325	Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems
Other Standards and Building Codes	
	Florida Building Code
	ITS (DIR) - Directory of Listed Products

- H. Acceptable manufacturer's include Overhead Door, Stanley Doors, Best Rolling Doors, Kinnear Rolling Doors or approved equal.

1.03 Submittals

- A. Submit shop drawings, product data, certifications, etc., in accordance with Section 00700, "General Conditions, Section 00800, "Supplementary Conditions", Section 01300, "Shop Drawings, Submittals and Samples", prior to fabrication of the aluminum overhead coiling doors.
- B. ***The Contractor shall provide all supporting mechanisms, braces, framing, reinforcing, etc.*** necessary to install the aluminum overhead coiling door in the location indicated on the Contract Drawings and meet the wind loading indicated in Article 1.01(C)(1). The cost of such materials shall be included in the Contractors Project Bid Price.
- C. Shop drawings shall indicate detailed plans, dimensioning, elevations, construction details, sizes, details of framing members, required clearances, anchors, hardware reinforcement and locations, metal thicknesses and wall conditions, anchorage methods, and installation details. Include the relationship with adjacent materials.
- D. Submit the manufacturer's recommended installation, operating and maintenance instructions and procedures for the aluminum overhead coiling doors and the operators in accordance with Section 01300, "Shop Drawings, Submittals and Samples". Include both published data and any specific data prepared for this Project.

- E. Submit a manufacturer's certification that the aluminum overhead coiling door and accessories conform to all requirements of this specification and of the reference standards.
- F. ***Submit a certification, from a structural, Professional Engineer, registered in the State of Florida, that the aluminum overhead coiling door has been designed and constructed to withstand hurricane force winds of 150 mph.***
- G. Submit a certification stating that the installed materials comply with this specification.
- H. Submit Operation and Maintenance Manuals in accordance with Section 01730, "Operation and Maintenance Manuals".

1.04 Product Delivery, Storage and Handling

- A. Deliver materials and products in labeled protective packages. ***Protect doors and accessories from damage during delivery, storage, and handling.*** Clearly mark the manufacturer's brand name.
- B. Store and handle in strict compliance with manufacturers instructions and recommendations. Protect materials from damage from weather, excessive temperatures and construction operations. Store doors in dry locations with adequate ventilation, free from dust and water, and in such a manner as to permit access for inspection and handling.
- C. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

1.05 Operation and Maintenance Manuals

- A. O&M Manuals shall be furnished for this Project in accordance with Section 01730, "Operation and Maintenance Data" and shall be submitted in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. The O&M Manuals shall be prepared specifically for this installation and shall include all detailed operating instructions (normal startup and shutdown procedures, normal operating conditions and emergency situations), maintenance procedures and instructions and specifications relative to the assembly, alignment, checking, lubrication, placing in operation, adjustment, and maintenance of equipment and auxiliaries furnished under this Contract, together with its complete parts lists therefore, and copies of shop drawings, certified dimensions drawings and design calculations, required cut sheets, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment.

- C. All such material shall be in addition to any instructions or parts lists packaged with or attached to the equipment when delivered.
- D. ***The “final” O&M Manuals shall contain plastic laminated pull-out lubrication and maintenance cards*** detailing all lubrication points, lubricant type, and frequency of lubrications and all additional required maintenance and frequency intervals.
- E. ***In addition to standard O&M Manuals, all manufacturers supplying equipment and products specified herein shall also submit their operation and maintenance manuals and data to the SCADA System Integrator for this Project on CD/DVD/BD’s in Corel WordPerfect (latest version), Microsoft Word (latest version), or text, “txt”, formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats (integrators preference for the system shall be required). All O&M Manual files shall also be submitted electronically on CD/DVD/BD’s to the Engineer in both PDF and JPEG formats, no exceptions.***
- F. ***The SCADA System Integrator shall be responsible to configure and compile the O&M Manuals into “hypertext” window help files for use as computer “on-line” help screens for equipment operation and maintenance. The SCADA System Integrator shall return all hypertext files to the equipment and product manufacturer’s for review and approval prior to introducing them into the SCADA System at the treatment facility.***

1.06 Special Tools and Spare Parts

- A. Furnish one (1) complete set of all special tools, including lubricating devices, required for normal operation, adjustment and maintenance of the equipment supplied. All such tools shall be furnished with a heavy duty, thermoplastic tool chest complete with a padlock and duplicate keys.
- B. Furnish all required lubricants required for operation and maintenance of the aluminum overhead coiling doors for a ***period of two (2) years***.
- C. Replacement parts required for normal operation, other than routine maintenance items, shall be provided by the manufacturer to assure uninterrupted operation of the aluminum overhead coiling doors.
- D. Submit a recommended spare parts list for all aluminum overhead coiling door components to the Engineer for approval during the shop drawings review process. Spare parts shall be properly bound and labeled for easy identification without opening the packaging and suitably protected for long-term storage.

1.07 Warranty

- A. The Contractor shall furnish the Owner with a **two (2) year service/parts warranty** as specified in Section 01740, "Warranties and Bonds".
- B. The aluminum overhead coiling doors shall be unconditionally **warranted by the manufacturer's for a period of five (5) years from the date of Final Project Acceptance by the Owner.**
- C. The equipment manufacturer shall guarantee that the equipment furnished is suitable for the purpose intended and free from defects of design, material and workmanship.
- D. In the event that any equipment fails to perform as specified herein, the equipment **manufacturer shall promptly repair or replace the defective equipment at no additional cost to the Owner.**
- E. This warranty is in addition to any other warranty required by the Contract Documents.

2. PRODUCTS

2.01 Aluminum Coiling Doors

- A. Shall be counterbalanced, overhead coiling type, and shall be designed for use on exterior openings, as indicated on the Contract Drawings.
- B. Doors shall be operated automatically by an electric operator/motor with an manual override (hand chain with gear or sprocket reduction operator).
- C. Doors shall be complete with framing members, guides, hardware, fastenings, operating mechanisms, anchors and accessories.
- D. Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to provide a clear opening when door is in the "open" position. Exterior doors shall be mounted in accordance with the manufacturers recommendations for the proposed Project application.
- E. **Doors, hardware, and anchors shall be designed to withstand a hurricane force wind of 150 mph without damage to any components.** Fabricate interlocking sections with high strength nylon endlocks on alternate slats each secured with two (2) ¼-inch rivets. **Provide windlocks as required to meet the specified wind load.**

2.02 Materials

A. Aluminum Alloy for Curtains

1. ASTM B-221, Alloy 6063-T5 for extrusion. ASTM B-209, alloy and temper best suited for the purpose for aluminum sheets and strips (16 gauge min. thickness).
2. ***The door (slats and hood) shall have a bronze anodized finish.***

B. Weatherstripping

1. A replaceable, 3-point, compressible vinyl gasket extending into the guides (bottom bar).
2. Provide a continuous neoprene rubber piece fastened to the inside of the hood and contacting the top of the curtain thus forming a seal.

C. Bottom Bar

1. Extruded aluminum shall be used up to a door width of 15 feet - 4 inches.
2. Two structural steel angles shall be used on doors with widths over 15'-4" wide. The angles shall be galvanized steel.

D. Guides

1. Roll-formed steel shapes attached to continuous steel wall angle shall be standard for doors up to 15'-4" wide.
2. Three (3) structural steel angles with a minimum thickness of $\frac{3}{16}$ -inch shall be used for doors over 15'-4" wide.
3. ***Provide windlock bars of the same material when windlocks are required to meet the specified wind load.***

E. Brackets

1. Fabricate from galvanized steel plate with permanently lubricated ball or roller bearings at rotating support points to support the counterbalance shaft assembly and form end closures.

F. Counterbalance Shaft Assembly

1. Oil-tempered, heat treated steel helical torsion spring assembly designed for the proper balance of the door to ensure that the maximum effort to operate will not exceed twenty-five pounds (25 lb). Provide wheel for applying and adjusting spring torque.
2. The counterbalance shall be housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inches per foot of span.
3. The counterbalance shall be adjustable by means of an adjusting tension wheel.

G. Hood

1. Provide an aluminum hood with reinforced top and bottom edges to maintain rigidity and shape.
2. Provide intermediate support brackets as required to prevent excessive sag.

H. Weather/Sensing Edge

1. Provide an automatic reversing control by an automatic sensing switch within a neoprene or rubber astragal extending the full width of the door bottom bar.

I. Electric Motor Operation

1. Provide a UL listed, industrial duty, belt drive type, jackshaft type, 480-volt, 3-phase, electric operator. The electric door motor/operator shall be of the size and capacity recommended by the door manufacturer for the conditions specified herein. The unit shall be complete with an electric motor and factory pre-wired motor controls, positive locking mechanical brake, emergency manual chain hoist, and operator control stations.
2. The motor shall be of the high starting torque, continuous duty, industrial type, protected against overload by a current sensing or thermal overload device.
3. Primary speed reduction shall be heavy duty 5L V-belt and sprocket double reduced secondary providing mechanical braking to hold the door in any position. The operator shall be equipped with an adjustable friction clutch and floor level disconnect and emergency manual chain hoist assembly, an output and door driven sprocket shall be provided with the operator.

4. The operator shall be capable of driving the door, in either direction, from any position, at a speed of 8 to 9 inches per second. A fully adjustable, driven linear type limit switch mechanism shall synchronize the operator with the door. Low friction nylon limit nuts fitted on threaded steel shaft, rotating on oilite self-lubricating bronze bushings shall be provided. The motor shall be removable without affecting the limit switch settings.
5. Automatic Operator Controls
 - a. A push-button and key operated control station shall be provided for each door with open, close, and stop buttons (NEMA 4).
 - b. The control station shall be mounted inside the building, with a surface/flush mounting, at the locations to be designated by the Owner and Engineer.
6. Special Operator Controls
 - a. **Radio control operation shall also be provided for operation of the door. Three (3) door remotes, programmed and ready for operation, shall be provided to the Owner.**
 - b. **Explosion and dust ignition proof control wiring shall be provided.**
7. Manual Operation
 - a. A chain hoist, with gear or sprocket reduction operator, shall be provided as specified herein.
- J. Locking Mechanism
 1. Masterkeyable cylinder operable from both sides of the bottom bar.
 2. Chain keeper locks for chain hoist operation shall be provided.
 3. Provide interlock switches on motor operated units.
- K. Anchors
 1. All anchors (size, type material) for installation of the aluminum overhead coiling doors shall be the standard of the aluminum overhead coiling door manufacturer for the type and weight of door to be installed as part of this Project and shall be corrosion resistant.

L. Fasteners

1. All fasteners (size, type material) for installation of the aluminum overhead coiling doors shall be the standard of the aluminum overhead coiling door manufacturer for the type and weight of door to be installed as part of this Project and shall be corrosion resistant.

M. Structural Steel

1. All structural steel for installation of the aluminum overhead coiling doors shall by ASTM A-36, hot-dipped galvanized.

N. Provide interlock switches on motor operated units.

2.03 Fabrication

A. Curtains

1. Shall be formed on interlocking anodized aluminum slats of shapes standard with the manufacturer, except that slats for exterior doors shall be flat type.
2. Curtains shall roll up on a barrel supported at head of opening on brackets and be balanced by a helical torsion spring assembly system in the barrel.
3. ***The assembled and installed door shall be able to withstand a hurricane force wind of 150 mph. The slats shall be 16 gauge, minimum.***

B. Endlocks and Windlocks

1. ***Both ends of each slat or each alternate slat shall be fitted with endlocks. In addition to endlocks, exterior doors shall have windlocks or integral slat lugs*** of manufacturer's standard design at ends of at least every sixth slat.
2. Windlocks of lugs shall prevent the curtain from leaving the guide because of deflection from wind pressure or other forces.

C. Bottom Bar

1. The bottom of the curtain shall be reinforced with the T-shaped extruded aluminum section for door widths up to 15'-4". For door widths greater than 15'-4", two galvanized steel angles shall be utilized.

2. ***In addition, exterior doors shall have a compressible and replaceable vinyl weather seal.***

D. Guides

1. Steel structural shapes or formed steel shapes fastened to the wall with steel shapes not less than $\frac{3}{16}$ -inch thick. Guides shall be of sufficient depth or shall incorporate a steel locking bar to retain the curtain in place under the wind pressure specified.
2. Provide continuous vinyl weather seals on guides at exterior doors. Securely attach guides to adjoining construction with not less than $\frac{3}{8}$ -inch diameter bolts, placed near each end and not over twenty-four (24) inches apart.

E. Barrel

1. Steel pipe or commercial welded steel tubing, galvanized, of proper diameter and thickness for the size of curtain. Deflection shall not exceed diameter and thickness for the size of curtain.
2. Deflections shall not exceed 0.03 inches per foot of span.
3. Close the ends of barrel with cast-iron plugs, machined to fit the pipe and either pinned or attached with screws in the spring barrel, except that drive end plug may be steel welded in place. Welding shall not be used on the tension end. Install within the barrel and oil-tempered, stress relieved, helical, counterbalancing steel spring having a 25% safety factor, and capable of producing sufficient torque to assure easy operation of the door curtain from any position.
4. ***At least eighty percent (80%) of the door weight shall be counterbalanced at any position.*** The spring-tension shall be adjustable without removing the hood.

F. Brackets

1. Fabricated of galvanized steel plate to support the barrel, curtain, and operator and to form a supporting ring and end closure for the hood.
2. ***Provide a weather baffle at the lintel or inside the hood or each exterior door.***

G. Locking Device

1. For each manually operated exterior rolling door provide manufacturer's standard chain or bar type locking device on the inside.

2. The locking device shall be of type capable of receiving a padlock with a $\frac{5}{16}$ -inch diameter shackle.

2.04 Automatic Reversing Control

- A. Furnish each door with an automatic safety switch, extending full width of door bottom, and located within a U-shaped vinyl astragal mounted to the bottom door rail.
- B. Contact with switch before fully closing will immediately stop the downward travel and reverse direction to the fully opened position. Connect to the control circuit through a retracting safety cord and reel.

2.05 Manual Operation

- A. Manual Hand-Chain Operation
 1. ***Provide a galvanized, endless chain operating over a sprocket and extending to within three (3) feet of the floor.*** Obtain reduction by use of roller chain and sprocket drive or suitable gearing.
 2. Gears shall be high-grade gray iron, cast from machine-cut patterns. ***The pull required to operate the door shall not exceed twenty-five (25) pounds.***

2.06 Ferrous Metal Finishes

- A. All steel and cast iron materials used in the manufacture of the door and frame shall be hot-dip galvanized after fabrication and machining.
- B. All ferrous surfaces exposed to view (including galvanized) except working parts of machinery or bearing surfaces shall receive one (1) shop coat of "rust inhibitive" metal primer compatible with the finish coating system in Specification Section 09900, "Painting".
- C. Finish paint in the field as specified in Section 09900, "Painting".

2.07 Aluminum Finishes

- A. Comply with the NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by “AA” conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Coating

1. AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; chemical finish; chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below).
2. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer’s instructions.
3. KYNAR-500 Fluoropolymer 3-Coat System
 - a. Manufacturer’s standard 3-coat thermocured system, complying with AAMA 605.2, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than seventy percent (70%) polyvinylidene fluoride resin by weight.
 - b. The color shall be selected by the Engineer from manufacturer’s standard colors.

3. EXECUTION

3.01 Preparation

A. Coordination and Measurements

1. Measurements shall be taken at the at each door location to assure proper erection of the work. ***The Contractor shall be responsible for checking in the field all dimensions***, whether or not shown on the Drawings, upon which the accurate fitting together and installation of the door may depend, or which would affect the proper operation of the door.
 2. The Contractor shall examine the conditions of substrates, supports, and other conditions under which this Work is to be performed. Verify that conditions are in accordance with the shop drawings.
- B. Do not proceed with any work until unsatisfactory conditions are corrected.
- C. Commencement of work by the installer shall mean acceptance of the substrate.

3.02 Installation

- A. Doors shall be delivered, stored and handled in accordance with Article 1.04, "Product Delivery, Storage and Handling", herein.
- B. Install aluminum overhead coiling doors in accordance with the instructions and recommendations of the manufacturer and in such a manner that will prevent damage or deformation.
- C. Use anchorage devices to securely fasten the assembly to wall construction and building framing without distortion or stress. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. **Doors shall be installed plumb, level and true to line** in accordance with the details shown on the approved shop drawings. Hardware shall be applied and adjusted to achieve quiet and smooth operation.
- E. Install the doors securely in appropriate frames, and adjusted for proper operation without sticking or binding.
- F. Install door and operating equipment complete with necessary hardware, jamb, and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with approved shop drawings, manufacturer's instructions, and as specified herein.
- G. Instruct the Owner's personnel in the proper operating procedures and maintenance schedule.
- H. Tolerances: Maintain dimensional tolerances and alignment with adjacent work. The maximum variation from plumb or level shall be $\frac{1}{16}$ -inch. The longitudinal or diagonal warp shall not exceed $\pm \frac{1}{8}$ -inch per 10 foot straight edge.

3.03 Adjusting and Cleaning

- A. Upon completion of installation including work by other trades, **lubricate, test and adjust doors** to operate easily, free from warp, twist or distortion and fitting weathertight for the entire perimeter.
- B. Clean exposed surfaces using non-abrasive materials and the methods recommended by the manufacturer of the material or product being cleaned.
- C. Touch-up damaged coatings and finishes and repair minor damage. Remove all surplus materials and debris from the site.

END OF SECTION

SECTION 08350

ALUMINUM ACCESS HATCH DOORS

1. GENERAL

1.01 Description

- A. This section includes providing all labor, materials and equipment necessary to install the aluminum access hatch doors in the locations shown on the Contract Drawings and/or specified herein.

1.02 Quality Assurance

- A. The aluminum access hatch doors shall meet the standards of the following:
 - 1. Florida Building Code
 - 2. OSHA requirements.
- B. Acceptable manufacturer's include The Bilco Company, Halliday Products, U.S. Foundry and Manufacturing, or approved equal.

1.03 Submittals

- A. Submit shop drawings, product data, certifications, etc., in accordance with the Section 00700, "General Conditions", Section 00800, "Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples" prior to fabrication of the aluminum access hatch doors.
- B. Shop drawings shall indicate materials, elevations, construction details, sizes, connections, hardware reinforcement and locations, metal thicknesses and wall conditions, installation details, and other required details to illustrate a complete operating access door.

- C. Submit the manufacturer's recommended installation, operating and maintenance instructions and procedures for the aluminum access hatch doors in accordance with Section 01300, "Shop Drawings, Submittals and Samples".

1.04 Product Delivery, Storage and Handling

- A. Protect the aluminum access hatch doors and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name on the packaging.
- B. Store doors in dry locations with adequate ventilation, free from dust and water, and in such a manner as to permit access for inspection and handling.
- C. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to "like-new" condition and provide new items at no additional cost to the Owner.

1.05 Warranty and Guarantees

- A. The manufacturer shall **guarantee** the aluminum access hatch doors against defects in material and workmanship **for a period of ten (10) years**.
- B. Refer to Section 01740, "Warranties and Bonds" for additional requirements.

2. PRODUCTS

2.01 Aluminum Access Hatch Doors

- A. The aluminum access hatch doors, in sizes as shown on the Contract Drawings, shall be the standard design of the manufacturer. The aluminum access hatch doors and all appurtenances shall be fabricated from high-grade, high-quality aluminum for the purposes and environments that they are to operate in.
- B. Each aluminum access hatch door shall be designed to the openings shown on the Contract Drawings.
- C. The aluminum access frames shall be manufactured from 1/4-inch thick (minimum), one-piece extruded aluminum frame.

- D. The frame shall be a self-draining channel with a 1½-inch draining coupling located in the channel frame.
- E. The door panels shall close flush and shall be ¼-inch thick aluminum diamond (checkered) plate.
- F. The installed aluminum access hatch doors shall be designed to withstand a minimum live load of 300 pounds per square foot. The aluminum access hatch doors shall be designed with a safety factor of 3.0.
- G. Aluminum cross-beams shall be provided by the aluminum access hatch door supplier as required to accomplish the stated loading. The doors shall have heavy duty aluminum recessed hinges with tamper-proof fasteners.
- H. All hardware shall be made of stainless steel, Type 316.
- I. Each door shall have spring operators, such that the maximum lifting effort is less than 25 pounds. The aluminum access hatch door supplier shall provide the number of springs as required to accomplish the maximum lifting requirement.
- J. Each door shall open to an angle of 90° and lock automatically with a aluminum, positive locking arm and a stainless steel release handle. Each door shall have a recessed stainless steel lifting handle.
- K. The aluminum access hatch doors shall be provided with a stainless steel, Type 316, snap-lock with a removable handle.
- L. ***All aluminum access hatch doors shall be designed to prevent to introduction of rainwater*** and shall also have with a neoprene gasket on the inside lip of the frame perimeter to form an essentially air/water tight seal.

3. EXECUTION

3.01 Installation

- A. The aluminum access hatch doors and associated equipment and accessories shall be installed as recommended by the manufacturer and adjusted for proper operation.
- B. The edges of the aluminum frame that will be in contact with concrete, shall be coated with coal tar epoxy prior to casting into the concrete, in accordance with Section 09900, "Painting".

3.02 Cleaning and Protection

- A. The Contractor shall clean all surfaces of the access hatch, remove all markings and protect the surface until Final Project Acceptance by the Owner.
- B. Any damage to the access doors shall be repaired by the Contractor in accordance with the recommendations and instructions of the manufacturer.
- C. The Engineer will determine whether the repair is acceptable. If it isn't acceptable, the Contractor shall replace the access door and appurtenances with new materials at no additional cost to the Owner.

END OF SECTION

SECTION 08370

ROOF ACCESS HATCHES

1. GENERAL

1.01 Description

- A. This section includes providing all labor, materials and equipment necessary to install stainless steel roof access hatches in the locations shown on the Contract Drawings and/or specified herein.

1.02 Quality Assurance

- A. The stainless roof access hatches shall meet the standards of the following:

- 1. Florida Building Code
 - 2. OSHA requirements.

- B. Qualifications

- 1. Manufacturer: A minimum of five (5) years experience manufacturing similar products.
 - 2. Installer: A minimum of three (3) years experience installing similar products.
 - 3. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

- C. Acceptable manufacturer's include The Bilco Company, Halliday Products or approved equal.

1.03 Submittals

- A. Submit shop drawings, product data, certifications, etc., in accordance with the Section 00700, "General Conditions", Section 00800, "Supplementary Conditions" and Section 01300, "Shop Drawings, Submittals and Samples" prior to fabrication of the stainless steel roof access hatches.

- B. Shop drawings shall indicate materials, elevations, profiles, construction details, sizes, connections, hardware reinforcement and locations, adjacent construction interface, metal thicknesses and wall conditions, installation details, accessories, and other required details to illustrate a complete operating roof access hatches.
- C. Submit the manufacturer's recommended installation, operating and maintenance instructions and procedures for the stainless roof access hatches in accordance with Section 01300, "Shop Drawings, Submittals and Samples" .

1.04 Product Delivery, Storage and Handling

- A. Deliver products in manufacturer's original packaging. Inspect the roof access hatches upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.
- B. Protect the roof access hatches and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name on the packaging.
- C. Store roof access hatches in dry locations with adequate ventilation, free from dust and water, and in such a manner as to permit access for inspection and handling.
- D. Handle roof access hatches carefully to prevent damage. Remove damaged items that cannot be restored to "like-new" condition and provide new items at no additional cost to the Owner.

1.05 Warranty and Guarantees

- A. The manufacturer shall guarantee the roof access hatches against defects in material and workmanship for a period of **ten (10) years from the date of Final Project Acceptance by the Owner**. Any replacement of parts or repairs during this period shall be **at no cost to the Owner**.
- B. Refer to Section 01740, "Warranties and Bonds" for additional requirements.

2. PRODUCTS

2.01 Roof Access Hatches

- A. The roof access hatches, in sizes as shown on the Contract Drawings, shall be as manufactured by the Bilco Company (Type E roof hatch), Halliday Products equivalent, or approved equal.

B. Roof Access Hatch Information

1. Furnish and install, where indicated on the Contract Drawings the following roof hatches:
 - a. Manufacturer: The Bilco Company
 - b. Roof Hatch Size: 36" x 36"
 - c. Hatch Material: Type 304 stainless, single-leaf, metal roof hatch
 - d. Halliday Model: Type E
 - e. Assembly: The roof hatch shall be pre-assembled from the manufacturer.

C. Roof Access Hatch Performance Characteristics

1. The roof access hatch shall be reinforced to support a minimum live load of 300 psf with a maximum deflection of $\frac{1}{150}$ th of the span. The roof access hatches shall be designed with a safety factor of 3.0. Cross-beams shall be provided by the roof access hatch supplier, as required, to accomplish the stated loading. The hatches shall have heavy duty recessed hinges with tamper-proof fasteners.
2. ***The roof access hatches, frames and accessories shall be able to withstand hurricane force winds up to 150 mph without damage or failure.***
3. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
4. Operation of the roof access hatches shall not be affected by temperature.
5. Entire roof access hatches shall be ***weather-tight*** with fully welded corner joints on covers and curb.

D. Cover and Frame

1. The cover and frame shall be 14 gauge, minimum, Type 304 stainless steel with a three (3) inch beaded flange with formed reinforcing members.
2. Covers shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

3. The cover insulation shall be fiberglass of one (1) inch thickness, fully covered and protected by an aluminum metal liner of a thickness required to meet the performance characteristics (18 gauge, minimum).

E. Curb

1. Each roof access hatch shall have a curb, twelve (12) inches in height and of 11 gauge aluminum, minimum.
2. The curb shall be formed with a 3½-inch flange with 7/16-inch holes provided for securing to the roof deck.
3. The curb shall be equipped with an integral metal cap-flashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, six (6) inches on center, to be bent inward to hold single ply roofing membrane securely in place.
4. Curb insulation shall be rigid, high-density fiberboard of one (1) inch thickness on the outside of the curb.

F. Lifting Mechanisms

1. The roof access hatch manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing.
2. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly (stainless steel construction).
3. The maximum lifting effort shall be less than 25 pounds.

- G. Each roof access hatch shall open to an angle of 90° and lock automatically with a Type 304 stainless steel, positive locking arm and a Type 304 stainless steel release handle. Each roof access hatch shall have a recessed Type 304 stainless steel lifting handle.

H. Hardware

1. Heavy-duty pintle hinges with Type 316 stainless steel hinge pins shall be provided.
2. Covers shall be equipped with an enclosed a spring latch with interior and exterior turn handles.

3. Roof access hatches shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Covers shall automatically lock in the open position with a rigid hold open arm equipped with a one (1) inch diameter red vinyl grip handle to permit easy release for closing.
6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be Type 316 stainless steel hardware.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. Finishes

1. The factory finish of each roof access hatch shall be Type 316 stainless steel with a mill finish and electrochemical passivation of welds.

3. EXECUTION

3.01 Examination

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 Installation

- A. The Type 316 stainless steel roof access hatches and associated equipment and accessories shall be installed in strict accordance with the manufacturer's instructions and approved submittals.
- B. Ensure that the roof access hatches are level, plumb, and in proper alignment with adjacent work.
 1. Test roof access hatches for proper function and adjust until proper operation is achieved.

2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

3.03 Cleaning and Protection

- A. The Contractor shall clean all surfaces of the each roof access hatch, remove all markings and protect the surface until Final Project Acceptance by the Owner.
- B. Any damage to the roof access hatches shall be repaired by the Contractor in accordance with the recommendations and instructions of the manufacturer.
- C. The Engineer will determine whether the repair is acceptable. If it isn't acceptable, the Contractor shall replace the roof access hatch and appurtenances with new materials **at no additional cost to the Owner.**

END OF SECTION

SECTION 08410

ALUMINUM-FRAMED STOREFRONT DOOR SYSTEM

1. GENERAL

1.01 Description

A. This section includes providing all labor, materials and equipment necessary to install an exterior aluminum entrance and storefront (fixed glazing) door system in the location shown on the Contract Drawings and/or specified herein.

B. Related Work Specified Elsewhere:

1. General Conditions:	Section 00700
2. Supplementary Conditions:	Section 00800
3. Joint Sealants:	Section 07900
4. Finish Hardware:	Section 08710
5. Glass and Glazing:	Section 08800

1.02 Manufacturers Qualifications and Performance Requirements

A. Manufacturer's Qualifications

1. Approval by the Engineer is required of products of the proposed manufacturer, or supplier, and will be based upon submission by Contractor of certification that the manufacturer regularly and presently manufactures aluminum entrance and storefront door systems as one of its principal products.
2. The aluminum entrance and storefront door system shall be manufactured by a single firm specializing in the production, fabrication and installation said systems.
3. The manufacturer shall have a minimum of five (5) years experience in the production, fabrication and installation of aluminum entrance/storefront door.

4. The manufacturer shall submit, in accordance with Section 01300, "Shop Drawings, Submittals and Samples", evidence of the ability to meet the performance and fabrication requirements specified, and include a list of five (5) projects of similar design, size and complexity completed within the past five (5) years.

B. System Performance Requirements

1. Provide an aluminum entrance and storefront door system that complies with the performance characteristics specified herein.

2. Design Requirements

- a. Provide an aluminum entrance and storefront door system that complies with structural performance, air filtration, and water penetration requirements indicated.
- b. Provide an aluminum entrance and storefront door system **capable of withstanding hurricane force winds of up to 150 mph** and the associated wind pressures inward and outward acting normal to the plane of the door system.

3. Structural Performance

a. Deflection Normal to the Plane of the Door System

- 1) Deflection normal to the plane of the door system shall not exceed $\frac{1}{175}$ of the clear span, when subjected to a uniform load deflection test.

b. Deflection Parallel to the Plane of the Door System

- 1) Deflection of any member carrying its full dead load shall not exceed an amount that will reduce glass bite below seventy-five percent (75%) of the design dimension and shall not reduce the edge clearance between the member and the fixed panel, glass or other fixed member above to less than $\frac{1}{8}$ -inch.
- 2) The clearance between the member and an operable door or window shall be at least $\frac{1}{16}$ -inch.

4. Thermal Movement

- a. Design the aluminum entrance and storefront door system to provide for expansion and contraction of the component materials. Entrance doors shall function normally over the specified temperature range.

- b. The system shall be capable of withstanding a metal surface temperature range of 180°F (100°C) without buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, stress on glass, or other detrimental effects.

5. Air Filtration

- a. Provide an aluminum entrance and storefront door framing system with an air infiltration rate of not more than 0.06 cfm/ft² of fixed area (excluding operable door edges) when tested in accordance with ASTM E283 at an inward test pressure differential of 1.57 psf.

6. Water Penetration

- a. Provide framing systems with no uncontrolled water penetration (excluding operable door edges) as defined in the test method when tested in accordance with ASTM E331 and/or ASTM E1105 at an inward test pressure differential of 6.24 lb/ft².

7. Thermal Transmittance

- a. Provide framing systems that have an overall U-value of not more than 0.50 BTU / (hr x ft² x °F) at 15 mph exterior wind velocity when tested in accordance with AAMA 1503.

8. Condensation Resistance

- a. Where framing systems are of “thermal-break” construction, provide units tested for thermal performance in accordance with AAMA 1502.7 showing a Condensation Resistance Factor (CRF) of not less than 45.

9. Forced Entry Resistance

- a. Provide entrance door units that comply with the requirements of the local governing authority, tested in accordance with ASTM F588.

1.03 Quality Assurance

A. Installer Qualifications

- 1. Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront door

systems similar to those required for this Project, whose work has resulted in construction with a record of successful in-service performance and who is acceptable to manufacturer.

B. Reference Standards

1. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

Standard	Description
American Society for Testing and Materials (ASTM)	
ASTM A36/A36M	Standard Specification for Carbon Structural Steel
ASTM A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM B221/B221M	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E283	Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330/E330M	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1996	Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
American Architectural Manufacturers Association (AAMA)	
AAMA CW-10	Care and Handling of Architectural Aluminum From Shop to Site
AAMA 501.2	Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage
AAMA 609 & 610	Cleaning and Maintenance Guide for Architecturally Finished Aluminum
AAMA 611	Voluntary Specification for Anodized Architectural Aluminum
AAMA 1503	Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
The Society for Protective Coatings (SSPC)	
SSPC - Paint 20	Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")
Other Standards and Building Codes	
	Florida Building Code

C. Manufacturer's Qualifications

1. The Contractor is referred to Article 1.02(A).

D. Source Limitations

1. Obtain each type of entrance and storefront door system through one source from a single manufacturer.
2. Do not modify the intended aesthetic effect, as judged solely by Engineer, except with Engineer's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Engineer for review.

E. Design Criteria

1. The Contract Drawings indicate the size, profile, and dimensional requirements of aluminum entrance and storefront door system work required and are based on the specific types and models indicated.

1.04 Submittals

- A. Submit shop drawings for review in accordance with Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", and Section 01300, "Shop Drawings, Submittals and Samples".
- B. Product data for each aluminum entrance and storefront door system required, including, but not limited to, the following:
 1. Manufacturer's standard details and fabrication methods.
 2. Data on component dimensions, components within the assembly, anchorage and fasteners, glass and infill, internal drainage details, finishing, hardware and accessories.
 3. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop drawings for each aluminum entrance and storefront door system required, including:
 1. Layout and installation detail, including relationship to adjacent work and attachments to other work.

2. Plans, elevations and sections, dimensional data, at a scale of $\frac{1}{4}$ - inch = 1 foot and provide details of components.
 3. Detail sections of typical composite members.
 4. Anchors and reinforcement.
 5. Hardware mounting heights.
 6. Provisions for expansion and contraction.
 7. Glazing details.
 8. Information regarding joinery, anchorage, glazing and flashing and drainage.
 9. Hardware Schedule
 - a. Submit a complete hardware schedule organized into sets. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Include the item name, name of manufacturer and complete designations of every item required for each door opening, quantities and locations.
 - b. Numerous doors to be installed in the building shall have electronic strikes and access card readers. See Section 08000, "Door Schedule" and the Contract Drawings for details.
 - c. The Contractor is referred to Section 08710, "Finish Hardware".
- D. Samples
1. Submit two samples 2 x 2 inches in size illustrating finished aluminum surface, glass, glazing materials.
 2. Samples for Verification Purposes
 - a. The Engineer reserves the right to require additional samples, that show fabrication techniques and workmanship, and design of hardware and accessories.
- E. Submit a manufacturer's certificate indicating that the products supplied meet or exceed the specified requirements.

1.05 System Description

A. General

1. Provide aluminum entrance and storefront door systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
2. Failure includes the following:
 - a. Air infiltration and water penetration exceeding specified limits.
 - b. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Hurricane-Resistance Test Performance

1. ***The aluminum doors, frames and glazing materials shall be able to withstand hurricane force winds up to 150 mph without damage or failure.*** Where the required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101, Section 3, "Optional Performance Classes" for higher than minimum performance class.
 2. Provide entrance and storefront system door systems that pass large and small missile-impact tests, as required by systems' location above grade, and cyclic-pressure tests according to testing requirements of authorities having jurisdiction.
- C. For each product specified, include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- D. Installer Certificates must be signed by the manufacturer certifying that installers comply with the specified requirements.

1.06 Delivery, Storage, and Handling

- A. Deliver aluminum entrance and storefront door system components in the manufacturer's original protective packaging.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

- C. Handle products of this section in accordance with AAMA CW-10.
- D. Store aluminum components in a clean dry location away from uncured masonry or concrete. Cover components with waterproof paper, tarpaulin or polyethylene sheeting in a manner to permit circulation of air.
- E. Stack aluminum components in a manner that will prevent bending and avoid significant or permanent damage.
- F. Any damaged materials or components shall be rejected and shall be replaced with "new" materials/components **at no additional cost to the Owner.**

1.07 Project Conditions

A. Field Measurements

- 1. Verify openings and dimensions by accurate field measurements before fabrication. Show recorded measurements on shop drawings.
- 2. Coordinate the fabrication schedule with the construction progress to avoid delaying the Work.
- 3. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

1.08 Warranty

A. General Warranty

- 1. Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:
 - a. Structural failures including excessive deflection, excessive leakage of water or air infiltration.
 - b. Faulty operation.
 - c. Deterioration of metals, metal finishes (fading, chalking or flaking) and other materials beyond normal weathering.
- 2. The manufacturer shall provide a **five (5) year warranty commencing from the date of Final Project Acceptance by the Owner.**

3. The warranty specified herein shall not deprive the Owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

2. PRODUCTS

2.01 Manufacturers

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Kawneer Company, Inc.
2. EFCO Corporation.
3. YKK AP America Inc.
4. Tubelite
5. Or approved equal

2.02 Aluminum-Framed Storefront

- A. Aluminum-Framed Storefront

1. Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
2. Characteristics

Parameter	Description
Glazing Rabbet	For 1-inch insulating glazing.
Glazing Position	Centered (front to back).
Vertical Mullion Dimensions	2 inches wide by 5 inches deep.
Finish	Class II natural anodized per AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils thick.
Factory finish	All surfaces that will be exposed in completed assemblies.
Finish Color	As selected by the Engineer and Owner from the manufacturer's standard line.
Fabrication	Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.

Parameter	Description
Construction	Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
System Internal Drainage	Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
Expansion/Contraction	Provide for expansion and contraction within system components caused by cycling temperature range of 170°F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
Movement	Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
Perimeter Clearance	Minimize space between framing members and adjacent construction while allowing expected movement.
Air and Vapor Seal	Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
Preparation for Window Treatments	Provide reinforced interior horizontal head rail.

B. Performance Requirements

1. Wind Loads

- a. Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.

- 1) Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

2. Wind-Borne-Debris Resistance

- a. Identical full-size glazed assembly without auxiliary protection, tested by independent agency in accordance with ASTM E1996 for Wind Zone 4 - Additional Protection for Large and Small Missile impact and pressure cycling at design wind pressure.

3. Water Penetration Resistance

- a. No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.

4. Air Leakage: Maximum of 0.06 ft³/min ft² of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
5. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.03 Materials

A. Aluminum Members

1. Alloy and temper aluminum members recommended by the manufacturer for the type of use, strength, corrosion resistance, and application of the required finish indicated, complying with the requirements of standards indicated below:

Aluminum Members	Applicable Standard
Sheet and Plate	ASTM B209
Extruded Bars, Rods, Shapes and Tubes	ASTM B221
Structural Pipe and Tubes	ASTM B429
Bars, Rods and Wire	ASTM B211

2. Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
3. Glazing stops shall be flush.
4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Structural Steel Sections

1. Carbon steel reinforcement of aluminum framing members shall comply with the following:

Reinforcement For	Applicable Standard
Structural Shapes, Plates and Bars	ASTM A36/A36M
Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products	ASTM A123/A123M

2. All carbon steel used for reinforcement shall be galvanized.

C. Glass and Glazing Materials

1. Comply with the requirements of Section 08800, "Glass and Glazing".
2. Glazing Gaskets
 - a. Manufacturers standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of the type and in the hardness recommended by the system and gasket manufacturer to comply with system performance requirements (weather, moisture, and air infiltration requirements, etc.).
 - b. Provide gasket assemblies that have corners sealed with a sealant recommended by the gasket manufacturer.

D. Fasteners

1. Provide stainless steel fasteners recommended by the system manufacturer for the installation.

E. Flashing

1. Concealed Flashing: Galvanized steel, 26 gage, 0.0179 inch minimum base metal thickness.
2. Exposed Flashing: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.
3. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.

- F. Structural supporting anchors attached to reinforced concrete members shall be designed for welded attachment to weld plates embedded in concrete.

- G. Sealant for setting thresholds shall be non-curing butyl type.

H. Touch-up Primer

1. For Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

2. For Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.
- I. Concrete and Masonry Inserts
 1. Provide cast iron, malleable iron, or hot-dip galvanized steel inserts complying with ASTM A-123.
- J. Spacers, Setting Blocks, Gaskets, and Bond Breakers
 1. Provide the manufacturer's standard permanent, non-migrating types in the hardness recommended by the manufacturer, compatible with sealants, and suitable for the system performance requirements.
- K. Sealants and joint fillers for joints at the perimeter of entrance and storefront systems shall be as specified in Section 07900, "Joint Sealants".
- L. Bituminous paint shall be cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for a thirty (30) mil thickness per coat.

2.04 Components

- A. Storefront Framing System
 1. Provide storefront and entrance framing systems fabricated from extruded aluminum members of the size and profile indicated or required. Include subframes and other reinforcing members of the type indicated.
 2. Provide for flush glazing storefront from the exterior on all sides without projecting stops. Shop-fabricate and preassemble frame components where possible. Provide storefront frame sections without exposed seams.
 3. Mullion Configurations
 - a. Provide pockets at the inside glazing face to receive the resilient elastomeric glazing. Mullions and horizontals shall be one piece.
 - b. Make provisions to drain moisture accumulation to the exterior.

B. Entrance Door Frames

1. Provide tubular and channel frame entrance door frame assemblies, as indicated or required, with welded or mechanical joints in accordance with the manufacturer's standards.
2. Reinforce as necessary to support the required loads.

C. Stile and Rail Type Entrance Doors

1. Provide the manufacturer's standard 1¾-inch (44.5 mm) thick glazed doors with minimum 0.125-inch (3.2 mm) thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
2. Glazing Stops and Gaskets
 - a. Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails.
 - b. Provide the manufacturer's standard snap-on extruded aluminum glazing stops and preformed gaskets, with exterior stops anchored for non-removal.
3. Stile Design: Medium stile; 3½-inch (88.9 mm) nominal width.

2.05 Hardware

- A. Numerous doors to be installed in the building shall have electronic strikes and access card readers. See Section 08000, "Door Schedule" and the Contract Drawings for details.
- B. Provide finish hardware per Specification Section 08710, "Finish Hardware".

2.06 Fabrication**A. General**

1. Fabricate aluminum entrance and storefront components to the designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes and profile requirements are indicated on the Contract Drawings.

2. Variable dimensions are indicated, with maximum and minimum dimensions required, to achieve design requirements and coordination with other work.
3. Thermal-Break Construction
 - a. Fabricate storefront framing system with an integrally concealed, low-conductance thermal barrier, located between exterior materials and exposed interior members to eliminate direct metal-to-metal contact.
4. Provide subframes and reinforcing of the types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

B. Prefabrication

1. Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.
2. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.
3. Cut, drill, and tap for factory-installed hardware before finishing components.
4. Pre-glaze door and frame units to greatest extent possible.

C. Welding

1. Comply with AWS recommendations.
2. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish.
3. Welding behind finished surfaces shall be performed in such a manner as to minimize distortion and discoloration on the finished surface.

D. Reinforcing

1. Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.
2. Reinforce as required to support the imposed loads.

E. Dissimilar Metals

1. Separate dissimilar metals with bituminous paint, or a suitable sealant, or a non-absorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.

F. Continuity

1. Maintain accurate relation of planes and angles with hairline fit of contacting members.
2. Uniformity of Metal Finish
 - a. Abutting extruded aluminum members shall not have an integral color or texture variation greater than half the range indicated in the sample pair submittal.

G. Fasteners

1. Conceal fasteners wherever possible.

H. Weatherstripping

1. For exterior doors, provide compression weatherstripping against fixed stops. At other edges, provide sliding weatherstripping retained in an adjustable strip mortised into door edge.
2. Provide EPDM or vinyl-blade gasket weatherstripping in the bottom door rail, adjustable for contact with the threshold.
3. At interior doors and other locations without weatherstripping, provide neoprene silencers on stops to prevent metal-to-metal contact.
- I. Provide finger guards of collapsible neoprene or PVC gasketing securely anchored into the frame at the hinge-jamb of center-pivoted doors.

2.07 Aluminum Finishes

- A. Comply with the NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Coating

1. AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
2. KYNAR-500 Fluoropolymer 2-Coat Coating System
 - a. Manufacturer's standard 2-coat thermocured system, complying with AAMA 605.2, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than seventy percent (70%) polyvinylidene fluoride resin by weight.
3. The color shall be as selected by the Engineer and Owner from manufacturer's standard colors.

D. Appearance of Finished Work

1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples. Noticeable variations in the same piece are not acceptable.
2. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

3. EXECUTION

3.01 Examination

- A. Examine areas, substrates and supports, with the Installer present, for compliance with the requirements for installation tolerances and other conditions affecting the performance of entrance and storefront systems. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 Installation

A. General

1. Comply with manufacturer's written instructions and recommendations for protecting, handling, and installing entrance and storefront systems.
2. Do not install damaged components.
3. Fit frame joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure non-movement joints.
5. Seal joints watertight and airtight.

B. Metal Protection

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with a primer or by applying sealant or tape recommended by the manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
3. Zinc or cadmium plate steel anchors and other unexposed fasteners after fabrication.

- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Section 07900, "Joint Sealants".
- E. Refer to Section 08800, "Glass and Glazing", for installation of glass and other panels indicated to be glazed into doors and framing, and not pre-glazed by manufacturer.
- F. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members, doors, or panels. Provide proper support and anchor securely in place. Maintain assembly dimensional tolerances, aligning with adjacent work.
- G. Provide alignment attachments and shims to permanently fasten system to building structure.

- H. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to the hardware manufacturers' written instructions.
 - 1. Install surface-mounted hardware according to the manufacturer's written instructions using concealed fasteners to the greatest extent possible.
 - 2. Install hardware in strict accordance with the manufacturer's instructions and recommendations. Use concealed fasteners wherever possible.
- I. Provide thermal isolation where components penetrate or disrupt building insulation.
- J. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- K. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- L. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.
- N. Erection Tolerances
 - 1. Install entrance and storefront door systems to comply with the following maximum tolerances:
 - a. Variation from Plane
 - 1) Limit variation from plane or location shown to $\frac{1}{16}$ -inch in 10 feet of length.
 - b. Offset from Alignment
 - 1) The maximum offset from true alignment between two identical members abutting end to end in line shall not exceed $\frac{1}{32}$ -inch.
 - c. Offset at Corners
 - 1) The maximum out-of-plane offset of framing at corners shall not exceed $\frac{1}{32}$ -inch.

d. Diagonal Measurements

- 1) The maximum difference in diagonal measurements shall not exceed $\frac{1}{32}$ -inch.

3.03 Adjusting

- A. Adjust doors and operating hardware to provide a tight fit at contact points and weather stripping; to function properly for smooth operation without binding; and for a weathertight closure.

3.04 Cleaning

- A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings, in accordance with the manufacturer's instructions and recommendations.
- B. Thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.
- C. Clean glass surfaces after installation, complying with requirements contained in Section 08800, "Glass and Glazing" and the manufacturer's recommendations.
- D. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.05 Protection

- A. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer.
- B. Ensure entrance and storefront systems are without damage or deterioration at the time of Final Project Acceptance by the Owner.

END OF SECTION

SECTION 08500

WINDOW SCHEDULE

1. GENERAL

1.01 Description

A. Scope of Work

1. The work included in this Section consists of furnishing all labor, materials, equipment and incidentals required to provide and install the "impact resistant" windows in the following "new" Sanford Main WTP Operations Building to be constructed as part of this Contract, indicated herein and as shown on the Contract Drawings.

B. Related Work Specified Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
00700	General Conditions
00800	Supplementary Conditions
01300	Shop Drawings, Submittals and Samples
08800	Glass and Glazing

1.02 Finish Schedule

- A. The door schedule for the building(s)/structures to be constructed as part of this Contract shall be as follows:

SANFORD MAIN WTP IMPROVEMENTS PROJECT: WINDOW SCHEDULE¹

Window No.	Room Name	Rough Opening			Frame Material	Glazing	Operation	Comments
		Width	Height	Bottom				
101	Reception Area	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
104	Meeting/Breakroom	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
104A	Meeting/Breakroom	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
104B	Meeting/Breakroom	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
104C	Meeting/Breakroom	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
104D	Meeting/Breakroom	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
110	Ops Center Control Room	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
110A	Ops Center Control Room	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
110B	Ops Center Control Room	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
110C	Ops Center Control Room	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Low E Glazing
111	High Service Pump Room	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
111A	High Service Pump Room	6' -0"	4' -0"	3' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
201	Stairwell	6' -0"	4' -0"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
203	Office No. 203	4' -0"	4' -0"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
203A	Office No. 203	6' -0"	4' -0"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
208	Office No. 208	6' -0"	4' -0"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
208A	Office No. 208	6' -0"	4' -0"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
209	Office No. 209	6' -0"	4' -0"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing

SANFORD MAIN WTP IMPROVEMENTS PROJECT: WINDOW SCHEDULE¹

Window No.	Room Name	Rough Opening			Frame Material	Glazing	Operation	Comments
		Width	Height	Bottom				
111B	High Service Pump Room	6' -0"	2' -8"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
111C	High Service Pump Room	6' -0"	2' -8"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
111D	High Service Pump Room	6' -0"	2' -8"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
111E	High Service Pump Room	6' -0"	2' -8"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
111F	High Service Pump Room	6' -0"	2' -8"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
111G	High Service Pump Room	6' -0"	2' -8"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing
111H	High Service Pump Room	6' -0"	2' -8"	15' -4"	Aluminum	Impact	Fixed	Tinted Low E Glazing

¹ Window Head, Jamb and Sill Details identified on the Contract Drawings

2. PRODUCTS - NOT USED

3. EXECUTION - NOT USED

END OF SECTION

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SECTION 08520

ALUMINUM WINDOWS

1. GENERAL

1.01 Description

A. This section includes providing all labor, materials and equipment necessary to install heavy commercial-grade aluminum window units of the performance class in the locations shown on the Contract Drawings and/or specified herein. Window types include, as identified on the Contract Drawings, the following:

1. Fixed, "impact resistant" windows.

B. All window units shall be constructed of tubular aluminum sections, shop fabricated, factory finished, with vision glass, related flashings, anchorage and attachment devices.

C. Related Work Described Elsewhere

1. Related work specified elsewhere includes:

Specification Section	Title
07900	Joint Sealants
08800	Glass and Glazing
Division 4 - Masonry	
Contract Drawings and General Provisions of the Contract	

1.02 System Performance Requirements

A. Provide aluminum window units that comply with performance requirements specified, as demonstrated by testing manufacturer's corresponding stock systems according to test methods indicated.

- B. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to the plane of the wall in accordance with the Florida Building Code, all applicable codes and as measured in accordance with ASTM E330.
- C. Limit member deflection to the flexure limit of the glass or $1/250$ (0.4%); with full recovery of the glazing materials, whichever is less.
- D. Comply with structural performance, air infiltration, and water penetration requirements indicated in AAMA 101 for the type, grade, and performance class of window units required.
- E. ***The aluminum windows, frames and glazing materials shall be able to withstand hurricane force winds up to 150 mph without damage or failure.*** Where the required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101, Section 3, "Optional Performance Classes" for higher than minimum performance class.
- F. Heights of window units above grade at the window centerline are indicated or can be determined from the Contract Drawings.
- G. The window systems shall accommodate, without damage to components or deterioration of seals, movement between the window and perimeter framing, and deflection of lintel.
- H. Provide window units with no failure or permanent deflection in excess of 0.4% of any member's span after removal of the imposed load, for a positive (inward) and negative (outward) test pressure of 30 lb_f/ft².
- I. Limit air filtration (leakage).
- J. Provide units with air infiltration rate of not more than 0.11 cfm/ft of operable sash joint for an inward test pressure of 6.24 lb_f/ft².
- K. Provide units with no water penetration in accordance with ASTM E331 as defined in the test method at an inward test pressure of 15 percent of the design pressure.
- L. Provide units that have been tested for thermal performance in accordance with AAMA 1503.1 showing a condensation resistance factor (CRF) of not less than 45.
- M. Provide window units that comply with the requirements for Forced-Entry Resistance, Performance Level 10, when tested in accordance with ASTM F588.
- N. Fabricate aluminum window units that have been certified to provide a Sound Transmission Class (STC) rating of at least 40 when tested in accordance with ASTM E90 and classified according to ASTM E413.

- O. **All exterior windows shall have a deep, dark, colored tinting** to reduce the transmission of heat and UV energy into the buildings to which they are to be installed. **All windows shall be impact resistant and withstand hurricane force winds up to 150 mph without damage or failure.**

1.03 Submittals

- A. Submit shop drawings to the Engineer, as provided in Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions" and in accordance with Section 01300, "Shop Drawings, Submittal and Sample".
- B. All materials specified shall be certified by the producer or manufacturer that the furnished material meets the specific requirements of the Contract Documents.
- C. **Submit product data** for each type of window required, including, but not limited to, the following:
 - 1. Construction details and fabrication methods.
 - 2. Profiles and dimensions of individual components.
 - 3. Data on hardware, accessories, and finishes.
 - 4. Recommendations for maintenance and cleaning of exterior surfaces.
- D. Submit shop drawings for each type of window required. Include information not fully detailed in the manufacturer's standard product data and the following:
 - 1. Schedule showing the location and size of each window.
 - 2. Details of window and frame construction along with metal gauges and fasteners.
 - 3. Layout and installation details, including anchorage.
 - 4. Elevations of continuous work at 1/4-inch scale and typical window unit elevations at 3/4-inch scale along with detailed cross references.
 - 5. Full-size section details of typical composite members, including reinforcement.
 - 6. Hardware details, including operators, and all required reinforcement.
 - 7. Glazing and weatherstripping details.
 - 8. Accessories.

- E. ***Calculations by a professional civil or structural engineer, registered in the State of Florida, showing that the window, window walls, entrances, and storefront systems and their structural connections are designed to meet the code requirements, the design requirements herein and the loads associated with hurricane force winds up to 150 mph.***
- F. Submit samples of each specified finish on 12 inch-long sections of window members for initial color selection. Where finishes involve normal color variations, include sample sets showing the full range of variations expected.
- G. The Engineer reserves the right to require additional samples for verification purposes, that show fabrication techniques and workmanship, and design of hardware and accessories.
- H. Provide certification by a recognized independent testing laboratory or agency showing that each type, grade, and size of window unit complies with performance requirements indicated.

1.04 Quality Assurance

A. Installer Qualifications

- 1. Engage an experienced Installer, who has at least five (5) years experience in this field, who has completed installation of aluminum windows similar in design and extent to those required for the Project and whose work has resulted in construction with a record of successful in-service performance.

B. Single-Source Responsibility

- 1. ***Provide aluminum window units from one source and produced by a single manufacturer.***

C. Design Concept

- 1. The Contract Drawings indicate the size, profiles, and dimensional requirements of the aluminum window types required.
- 2. Aluminum windows by other manufacturers may be considered provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Engineer and Owner. The burden of proof of equality is on the Proposer.

D. Standards

1. Requirements for aluminum windows, terminology and standards of performance, and fabrication workmanship are those specified and recommended in AAMA 101 and applicable general recommendations published by AAMA.
2. Unless otherwise indicated, all materials, workmanship and practices shall conform to the latest revision of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

STANDARD	DESCRIPTION
American Architectural Manufacturers Association (AAMA)	
AAMA 101	Specifications for Aluminum Prime Windows and Sliding Glass Doors
AAMA 603.8	Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum
AAMA 605.2	Specifications for High Performance Organic Coatings on Architectural Extrusions and Panels
AAMA 606.1	Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum
AAMA 607.1	Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum
AAMA 608.1	Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum
American Society for Testing and Materials (ASTM)	
ASTM A386	Zinc Coating (Hot Dip) on Assembled Steel Products
ASTM B-09	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E283	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
Other Standards and Codes	
	Florida Building Code
	SSPC: Steel Structures Painting Manual
	FS L-S-125: Screening, Insect, Non-metallic
	FS RR-W-365: Wire Fabric (Insect Screening)

1.05 Project Conditions

A. Field Measurements

1. ***Check actual window openings by accurate field measurement before fabrication. Show all recorded measurements on the final shop drawings.***
2. Coordinate the fabrication schedule with the construction progress to avoid any delay in the Project Work.

1.06 Delivery, Storage, and Handling

- A. ***Deliver aluminum windows and all components in the manufacturer's original protective packaging.***
- B. Protect the aluminum windows and components from damage during delivery, storage and handling. Clearly mark the manufacturer's brand name and all identification details on the packaging in indelible ink.
- C. Store aluminum windows and components in a clean dry location with adequate ventilation, free from dust and water, and in such a manner as to permit access for inspection and handling.
- D. Stack all components in a manner that will prevent bending and avoid significant or permanent damage.
- E. Handle all window components carefully to prevent damage. Remove damaged items that cannot be restored to a "like-new" condition and provide new items at no additional cost to the Owner.

1.07 Warranty

A. Aluminum Window Warranty

1. Submit a written warranty, executed by the window manufacturer, agreeing to repair or replace window units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to, the following:
 - a. Structural failures including excessive deflection, excessive leakage, or air infiltration.
 - b. Faulty operation of sash and hardware.

- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. *The warranty shall be for a period of ten (10) years from the date of Final Project Acceptance by the Owner.*

- B. The warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and is in addition to, and runs concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

2. PRODUCTS

2.01 Acceptable Manufacturers

- A. Subject to compliance with requirements and Florida Product approval for high wind velocity impact, provide the following:
 - 1. Kawneer Company - Model AA4325.
 - 2. Kawneer Company - Model NX3800.
 - 3. Or approved equal.

2.02 Materials

- A. Aluminum Extrusions

- 1. Provide the aluminum alloy and temper (6063 T5) recommended by the window manufacturer for the strength, corrosion resistance, and application of required finish, but not less than 22,000 psi ultimate tensile strength, 16,000 psi yield strength, and not less than 0.062 inch thick at any location for the main frame and sash members.

- B. Fasteners

- 1. Provide non-magnetic stainless steel or aluminum fasteners that are compatible with aluminum window members, trim, hardware, anchors, and other components of the window units.

2. Reinforcement
 - a. Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads or provide standard non-corrosive pressed-in splined grommet nuts.
3. Exposed Fasteners
 - a. Except where unavoidable for application of hardware, do not use exposed fasteners.
 - b. For application of hardware, use fasteners that match the finish of the member or hardware being fastened, as appropriate.
- C. Frames and Sills
 1. Frames shall have a deep profile to meet the wind loading and impact resistance requirements.
 2. Sills shall be fabricated of extruded aluminum; sloped for positive wash; shall fit under the sash to ¼-inch beyond the wall face; and shall be one piece extending the full width of the opening.
- D. Anchors, Clips, and Window Accessories
 1. Fabricate anchors, clips, and window accessories of aluminum or non-magnetic stainless steel.
 2. Provide sufficient strength to withstand the design pressure and hurricane force winds indicated.
- E. Glass and Glazing Materials
 1. ***Glass in exterior windows shall have a deep, dark, colored tinting and emissivity coating*** to reduce the transmission of heat and UV energy into the buildings to which they are to be installed.
 2. The Contractor shall refer to Section 08800, "Glazing" for additional information.
- F. ***All windows shall be impact resistant and withstand hurricane force winds up to 150 mph without damage or failure.***

G. Compression-Type Glazing Strips and Weatherstripping

1. Unless otherwise indicated, and at the manufacturer's option, provide compressible stripping for glazing and weatherstripping such as molded EPDM or neoprene gaskets complying with AAMA SG-1 or with ASTM D-2000 Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D-2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C-509, Grade 4.

H. Sliding-Type Weatherstripping

1. Provide woven pile weatherstripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.2.

I. Sealants

1. For sealants required within fabricated window units, provide the type recommended by the manufacturer for joint size and movement.
2. The sealant shall remain permanently elastic, non-shrinking, and non-migrating.
3. Comply with Section 07900, "Joint Sealants" of these specifications for selection and installation of sealants.

J. Wire Fabric Insect Screen

1. Provide 18 by 18, 18 by 16, or 18 by 14 mesh of 0.013-inch diameter coated aluminum wire mesh, complying with FS RR-W-365, Type VII, where indicated.

2.03 Hardware

- A. Provide the manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.

B. Project Sash Arms

1. Cadmium plated steel, friction pivot joints with nylon bearings and removable pivot clips for cleaning.

- C. Sash lock shall be a lever handle with cam lock.

2.04 Accessories

- A. Provide the manufacturer's standard accessories that comply with indicated standards.
- B. Insect Screens - NOT USED
- C. Weatherstripping
 - 1. Provide sliding-type weatherstripping where sash rails slide horizontally or vertically along the unit frame. Provide compression-type weatherstripping at the perimeter of each operating sash where sliding type is not appropriate.
 - 2. ***Provide weatherstripping locked in to extruded grooves in the sash.***
- D. Window Grade and Class
 - 1. Provide window units that comply with requirements of AAMA Grade and Performance Class HC40, including vertical deflection test, hardware load test, and torsion test performance requirements specified in AAMA 101.

2.05 Horizontal Sliding Windows - NOT USED

2.06 Top-Hinged Windows - NOT USED

2.07 Fixed Windows

- A. Provide window units that comply with requirements of AAMA Grade and Performance Class HC40.

2.08 Fabrication

- A. General
 - 1. Fabricate aluminum window units to comply with the indicated standards. Include a complete system for assembly of components and anchorage of window units.

- a. Provide units that are re-glazable without dismantling sash or ventilator framing.
 - b. Prepare window sash or ventilators for glazing except where pre-glazing at the factory is indicated.
2. Fabricate components with minimum clearances and shim spacing around the perimeter of the assembly, yet enabling installation and dynamic movement of the perimeter seal.
3. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.
4. Prepare components to receive anchor devices. Fabricate anchors.
5. Arrange fasteners and attachments to ensure concealment from view.
6. Prepare components with internal reinforcement for operating hardware.
7. Provide internal reinforcement in mullions with **non-corrosive structural members** to maintain rigidity.
8. Permit internal drainage weep holes and channels to migrate moisture to the exterior. Provide internal drainage of glazing spaces to the exterior through weep holes.
9. Assemble insect screens of rolled aluminum rectangular screen sections. Miter and reinforce the frame corners. Fit mesh taught in frame into the frame and secure. Fit frame with four spring loaded steel pin retainers.
10. Double weatherstrip operable units.
11. Factory glaze window units.

B. Thermal-Break Construction

1. Fabricate window units with an integral concealed low conductance thermal barrier, located between exterior materials and window members exposed on the interior, in a manner that eliminates direct metal-to-metal contact.
2. **Provide thermal-break construction that has been in use for not less than three (3) years**, has been tested to demonstrate resistance to thermal conductance and condensation, and has been tested to show adequate strength and security of glass retention.

3. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
 4. Provide weepholes and internal passages to conduct infiltrating water to the exterior.
 5. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
 6. Provide subframes with anchors for window units, where shown, of profile and dimensions indicated but not less than 0.062-inch-thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units.
 7. Provide mullions and cover plates, matching window units, complete with anchors for support to the structure and installation of the window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, in the manner indicated.
 8. Provide screw-applied or snap-on glazing stops, coordinated with the glass selection and glazing system indicated. Finish glazing stops to match window units.
- C. Pre-glaze window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of Section 08800, "Glazing", of these specifications and AAMA 101.

2.09 Finishes

- A. Comply with the NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Coating
 1. AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

2. KYNAR-500 Fluoropolymer 2-Coat Coating System

- a. Manufacturer's standard 2-coat thermocured system, complying with AAMA 605.2, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than seventy percent (70%) polyvinylidene fluoride resin by weight.

3. ***The color shall be as selected by the Engineer and Owner from manufacturer's standard colors.***

D. Appearance of Finished Work

1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples.
2. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

3. EXECUTION

3.01 Inspection

- A. ***Inspect all openings before beginning installation.***
- B. Verify that rough or masonry opening is correct and the sill plate is level.
- C. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

3.02 Installation

- A. Install window frames, glass and glazing, operators and hardware, and all other components in accordance with the manufacturer's instructions and recommendations.
- B. Attach window frame and shims to the perimeter opening to accommodate construction tolerances and other irregularities.
- C. ***Set window units plumb, level, and true to line, without warp or rack of frames or sash.*** Maintain dimensional tolerances, aligning with adjacent work. Provide proper support and anchor securely in place.

- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with the requirements specified under the paragraph entitled "Dissimilar Materials" in the Appendix to AAMA 101.
- E. Set sill members and other members in a bed of compound or with joint fillers or gaskets, as shown, to provide weathertight construction. Refer to Section 07900, "Joint Sealants" for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the work.
- F. Install perimeter sealant by the method required to achieve the performance criteria.
- G. Tolerances
 - 1. The maximum variation from level or plumb shall not exceed 0.06 inches every three (3) feet, non-cumulative; or 0.5 inches per 100 feet; whichever is less.

3.03 Adjusting

- A. ***Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping.***
- B. ***Adjust operating hardware for smooth operation and a weathertight closure.***

3.04 Cleaning

- A. Clean glass promptly after installation of the windows and in accordance with the manufacturers recommendations.
- B. Remove any protective material from pre-finished aluminum surfaces.
- C. Clean aluminum surfaces promptly after installation of the windows. Use cleaning agents and materials recommended by the manufacturer. Exercise care to avoid damage to protective coatings and finishes.
- D. Remove excess glazing and sealant compounds, dirt and other substances. Lubricate hardware and other moving parts.
- E. Trademarks, nameplates or similar items shall not be visible nor attached to the installation.

3.05 Testing and Protection

- A. After completion of the installation, the window units shall be tested for water leaks.
- B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer.
- C. Ensure window systems are without damage or deterioration at the time of Final Project Acceptance by the Owner.

END OF SECTION

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SECTION 08710

FINISH HARDWARE

1. GENERAL

1.01 Description

- A. Furnish, deliver to the Project site and install all finish hardware required to complete the Work as indicated on the Contract Drawings and specified herein. Provide all trim attachments and fastenings specified or required for proper and complete installation.
- B. “*Finish Hardware*” includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and frame or the security hardware and electronic security equipment.
- C. Numerous doors to be installed shall have electronic strikes and access card readers. See Section 08000, “Door Schedule” and the Contract Drawings for details.
- D. The extent of the finish hardware is shown on the Contract Drawings and indicated in the enclosed schedules.
- E. The types of finish hardware include, but are not limited to, the following:
 - 1. Hinges, pivots
 - 2. Cylinders, keying, keys
 - 3. Locks, latches
 - 4. Surface and Flushbolts
 - 5. Thresholds
 - 6. Closers, Concealed, Overhead and Floor Types
 - 7. Sliding and Bi-folding Door Hardware
 - 8. Overhead Door Holders, Floor and Wall Stops
 - 9. Weatherstripping, Sound Seals, Light Seals
 - 10. Fire Exit Devices
 - 11. Push and Pull Units
 - 12. Protective Plates
 - 13. Astragals

1.02 Related Work Specified Elsewhere

- A. Related work specified elsewhere includes:

Specification Section	Title
07900	Joint Sealants
08120	Aluminum Doors and Frames
08210	Wood Doors
08330	Aluminum Overhead Coiling Doors
08410	Aluminum-Framed Storefront Door System
08800	Glass and Glazing
Division	Information
5	Miscellaneous Metals
Contract Drawings and General Provisions of the Contract	

1.03 References and Standards

- A. All work shall be executed and installed in accordance with the requirements of all applicable codes.
- B. The following publications, listed below, form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- C. Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

STANDARD	DESCRIPTION
Underwriters Laboratory (UL)	
UL 10B	Fire Test of Door Assemblies
UL 10C	Positive Pressure Test of Fire Door Assemblies
UL 1784	Air Leakage Tests of Door Assemblies
UL 305	Panic Hardware
Door and Hardware Institute (DHI)	
Sequence and Format for the Hardware Schedule	
Recommended Locations for Builders Hardware	
Key Systems and Nomenclature	

STANDARD	DESCRIPTION
American National Standards Institute (ANSI)	
ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31	Standards for Hardware and Specialties
Other Standards	
	Florida Building Code
	Uniform Building Code (Latest Edition)

1.04 Quality Assurance

A. Supplier Qualifications and Responsibilities

1. Recognized architectural hardware supplier with warehousing facilities, who has been furnishing finish hardware in the projects vicinity for a period of not less than five (5) years, with a record of successful in-service performance for supplying commercial door hardware similar in quantity, type, and quality to that indicated for this Project and that provides an experienced, certified and competent Architectural Hardware Consultant (AHC) who shall be available to the Owner, Architect, and Contractor, at reasonable times during the Work for consultation. The AHC shall approve the complete finish hardware design and installation in order that all items shall be installed in the best manner and function properly.
 - a. Warehousing Facilities: The supplier shall have an office and warehouse, including substantial inventory of the types of hardware specified, located within a 75 mile radius of the Project site.
 - b. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - c. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - d. Coordination Responsibility: Coordinate installation of electronic security hardware with the Engineer and provide installation and technical data to the Engineer and other related subcontractors.
 - 1) Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

B. Installer Qualifications

1. Qualified tradesmen, skilled in the application of commercial grade hardware with a record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

C. Architectural Hardware Consultation Qualifications

1. The architectural hardware consultant shall be experienced in providing consulting services for commercial door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 - b. Shall provide installation and technical data to the Engineer, Contractor and other related subcontractors.
 - c. Shall inspect and verify components are in working order upon completion of installation.
 - d. Shall be capable of producing wiring diagrams.
 - e. Shall be capable of coordinating the installation of electrified hardware and card reader systems with the Engineer, his subconsultants and the Owner.

D. Single Source Responsibility

1. Obtain each type of door hardware (hinges, locks & latches, closers, overhead holders, etc.) from a single manufacturer, although several may be indicated as offering products complying with the requirements.
2. Provide electrified door hardware from the same manufacturer as the mechanical door hardware, unless otherwise indicated.
3. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

E. Exterior Openings - Severe Windstorm Components Testing

1. Listed and labeled by a testing and inspecting agency acceptable to authority having jurisdiction, based on testing according to ANSI A250.13.
2. Compliance with Florida Building Codes for all exterior openings.

F. Fire Rated Door Openings

1. Provide hardware for fire rated openings in compliance with NFPA 80 and requirements of authorities having jurisdiction.
2. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories (UL), Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
3. Where the emergency exit devices are required on fire rated doors, provide a UL label on the exit device indicating **"FIRE EXIT HARDWARE"**.

G. Smoke- and Draft-Control Door Assemblies

1. Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
2. Air Leakage Rate: Maximum air leakage of 0.3 cfm/ft² at tested pressure differential of 0.3-inch wg of water.

H. Electrified Door Hardware

1. Electrified door hardware shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

I. Means of Egress Doors

1. Latches do not require more than 15 lb_f to release the latch. Locks do not require use of key, tool, or special knowledge for operation.

J. Accessibility Requirements

1. For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in Article 1.03(C), herein.
 - a. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lb_f.
 - b. Maximum opening-force requirements
 - 1) *Interior, Non-Fire-Rated Hinged Doors*: 5 lb_f applied perpendicular to door.

- 2) *Sliding or Folding Doors*: 5 lb_f applied parallel to door at latch.
- 3) *Fire Doors*: Minimum opening force allowable by authorities having jurisdiction.
- c. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than ½-inch high.
- d. Adjust door closer sweep periods so that, from open position of 70°, the door will take at least 3 seconds to move to 3-inches from the latch, measured to leading edge of door.

K. Keying Conference

- 1. Conduct a keying conference at the Project site to comply, at the appropriate time in the construction schedule, in accordance with the requirements of Division 1, "General Requirements".
- 2. Attendees: Engineer, Owner, Contractor, Installer, and Supplier's Architectural Hardware Consultant (AHC).
- 3. Incorporate keying conference decisions into the final keying schedule after reviewing the door hardware keying system including, but not limited to, the following:
 - a. Function of the building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for the key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.

L. Pre-installation Conference

- 1. Conduct a pre-installation conference at the Project site to comply, at the appropriate time in the construction schedule, in accordance with the requirements of Division 1, "General Requirements".
- 2. Review and finalize the construction schedule and verify the availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

3. Inspect and discuss preparatory work performed by other trades.
4. Inspect and discuss electrical roughing-in for electrified door hardware.
5. Review the sequence of operation for each type of electrified door hardware.
6. Review required testing, inspecting, and certifying procedures.

M. Coordination Conferences

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold an installation meeting to review questions or concerns related to proper installation and adjustment of all door hardware.
2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold a meeting to coordinate the door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 Submittals

A. General

1. Submit shop drawings and product data in accordance with Section 01300, "Shop Drawings, Submittals, and Samples", showing materials of construction and details for installation.
2. Highlight, encircle, or otherwise specifically identify on submittals any deviations from the Contract Documents, issues of incompatibility or other issues which may affect the Work.
3. Prior to forwarding the shop drawing submittal, comply with procedures for verifying existing door and frame compatibility for the new hardware, as specified in Article 3.02, herein.

B. Action Submittals

1. Product Data

- a. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

2. Samples for Verification

- a. If requested by the Engineer, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
- b. Samples will be returned to supplier in like-new condition. Units that are acceptable to the Engineer may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

3. Door Hardware Schedule

- a. Submit a final hardware schedule in accordance with the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute (DHI). Coordinate hardware with the doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware. Based on the finish hardware indicated, organize the hardware schedule into sets indicating complete designations of every item of hardware required for each door or opening. Include the following information:
 - 1) Door Index: Include the door number, heading number, and hardware set number.
 - 2) Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - 3) Type, style, function, size, quantity and finish of each hardware item.
 - 4) Name and manufacturer of each item, including catalog numbers and any other pertinent information.
 - 5) Fastenings and other pertinent information.
 - 6) Location of each hardware set, cross-referenced to the door number on the Contract Drawings and the hardware group in the specifications.
 - 7) Explanations of all abbreviations, symbols and codes contained in the schedule.
 - 8) Door and Frame sizes and materials.
 - 9) Mounting information, including location on door, degree of opening and coordination with other items.
 - 10) Name and phone number for the local manufacturer's representative for each product.

- 11) Operational description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). The operational description should include how each door will operate on egress, ingress, and fire and smoke alarm connection.
- 12) Submittal Sequence: Submit the door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of the door hardware schedule with scheduling requirements of other work to facilitate fabrication of the other work that is critical in Contractor's project construction schedule.

4. Riser and Wiring Diagrams

- a. After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - 1) Wiring Diagrams for power, signal, and control wiring including but not limited to, the following:
 - a) Details of interface of electrified door hardware and building safety and security systems.
 - b) Schematic diagram of systems that interface with electrified door hardware.
 - c) Point-to-point wiring.
 - d) Risers.
 - 2) Openings using electrically operated hardware will require a detailed, color coded, wiring diagram showing all components used in the opening. The hardware supplier will provide this diagram at the time of the hardware submittals. Factory installation instructions from the various elements will not be accepted as meeting this requirement. The diagram will include an elevation showing the location of various elements and power sources, a written description of the function of the opening and a custom diagram showing all runs and terminations for all the equipment used.

5. Key Schedule

- a. After the Keying Conference, provide a keying schedule to the Engineer listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.

- b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as a guideline for nomenclature, definitions, and approach for selecting the optimal keying system.
- c. Provide an electronic submittal and three (3) hard copies of the keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include a schematic keying diagram and index each key to the unique door designations.
- d. Index the keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward the bitting list, key cuts and key system schematic to the Engineer.
- f. The key schedule shall be prepared by or under supervision of supplier, detailing the Owner's final keying instructions for all locks and the card reading system.

6. Templates

- a. Submit templates for each fabricator of doors, frames and other related work to be factory prepared for the installation of hardware.
- b. Upon request, check shop drawings of other such work to confirm that adequate provisions are made for the proper location and installation of hardware.

C. Informational Submittals

- 1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
- 2. Product certificates for electrified door hardware, signed by manufacturer certifying that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- 3. Certificates of Compliance
 - a. Certificates of compliance for fire-rated hardware and installation instructions.
 - b. Installer Training Meeting Certification: Letter of compliance, signed by the Contractor, attesting to completion of the installer training meeting specified in Article 1.03 "Quality Assurance", herein.

- c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by the Contractor, attesting to completion of the electrified hardware coordination conference, specified in Article 1.03 "Quality Assurance".
- d. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by the manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- e. Warranty: In compliance with Article 1.09, "Warranty/Guarantee".

D. Closeout Submittals

- 1. Operations and Maintenance Data: Provide in accordance with Section 01730 "Operation and Maintenance Data including but not limited to, the following:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representatives for each manufacturer.
 - d. Parts list for each product.
 - e. Final approved hardware schedule edited to reflect conditions as installed.
 - f. Final keying schedule.
 - g. Copies of floor plans with keying nomenclature.
 - h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 - i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.06 Product Packaging, Handling, Delivery and Storage

A. Packaging and Marking

- 1. Package each item of hardware separately in individual containers, complete with fasteners, keys, special wrenches, instructions and installation templates necessary for accurately locating, setting, adjusting and attaching hardware.

2. All items of Finish Hardware shall be packaged, numbered, labeled to identify each opening for which it is intended and to correspond with the hardware item number on the approved Hardware Schedule.
3. At Project Completion, turn over to the Owner, installation instructions, installation tools (which are packaged with the hardware), templates and adjusting tools.

B. Delivery

1. Deliver approved hardware of proper design and finish in ample time to meet the Project construction schedule.
2. Each item of Finish Hardware shall be delivered to the Project site, or as otherwise specified or required, and shall be checked in for completeness and familiarization with the Contractor.

C. Storage

1. The Contractor, after receiving material at the Project site and checking the material against the delivery ticket(s) for accuracy shall:
 - a. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 - b. Provide a secure lock-up for the hardware delivered to the jobsite but not yet installed. Control handling and installation of hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation. Maintain a strict inventory of storage to assure that items are not lost or stolen.

D. Protection and Damage

1. The Contractor shall promptly replace hardware products damaged during shipping.
2. Handle hardware in a manner to avoid damage, marring, or scratching. Correct, replace or repair hardware products damaged during Work.
3. Protect hardware products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to the manufacturer of the key control system for subsequent delivery to Owner.

F. *Deliver keys and permanent cores*** to the Owner by registered mail, overnight package service or hand delivery with a signed receipt.**

1.07 Coordination

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into the concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3, "Concrete".
- B. Installation Templates: Distribute installation templates for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.
- F. Direct shipments are not permitted, unless approved by the Contractor.

1.08 Operation and Maintenance Manual

- A. O&M Manuals shall be furnished for this Project in accordance with Section 01730, "Operation and Maintenance Data" and shall be submitted in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. The O&M Manuals shall be prepared specifically for this installation and shall include all detailed operating instructions (normal startup and shutdown procedures, normal operating conditions and emergency situations), maintenance procedures and instructions and specifications relative to the assembly, alignment, checking, lubrication, placing in operation, adjustment, and maintenance of equipment and auxiliaries furnished under this Contract, together with its complete parts lists therefore, and copies of shop drawings, certified dimensions drawings and design calculations, required cut sheets, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment.
- C. All such material shall be in addition to any instructions or parts lists packaged with or attached to the equipment when delivered.

- D. ***The "final" O&M Manuals shall contain plastic laminated pull-out lubrication and maintenance cards*** detailing all lubrication points, lubricant type, and frequency of lubrications and all additional required maintenance and frequency intervals.
- E. ***In addition to standard O&M Manuals, all manufacturers supplying equipment and products specified herein shall also submit their operation and maintenance manuals and data to the SCADA System Integrator for this Project on CD/DVD/BD's in Corel WordPerfect (latest version), Microsoft Word (latest version), or text, ".txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats (integrators preference for the system shall be required). All O&M Manual files shall also be submitted electronically on CD/DVD/BD's to the Engineer in both PDF and JPEG formats, no exceptions.***
- F. ***The SCADA System Integrator shall be responsible to configure and compile the O&M Manuals into "hypertext" window help files for use as computer "on-line" help screens for equipment operation and maintenance. The SCADA System Integrator shall return all hypertext files to the equipment and product manufacturer's for review and approval prior to introducing them into the SCADA System at the treatment facility.***

1.09 Warranty/Guarantee

- A. The hardware supplier and Contractor shall provide, in writing, a guarantee that all materials furnished under this Section shall be free from defect and warrant workmanship ***for a period of three (3) years, with the exception of door closers, which shall carry a twenty-five (25) year warranty, from the date of Final Project Acceptance by the Owner*** as specified in Section 01740, "Warranties and Bonds".
- B. The equipment manufacturer shall guarantee that the equipment furnished is suitable for the purpose intended and free from defects of design, material and workmanship.
- C. In the event that any equipment fails to perform as specified herein, the equipment ***manufacturer shall promptly repair or replace the defective equipment at no additional cost to the Owner.***
- D. This warranty is in addition to any other warranty required by the Contract Documents.

1.10 Special Tools and Spare Parts

- A. Furnish one (1) complete set of all special tools required for normal operation, adjustment and maintenance of the door hardware, including changing of cylinders. They shall be properly packaged and labeled.

2. PRODUCTS

2.01 Manufacturers

- A. Approval of products from manufacturers indicated in "*Acceptable Manufacturers*" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- B. Hand of Door: The Contract Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having the same operation and quality as the type specified, subject to the Engineer and Owner's approval.

2.02 Materials

A. Fasteners

- 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
- 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match the hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
- 3. Provide concealed fasteners for hardware units exposed when the door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where the bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review the door specification and advise the Engineer if thru-bolts are required.
- 4. Install hardware with fasteners provided by the door hardware manufacturer.

2.03 Hinges

- A. Provide five-knuckle, ball bearing hinges.

B. Manufacturer's and Products

Manufacturer	Hinge Product
Scheduled Manufacturer	
Stanley	FBB Series
Acceptable Manufacturers	
Ives	5BB Series
McKinney	TA Series
Hager	BB Series

C. Hinge Requirements (Unless otherwise noted)

1. 1 $\frac{3}{4}$ -inch thick doors, up to and including 36 inches wide
 - a. Exterior: Standard weight, bronze or stainless steel, 4 $\frac{1}{2}$ -inch high.
 - b. Interior: Standard weight, steel, 4 $\frac{1}{2}$ -inch high.
2. 1 $\frac{3}{4}$ -inch thick doors over 36 inches wide
 - a. Exterior: Heavy weight, bronze/stainless steel, 5-inch high.
 - b. Interior: Heavy weight, steel, 5-inch high.
3. 2-inch or thicker doors
 - a. Exterior: Heavy weight, bronze or stainless steel, 5-inch high.
 - b. Interior: Heavy weight, steel, 5-inch high.
4. Provide three (3) hinges per door leaf for doors 90 inches or less in height, and one (1) additional hinge for each 30 inches of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins.
 - b. Non-Ferrous Hinges: Stainless steel pins.
 - c. Out-Swinging Exterior Doors: Non-removable pins.

- d. Out-Swinging Interior Lockable Doors: Non-removable pins.
 - e. Interior Non-lockable Doors: Non-rising pins.
7. Width of hinges: 4½-inches at 1¾-inch thick doors, and 5-inches at 2-inches or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
 8. For doors 36-inches wide or less, furnish hinges 4½-inches high. For doors greater than 36-inches wide, furnish hinges 5-inches high, heavy weight or standard weight as specified.
 9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate the electric function of specified hardware. Locate the electric hinge at the second hinge from the bottom or nearest to electrified locking component.
 10. Provide mortar guard for each electrified hinge specified, unless specified in hollow metal frame specification.
 11. Provide exterior hinges with additional corrosion resistant coating.

2.04 Mortise Locks - Grade 1, Heavy Duty

A. Manufacturer's and Products

Manufacturer	Mortise Lock Product
Scheduled Manufacturer	
Best	45H Heavy Duty Mortise
Acceptable Manufacturers	
Dorma	M9000 Series
Sargent	8200 Series

B. Mortise Type Lock and Latch Requirements

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Heavy Duty, Security Grade 2 and be UL10C.
2. Fit ANSI A115.1 door preparation.
3. 2¾-inch backset.

4. Solid, one-piece, $\frac{3}{4}$ -inch throw, anti-friction latchbolt made of self-lubricating stainless steel.
5. Deadbolt functions shall have 1-inch throw bolt made of hardened stainless steel.
6. Auxiliary deadlatch to be made of one-piece stainless steel, permanently lubricated.
7. Provide sufficient curved strike lip to protect door trim.
8. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable.
9. Lock shall have self-aligning, thru-bolted trim.
10. Mortise cylinders of the lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
11. Provide locksets with 7-pin removable and interchangeable core cylinders.
12. The core face must be the same finish as the lockset.
13. Functions as indicated in the hardware groups.
14. Lever Design: "14" Lever, "H" Rose

2.05 Cylindrical Locks - Grade 1, Heavy Duty

A. Manufacturer's and Products

Manufacturer	Cylindrical Lock Product
Scheduled Manufacturer	
Best	9K Series
Acceptable Manufacturers	
Dorma	C800 Series
Sargent	10 Line

B. Cylindrical Type Lock and Latch Requirements

1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed.
2. Fit modified ANSI A115.2 door preparation.
3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty.
4. Locksets to have anti-rotational studs that are thru-bolted.
5. Keyed lever shall not have an exposed "keeper" hole.
6. Each lever shall have an independent spring mechanism controlling it.
7. 2³/₄-inch backset.
8. ⁹/₁₆-inch throw latchbolt.
9. Provide sufficient curved strike lip to protect the door trim.
10. Outside lever sleeve shall be seamless, of one-piece construction made of a hardened steel alloy.
11. Keyed lever to be removable only after core is removed, by authorized control key.
12. Provide locksets with 7-pin removable and interchangeable core cylinders.
13. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
14. Locksets outside locked lever must withstand minimum 1400-inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
15. Core face must be the same finish as the lockset.
16. Functions as indicated in the hardware groups.
17. Lever Design: "14" Lever, "D" Rose

2.06 Exit Devices - Heavy Duty

A. Manufacturer's and Products

Manufacturer	Exit Device Product
Scheduled Manufacturer	
Precision	Apex 2000 Series
Acceptable Manufacturers	
Dorma	9000 Series
Von Duprin	98/35A Series

B. Exit Device Requirements

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Refer to Article 2.08, "Keying", herein.
2. Exit Devices: Touchpad type, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match the balance of door hardware.
3. Touchpad: Extend a minimum of one half of the door width. Match exit device finish or provide compatible finish.
4. Provide devices with a dead-latching feature for security and for future addition of alarm kits and other electrical requirements.
5. Provide the manufacturer's standard strikes.
6. Provide exit devices cut to the door width and height. Locate exit devices at the height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Engineer.
7. Mount mechanism case flush on the face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
8. Provide cylinder dogging at non-fire-rated exit devices.
9. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers. Match the lever style of the locksets.

10. Provide UL labeled fire exit hardware for fire rated openings.
11. Field drill weep holes per the manufacturer's recommendation for exit devices used in full exterior application, highly corrosive areas, and where noted in the hardware sets.
12. Motorized latch retraction (MLR) to provide momentary and continuous remote latch retraction. MLR requires 24V @ 1 amp, holding current 250mA. UL listed for both panic and fire, shall be tested in compliance with UL 305, UL 10C and ANSI/BHMA 156.3, Grade 1.
13. Provide additional electrified options as scheduled in the hardware sets.

2.07 Cylinders

A. Manufacturer's and Products

Manufacturer	Cylinder Product
Scheduled Manufacturer	
Best	Cormax
Acceptable Manufacturers	
Dorma	---
Sargent	---

- B. Cylinders/cores shall be provided that are compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated.
- C. Full-sized cylinders with small format interchangeable cores (SFIC), in the below-listed configuration(s), distributed throughout the Project as indicated.
 1. Keying: Manufacturer-keyed permanent cylinders/cores, configured into keying system per Article 2.08, "Keying", herein.
 2. Features: Cylinders/cores shall incorporate the following features.
- D. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.

- E. Identification stamping provisions must be approved by the Engineer and Owner.
- F. Failure to comply with stamping requirements shall be cause for replacement of cylinders/cores involved at ***no additional cost to Owner***.
- G. Forward cylinders/cores to the Owner, separately from the keys, by means as directed by the Engineer and Owner.
- H. Project Cylinder/Core Distribution: Provide cylinders/cores complying with the following requirements in Project locations as indicated.
 - 1. Replaceable Construction Cores: Provide temporary construction cores replaceable by permanent cores. Provide 12 operating keys for contractor use during construction.
 - 2. Permanent Keyed Cores: Contractor to replace construction cores with permanent cores as directed by Owner. Installation will be in presence of owner representative, indicating keys operate locking hardware and to turn over all permanent keys.

2.08 Keying

- A. The keying system shall be factory registered, complying with the guidelines in ANSI/BHMA A156.28, incorporating decisions made at the project keying conference.
- B. Permanent cylinders/cores shall be keyed by the manufacturer according to the following key system requirements.
- C. Provide keys with patent protection such that the keys and blanks are protected by a special broching in the restricted keyway.
- D. Keys
 - 1. Material: Nickel silver; minimum thickness of 0.107-inch (2.3mm).
 - 2. Identification: Stamp all keys with keyset symbol.
 - 3. Quantity of keys
 - a. Provide (2) operating keys per keyed core.
 - b. Provide (6) Master Keys.
 - c. Provide (2) Control Keys.
- E. Coordinate with the cylinder/core and key identification requirements above.

- F. Stamp keys with the Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
- G. Failure to comply with stamping requirements shall be cause for replacement of keys involved **at no additional cost to Owner**.

2.09 Door Closers - Medium Duty

A. Manufacturer's and Products

Manufacturer	Door Closer Product
Scheduled Manufacturer	
Best	HD7000 Series
Acceptable Manufacturers	
Dorma	8600 Series
LCN	1460 Series
Norton	8501 Series
Sargent	1430 Series

B. Rack and Pinion Aluminum Surface Closers

1. Provide Full Rack and Pinion type closers constructed of R14 High Silicon Aluminum Alloy, or equal, to exceed the ANSI/BHMA A156.4 Grade 1 requirements.
2. Provide closers that are tested and approved for UL10C for positive pressure; UL228 & CAN/ULC-S133.
3. Provide closers that conform to ANSI/ICC A117.1 and ADA requirements for barrier-free accessibility.
4. The Closer shall be available with heavy-duty arms and knuckles/elbows.
5. The Closer shall have maximum 2 $\frac{1}{8}$ -inch case projection with a non-ferrous cover. The Closer cover to be of the plastic type and painted.
6. Provide closers with all-weather hydraulic fluid.
7. Provide closers with separate adjusting valves for closing and latching speeds, as well as advanced backcheck and delayed action.

8. Provide closers with delayed action and/or advanced backcheck where noted in hardware sets.
9. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions.
10. Mount closers on non-public side of door and stair side of stair doors, unless otherwise noted in hardware sets.
11. Closers shall be non-handed and multi-sized as noted in hardware sets. Provide closers fully adjustable to Sizes 1 through 6 to meet the barrier-free ADA requirements.

2.10 Protection Plates

A. Manufacturer's and Products

Manufacturers			
Scheduled Manufacturer			
Trimco		---	
Acceptable Manufacturers			
Burns	Don-Jo	Ives	Rockwood

- B. Provide kick plates, mop plates, and armor plates with a minimum thickness of 1/8-inch, as scheduled. Furnish with sheet metal or wood screws, finished to match the plates.
- C. Kick plates shall be 10-inches high by 2-inches less the width of door on single doors, 1-inch less the width of door on pairs.

2.11 Overhead Stops and Overhead Stop/Holders

A. Manufacturer's and Products

Manufacturers		
Scheduled Manufacturer		
ABH	---	
Acceptable Manufacturers		
Glynn-Johnson	Rixson	Sargent

- B. Provide a heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
- C. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
- D. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140° before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
- E. Where overhead holders are specified provide the friction type at doors without closer and positive type at doors with closer.

2.12 Door Stops and Holders

A. Manufacturer's and Products

Manufacturer	
Scheduled Manufacturer	
Trimco	---
Acceptable Manufacturers	
Burns	Ives
Don-Jo	Rockwood

- B. Provide door stops at each door leaf:
 - 1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
 - 2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
 - 3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.13 Thresholds, Seals, Door Sweeps, Automatic Door Bottoms and Gasketing

A. Manufacturer's and Products

Manufacturer		
Scheduled Manufacturer		
National Guard	---	
Acceptable Manufacturers		
Pemko	Reese	Zero International

- B. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per the architectural details. Match the finish of other items.

C. Size of Thresholds

- Saddle Thresholds: ½-inch high by jamb width by door width.
 - Bumper Seal Thresholds: ½-inch high by 5-inches wide by door width.
- D. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.14 Silencers

A. Manufacturer's and Products

Manufacturer			
Scheduled Manufacturer			
Trimco	---		
Acceptable Manufacturers			
Burns	Don-Jo	Ives	Rockwood

- B. Provide "push-in" type silencers for hollow metal or wood frames.
- C. Provide one silencer per 30-inches of height on each single frame, and two for each pair frame.

- D. Omit where gasketing is specified.

2.15 Finish

- A. Designations used in Article 3.07, "Door Hardware Schedule", and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products.
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Gasketing to coordinate with frame color.

3. EXECUTION

3.01 Deliveries

- A. Stockpile all items sufficiently in advance to ensure their availability, and make all necessary deliveries in a timely manner to ensure orderly progress of the total work.
- B. Store and handle all materials in accordance with Article 1.05 of this Specification Section.

3.02 Examination

- A. Prior to installation of door hardware, examine all doors and frames, with the Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that the new hardware is compatible with the door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 Preparation

- A. Where on-site modification of doors and frames is required:
1. Carefully remove the existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 2. Field modify and prepare the door and frame for the new hardware being installed.
 3. When modifications are exposed to view, use concealed fasteners, when possible.
 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors".
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.04 Installation

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Whenever cutting or fitting is required to install hardware on or into surfaces which are later to be painted, or finished another way; coordinate removal, storage and the re-installation of hardware with the finishing work specified in Division 9, "Finishes". Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges
 - 1. Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30-inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period. Replace construction cores with permanent cores as indicated in keying section.
- I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by the Engineer and Owner.
- J. Thresholds: Set thresholds in a full bed of sealant complying with requirements specified in Section 07900, "Joint Sealants".
- K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- L. Perimeter Gasketing: Apply to perimeter gasketing to the head and jamb, forming a seal between the door and frame.
- M. Meeting Stile Gasketing: Fasten to meeting stiles, forming a seal when doors are closed.
- N. Door Bottoms: Apply to the bottom of the door, forming a seal with the threshold when the door is closed.
- O. Install electronic strikes and card reader systems in the locations indicated and in accordance with the manufacturers instructions and recommendation
- P. ***A representative of the hardware supplier, prior to the Final Inspection and Substantial Completion of the Project, shall check all locks with the Engineer and Owner's representative, for proper location, operation, and keying.***

- Q. Instruct the Owner's personnel in the proper adjustment and maintenance of the hardware and finishes during the final adjustment of the hardware.

3.05 Adjusting

A. Initial Adjustment

1. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - a. Spring Hinges: Adjust to achieve positive latching when the door is allowed to close freely from an open position of 30°.
 - b. Electric Strikes: Adjust the horizontal and vertical alignment of keeper to properly engage lock bolt.
 - c. Door Closers: Adjust the sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment

1. Approximately three (3) months after date of Substantial Completion, the Installer's Architectural Hardware Consultant (AHC) shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.06 Cleaning and Protection

- A. Clean adjacent surfaces soiled by the door hardware installation.
- B. Clean operating items, as necessary, to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure the door hardware is without damage or deterioration at time of Substantial Completion.
- D. Provide training of the Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.07 Door Hardware Schedule

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function.
 - 1. Refer to the above specification articles for special features, options, cylinders/keying, and other requirements.
- B. Furnish the following hardware groups in the amounts indicated on the Contract Drawings required for a complete and proper installation.
- C. This Project may contain doors that are oversized, have non-standard thicknesses or applied trims.
 - 1. See the Contract Drawings and door schedules for hinge widths and clearance requirements, or if not identified, follow industry standards.
- D. Doors with glass lites and/or applied mouldings will require spacers to allow fire exit device installation.
- E. Through-bolts are to be used only where specifically indicated. No bolts, heads or retainers are to show through door surface from applied hardware. All wood, hollow metal or specialty doors are to be reinforced to allow for drilling and tapping of metal reinforcement or hardwood blocking to hold wood screws.
- F. Manufacturer List

Code	Name
AB	ABH Manufacturing, Inc.
BE	Best Access Systems
BY	By Others
IV	Ives
NA	National Guard
PR	Precision
ST	Stanley
TR	Trimco

G. Finish List

Code	Description
AL	Aluminum
26D	Satin Chrome
626	Satin Chrome Plated
630	Satin Stainless Steel
689	Aluminum Painted
626W	Weatherized Satin Chrome
630W	Weatherized Stainless Steel
GREY	Grey
US26D	Chromium Plated, Dull
US32D	Stainless Steel, Dull

H. Option List

Code	Description
HC	Hurricane Code Device
S1	ANSI - Deadbolt Strike
S3	ANSI Strike Package
3RO	Prefix Option for 2000 Apex Series
CSK	Counter Sinking of Kick Plates
SPC	Sprayed Cover - Painted Only
VIB	Double Visual Indicator Option
S300	Standard Strike - Rim and Top of SVR Devices
S460	Standard Bottom Strike - SVR & CVR
S519	Standard Top Strike - CVR
SN134	1¾-inch Door SN134 Screw Pack
END CAPS	Set of End Caps
SSMS/LA	Stainless Machine Screws/Lead Anchor

I. Hardware Set No. 01

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 203

b. 208

c. 209

HARDWARE SET No. 01: INTERIOR - SINGLE - OFFICE					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB179 4½ x 4½	US26D	ST
1	each	Lock Set	9K3-7AB14D PATD S3	626	BE
1	each	Wall Stop	1270WV	630	TR
1	each	Wardrobe Hook	582 B	26D	IV
3	each	Door Silencers	1229 A	GREY	TR

J. Hardware Set No. 02

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 102

b. 103

c. 108

d. 207

HARDWARE SET No. 02: INTERIOR - SINGLE - RESTROOM					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB179 4½ x 4½	US26D	ST
1	each	Privacy Set	45H-0LT14H S1 VIB	626	BE
1	each	Closer	HD7016 ARP SN134 SPC	689	BE
1	each	Kick Plate	KO050 10" x 2" LDW CSK	630	TR
1	each	Wall Stop	1270WV	630	TR
1	each	Wardrobe Hook	582 B	26D	IV
3	each	Door Silencers	1229A	GREY	TR

K. Hardware Set No. 03

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

- a. 109 b. 203A c. 206

HARDWARE SET No. 03: INTERIOR - SINGLE - STORAGE					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB179 4½ x 4½	US26D	ST
1	each	Lockset	9K3-7D14D PATD S3	626	BE
1	each	Wall Stop	1270WV	630	TR
3	each	Door Silencers	1229A	GREY	TR

NOTE: Provide Floor Stop W1211 on Door 206

L. Hardware Set No. 04

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

- a. 204

HARDWARE SET No. 04: INTERIOR - SINGLE - MECHANICAL/ELECTRICAL					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB179 4½ x 4½	US26D	ST
1	each	Lockset	9K3-7D14D PATD S3	626	BE
1	each	Closer	HD7016 DS SN134 SPC	689	BE
3	each	Door Silencers	1229A	GREY	TR

M. Hardware Set No. 05

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 107

HARDWARE SET No. 05: INTERIOR - SINGLE - MECHANICAL/ELECTRICAL					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB179 4½ x 4½	US26D	ST
1	each	Lockset	9K3-7D14D PATD S3	626	BE
1	each	Closer	HD7016 DS SN134 SPC	689	BE
3	each	Door Silencers	1229A	GREY	TR

N. Hardware Set No. 06

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 205

HARDWARE SET No. 06: INTERIOR - SINGLE - IT CLOSET					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB179 4½ x 4½	US26D	ST
1	each	Lockset	9K3-7D14D PATD S3	626	BE
1	each	Closer	HD7016 ARP SN134 SPC	689	BE
1	each	Wall Stop	1270WV	630	TR
1	each	Gasketing	5050 B (Head and Jamb)	---	NA

O. Hardware Set No. 07

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 106A

HARDWARE SET No. 07: INTERIOR - SINGLE - STAIRWELL (ALUMINUM)					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB168 4½ x 4½	US26D	ST
1	each	Exit Device	3RO 2114 X 4914D S300	630	PR
1	each	Closer	HD7016 ARP SN134 SPC	689	BE
1	each	Kick Plate	KO050 10" x 2" LDW CSK	630	TR
1	each	Wall Stop	1270WV	630	TR
1	each	Gasketing	5050 B (Head and Jamb)	---	NA

P. Hardware Set No. 07.1

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 201

HARDWARE SET No. 07.1: INTERIOR - SINGLE - STAIRWELL (ALUMINUM) - CR					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB168 4½ x 4½	US26D	ST
1	each	Exit Device	3RO FL E2103 X 4908D FS S300	630	PR
1	each	Closer	HD7016 ARP SN134 SPC	689	BE
1	each	Power Transfer	PT1000	US28	AB
1	each	Power Supply	PS161-6	---	PR
1	each	Kick Plate	KO050 10" x 2" LDW CSK	630	TR
1	each	Wall Stop	1270WV	630	TR
1	each	Gasketing	5050 B (Head and Jamb)	---	NA
1	each	Card Reader	By Owners Security Vendor	---	BY

Q. Hardware Set No. 08

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 110

HARDWARE SET No. 08: INTERIOR - SINGLE - OPS CENTER					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB179 4½ x 4½	US26D	ST
1	each	Lockset	9K3-7R14D PATD S3	626	BE
1	each	Closer	HD7016 ARP SN134 SPC	689	BE
1	each	Kick Plate	KO050 10" x 2" LDW CSK	630	TR
1	each	Wall Stop	1270WV	630	TR
1	each	Gasketing	5050 B (Head and Jamb)	---	NA

R. Hardware Set No. 09

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 101A

HARDWARE SET No. 09: INTERIOR - SINGLE - MEETING/BREAKROOM					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB179 4½ x 4½	US26D	ST
1	each	Lockset	9K3-7R14D PATD S3	626	BE
1	each	Closer	HD7016 SPA SN134 SPC	689	BE
1	each	Kick Plate	KO050 10" x 2" LDW CSK	630	TR
1	each	Floor Stop	W1211	630	TR
1	each	Gasketing	5050 B (Head and Jamb)	---	NA

S. Hardware Set No. 10

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 111

HARDWARE SET No. 10: INTERIOR - SINGLE - PUMP ROOM (ALUMINUM)					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB199 4½ x 4½ NRP	630W	ST
1	each	Lockset	9K3-7R14D PATD S3	626	BE
1	each	Closer	HD7016 DS SN134 SPC	689	BE
1	each	Kick Plate	KO050 10" x 2" LDW CSK	630	TR
1	each	Gasketing	700 EN (Head and Jamb)	---	NA
1	each	Auto Door Bottom	220 SDKB 36" END CAPS	---	NA
1	each	Saddle Threshold	425 SSMS/LA	AL	NA

T. Hardware Set No. 11

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building:

a. 112B

HARDWARE SET No. 11: INTERIOR - SINGLE - ELECTRICAL ROOM (ALUMINUM)					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB199 4½ x 4½ NRP	630W	ST
1	each	Exit Device	3RO 2108 X 4908D S300	626W	PR
1	each	Rim Cylinder	12E-72 PATD	626	BE
1	each	Closer	HD7016 SDS SN134 SPC	689	BE
1	each	Gasketing	700 EN (Head and Jamb)	---	NA
1	each	Auto Door Bottom	220 SDKB 36" END CAPS	---	NA
1	each	Saddle Threshold	425 SSMS/LA	AL	NA

U. Hardware Set No. 12

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building: (a) 104; (b) 106.

HARDWARE SET No. 12: EXTERIOR - SINGLE - EXIT (ALUMINUM) - CR					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB199 4½ x 4½ NRP	630W	ST
1	each	Exit Device	3RO HC MLR 2103 X 1703A S300	630	PR
1	each	Rim Cylinder	12E-72 PATD	626	BE
1	each	Closer	HD7016 SDS SN134 SPC	689	BE
1	each	Power Transfer	PT1000	US28	AB
1	each	Power Supply	RPSMLR2BB	---	PR
1	each	Drip Cap	16 A 4"ODW	---	NA
1	each	Gasketing	700 EN (Head and Jamb)	---	NA
1	each	Threshold	896 N SSMS/LA	AL	NA
1	each	Card Reader	By Owner's Security Vendor	---	BY

NOTE: Hardware components are subject to approval for hurricane compliance by authority having jurisdiction

V. Hardware Set No. 13

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building: (a) 113; (b) 114.

HARDWARE SET No. 13: EXTERIOR - SINGLE - EXIT (ALUMINUM)					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB199 4½ x 4½ NRP	630W	ST
1	each	Exit Device	3RO HC 2103 X 1703A S300	630	PR
1	each	Rim Cylinder	12E-72 PATD	626	BE
1	each	Closer	HD7016 SDS SN134 SPC	689	BE
1	each	Drip Cap	16 A 4"ODW	---	NA
1	each	Gasketing	700 EN (Head and Jamb)	---	NA
1	each	Threshold	896 N SSMS/LA	AL	NA

NOTE: Hardware components are subject to approval for hurricane compliance by authority having jurisdiction

W. Hardware Set No. 13.1

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building: (a) 111A (b) 112A

HARDWARE SET No. 13.1: EXTERIOR - SINGLE - EXIT (ALUMINUM) - CR					
Quantity	Units	Item	Designation	Finish	Manufacturer
3	each	Hinges	CB199 4½ x 4½ NRP	630W	ST
1	each	Exit Device	3RO HC MLR 2103 X 1703A S300	630	PR
1	each	Rim Cylinder	12E-72 PATD	626	BE
1	each	Closer	HD7016 SDS SN134 SPC	689	BE
1	each	Power Transfer	PT1000	US28	AB
1	each	Power Supply	RPSMLR2BB	---	PR
1	each	Drip Cap	16 A 4"ODW	---	NA
1	each	Gasketing	700 EN (Head and Jamb)	---	NA
1	each	Threshold	896 N SSMS/LA	AL	NA
1	ea	Card Reader	By Owner's Security Vendor	---	BY

NOTE: Hardware components are subject to approval for hurricane compliance by authority having jurisdiction

X. Hardware Set No. 14

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building: (a) 112

HARDWARE SET No. 14: EXTERIOR - PAIR - ELECTRICAL ROOM (ALUMINUM) - CR					
Quantity	Units	Item	Designation	Finish	Manufacturer
8	each	Hinges	CB199 4½ x 4½ NRP	630W	ST
1	each	Exit Device	3RO HC 2801 S460 S519	626W	PR
1	each	Exit Device	3RO HC MLR 2803 X C1703A S460 S519	626W	PR
1	each	Rim Cylinder	12E-72 PATD	626	BE
1	each	Closer	HD7016 SDS SN134 SPC	689	BE
1	each	Power Transfer	PT1000	US28	AB
1	each	Power Supply	RPSMLR2BB	---	PR
1	each	Overhead Stop	1023	US32D	AB
1	each	Drip Cap	16 A 4"ODW	---	NA

HARDWARE SET No. 14: EXTERIOR - PAIR - ELECTRICAL ROOM (ALUMINUM) - CR					
Quantity	Units	Item	Designation	Finish	Manufacturer
1	each	Astragal Set (Brush)	672 A (Set)	---	NA
1	each	Gasketing	700 EN (Head and Jamb)	---	NA
1	each	Threshold	896 N SSMS/LA	AL	NA
1	each	Card Reader	By Owner's Security Vendor	---	BY

NOTE: Hardware components are subject to approval for hurricane compliance by authority having jurisdiction

Y. Hardware Set No. 15

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building: (a) 111B

HARDWARE SET No. 15: EXTERIOR OVERHEAD COILING DOOR					
Quantity	Units	Item	Designation	Finish	Manufacturer
1	each	Cylinder	As Required	626	BE
1	set	Hardware	Remainder of Hardware by Overhead Door Supplier	---	BY

Z. Hardware Set No. 16

The following door hardware shall be installed on the following doors in the new Main WTP Operations Building: (a) 101

HARDWARE SET No. 16: EXTERIOR - SINGLE - RECEPTION (ALUMINUM) - CR					
Quantity	Units	Item	Designation	Finish	Manufacturer
1	each	Cylinder	As Required	626	BE
1	each	Card Reader	By Owner's Security Vendor	---	BY
1	set	Hardware	Remainder of Hardware by Aluminum-Framed Storefront Supplier	---	BY

NOTE: Aluminum Doors. All hardware provided by door supplier except cylinder as noted above. Tested assembly to comply with project wind load requirements. Weatherstrip by Aluminum Door Supplier. Verify Owner's requirements for Access Control.

END OF SECTION

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SECTION 08800

GLASS AND GLAZING

1. GENERAL

1.01 Description of the Work

- A. Furnish all labor, materials and equipment for the complete installation of the glass and glazing work as indicated on the Contract Drawings and as specified herein.
- B. Glass includes prime glass, processed glass and fabricated glass products. Glazing includes glass installation and materials used to install glass. This Section includes glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Window units.
 - 2. Vision lites.
 - 3. Glazed curtain walls.
 - 4. Entrances and other doors.
- C. All interior and exterior glass and glazing systems shall be designed to withstand wind and pressure loadings (internal and external) from ***hurricane force winds up to 150 mph. All interior and exterior windows shall have new, "impact resistant glazing" (large missile).***
- D. ***All exterior windows shall be fabricated with a deep, dark, colored tinting*** to reduce the transmission of heat and UV energy into the buildings to which they are to be installed.
- E. Related Work Specified Elsewhere
 - 1. Related work specified elsewhere includes:

Specification Section	Title
08120	Aluminum Doors and Frames
08410	Aluminum-Framed Storefront Door System
08520	Aluminum Windows
Contract Drawings and General Provisions of the Contract	

1.02 Definitions

- A. The term “*manufacturer*” is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.
- B. Deterioration of Coated Glass
 - 1. Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's directions.
 - 2. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- C. Deterioration of Insulated Glass
 - 1. Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass.
 - 2. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.
- D. Deterioration of Laminated Glass
 - 1. Defects developed from normal use that are attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's directions.
 - 2. Defects include edge separation, delamination materially obstructing vision through the glass, and blemishes exceeding those allowed by referenced laminated glass standards.

1.03 System Performance Requirements

- A. Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (exterior windows), without failure including loss or glass breakage attributable to defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.
- B. All exterior windows shall be fabricated with a ***deep, dark, colored tinting*** to reduce the transmission of heat and UV energy into the buildings to which they are to be installed.

C. Cyclical Wind Pressure Loading

1. All glazing assemblies used in this Project are required to have been successfully tested under Protocol PA 203-94, as required by Section 2314.5 of the Florida Building Code.

D. Impact Resistance

1. All glazing assemblies are required to have been successfully tested under Protocol PA 201-94, as required by Section 2315 of the Florida Building Code.

E. The design wind load criteria to determine impact resistance, and cyclic wind pressure loading adequacy shall be as follows:

1. ***Design wind speed is to be 150 mph.***
2. Assemblies are to be capable of withstanding pressures calculated in accordance with the procedures of ASCE 7-88 using the Florida Building Code's Importance Factor, and Exposure Category.

F. Testing Facilities shall be as described in protocol PA 301-94.

G. Thermal movement

1. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculations on the materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.
2. Temperature Change (Range)
 - a. 120°F (67°C), ambient.
 - b. 180°F (100°C), material surfaces.

H. Glass Design

1. The manufacturer shall determine the required glass thicknesses by analyzing the required Project loads (interior and exterior) and in-service conditions.
2. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
 - a. The minimum glass thickness, nominally, of lites in exterior walls shall be 6.0 mm (0.23-inch).

- b. Tinted and heat-absorbing glass thicknesses for each tint indicated are the same throughout Project.
- c. The minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
 - 1) 8 lites per 1,000 for lites set vertically or not over 15° off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E1300. For other than monolithic annealed glass, determine the thickness per the glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E1300 based on the type of glass.
 - 2) 1 lite per 1,000 for lites set over 15° off vertical and under action of wind or snow.

1.04 Quality Assurance

- A. Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated.
- B. Comply with and perform all work in accordance with GANA (GM), GANA (SM), GANA (LGRM), IGMA TM-3000 for glazing installation methods and the recommendations of the Glass Association of North America Flat Glass Marketing Association (FGMA) Glazing Manual and Sealant Manual and the Consumer Product Safety Commission's (CPSC) 16 CFR, Part 1201, "Safety Standard for Architectural Glazing Materials", except where stringent requirements of glass and glazing terms not otherwise defined in this Section or other referenced standards.
- C. To ensure quality of appearance and performance, **provide materials produced by a single manufacturer/fabricator** for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.
- D. **Engage a single firm, to assume the undivided responsibility** for the glazing task, which can demonstrate not less than five (5) years of successful experience in glazing work similar to the scope and complexity of the work required for this project.
- E. Unless otherwise indicated, all materials, workmanship and practices shall conform to the latest revision of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

STANDARD	DESCRIPTION
Flat Glass Manufacturers Association (FGMA)	
	FGMA Glazing Manual
	Glazing Sealing Systems Manual
American Architectural Manufacturers Association (AAMA)	
	AAMA TIR-A7 "Sloped Glazing Guidelines" and "Glass Design for Sloped Glazing".
Laminators Safety Glass Association (LSGA)	
	LSGA Design Guide
SIGMA Publications	
	TM-3000 "Vertical Glazing Guidelines" and TB-3001 "Sloped Glazing Guidelines."
Consumer Products Safety Commission (CPSC)	
	16 CFR, Part 1201, "Safety Standard for Architectural Glazing Materials"
American Society for Testing and Materials (ASTM)	
ASTM C542	Standard Specification for Lock-Strip Gaskets
ASTM C716	Standard Specification for Installing Lock-Strip Gaskets and Infill Glazing Materials
ASTM C864	Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1036	Standard Specification for Flat Glass
ASTM C1048	Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM C1115	Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories
ASTM C1172	Standard Specification for Laminated Architectural Flat Glass
ASTM C1193	Standard Guide for Use of Joint Sealants
ASTM C1376	Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E774	Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units
ASTM E1300	Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation
National Fire Protection Association (NFPA)	
NFPA 252	Standard Methods of Fire Tests of Door Assemblies
NFPA 257	Standard on Fire Test for Window and Glass Block Assemblies

STANDARD	DESCRIPTION
National Fenestration Rating Council (NFRC)	
NFRC 100	Procedure for Determining Fenestration Product U-factors
NFRC 200	Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
NFRC 300	Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems
Underwriters Laboratory (UL)	
UL 9	Standard for Fire Tests of Window Assemblies
UL 10B	Standard for Fire Tests of Door Assemblies
UL 10C	Standard for Positive Pressure Fire Tests of Door Assemblies
UL 263	Standard for Fire Tests of Building Construction and Materials
UL 972	Standard for Burglary Resisting Glazing Material; Current Edition
Glass Association of North America (GANA)	
GANA (GM)	GANA Glazing Manual
GANA (SM)	GANA Sealant Manual
GANA (LGRM)	GANA - Laminated Glazing Reference Manual
Federal Specifications	
DD-G-451	General Glass Standard
DD-G-1403B	Tempered Glass Standard
TT-S-00230C	Sealing Compound, Elastomeric Type, Single Component
American National Standards Institute (ANSI)	
ANSI Z97.1	Glazing Materials Used in Bldgs, Safety Performance Specifications & Methods of Test
Other Standards and Codes	
	Florida Building Code (FBC)
	International Building Code (IBC)

F. Safety Glass

1. Products complying with ANSI Z97.1 and testing requirements of the CPSC's 16 CFR, Part 1201, for Category II materials.
2. Subject to compliance with requirements, provide safety glass permanently marked with certification label of the Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

G. Mirror Glass

1. Comply with the recommendations of the National Association of Mirror Manufacturers (NAMM) in their publication "Tips for the Professional on the Care and Handling of Mirrors".
2. Where safety glass mirrors are indicated or required by authorities having jurisdiction, provide the types of products indicated which comply with ANSI Z97.1 and the testing requirements of CPSC's 16 CFR, Part 1201 for Category II materials.
3. Submit mirror mastic products to the manufacturer of protective organic coatings for testing by the coating manufacturer's standard test method to determine compatibility of the adhesive with the mirror coating.
4. Submit twelve (12) inch square samples of each type of mirror glass required, including edge treatment on two adjoining edges of samples.
5. Submit certificates from respective manufacturer's attesting that mirror products furnished for the Project comply with the requirements.
6. Submit mirror mastic-glass coating compatibility test reports, including the organic productive coating manufacturers findings and recommendations.

H. Insulating Glass Certification Program

1. Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
 - a. Insulating Glass Certification Council (IGCC)
 - b. Associated Laboratories
 - c. National Certified Testing Laboratories (NCTL).

I. Glazier Qualifications

1. Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance and at least five (5) years of documented experience.

J. Preconstruction Compatibility and Adhesion Testing

1. Submit preparation data that is based on previous testing of current sealant products for adhesion to and compatibility with submitted glazing materials.

- K. A **“pre-installation” conference shall be conducted at the Project** site in accordance with the requirements of Section 01200, "Project Meetings".

1.05 Submittals

- A. Submit shop drawings, product data, certifications, etc., in accordance with the Section 00700, "General Conditions", Section 00800, "Supplementary Conditions", Section 00805, "FDEP Supplementary Conditions (Construction)" and Section 01300, "Shop Drawings, Submittals and Samples".
- B. The Contractor shall submit the manufacturer's technical data for each glazing material, fabricated glass product, glazing compounds and accessories required, including structural, physical and environmental characteristics, size limitations, colors, special handling and installation and maintenance instructions.
- C. The Contractor shall submit samples for verification purposes of 12-inch-square samples of each type of glass indicated except for clear monolithic glass products, and 12-inch-long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.
- D. The Contractor shall **submit certificates** from respective manufacturers attesting that glass and glazing materials furnished for the Project comply with the requirements.
1. **Submit product certificates** signed by glazing materials manufacturers certifying that their products comply with the specified requirements.
 2. Separate certifications are not required for glazing materials bearing the manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.
- E. The Contractor shall **submit compatibility and adhesion test reports** from the sealant manufacturer and laminated glass manufacturer indicating that the glass and glazing materials have been tested for compatibility and adhesion.
1. Include evaluation of a test relative to material performance, including recommendations for primers and substrate preparation needed for adhesion.
- F. The Contractor shall **submit a compatibility test report** from the manufacturer of the insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

- G. The Contractor shall **submit product test reports** for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.
- H. The Contractor shall submit maintenance data for glass and other glazing materials to include in the Operation and Maintenance Manual as specified in Section 01730, "Operation and Maintenance Data".

1.06 Product Delivery, Storage and Handling

- A. Deliver glass to the Project site in suitable containers that will protect the glass from the weather and from breakage.
- B. Carefully store material, as directed, in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage. Glazing compounds shall arrive at the Project site in labeled containers which have not been opened.
- C. **Protect glass and glazing materials** during delivery, storage and handling to comply with manufacturer's directions and as required to prevent damage to glass and glazing materials from the effects of moisture, condensation, temperature changes, direct exposure to sun, or from other causes.
- D. Where insulating glass will be exposed to substantial altitude changes, comply with the insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.
- E. Remove any damaged items from the Project site and provide new items at no additional cost to the Owner.

1.07 Project Conditions

- A. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by the glazing materials manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.
- B. Install glazing sealants only when temperatures are in the middle third of the manufacturer's recommended installation temperature range.

1.08 Operation and Maintenance Manuals

- A. O&M Manuals shall be furnished for this Project in accordance with Section 01730, "Operation and Maintenance Data" and shall be submitted in accordance with Section 01300, "Shop Drawings, Submittals and Samples".
- B. ***The O&M Manuals shall be prepared specifically for this installation*** and shall include all detailed operation and maintenance procedures and instructions and specifications relative to the assembly, alignment, checking, adjustment and maintenance, together with complete parts lists therefore, and copies of shop drawings, certified dimensions drawings and design calculations, required cut sheets, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such materials.
- C. All such material shall be in addition to any instructions or parts lists packaged with or attached to the equipment when delivered.
- D. The "final" O&M Manuals shall contain plastic laminated pull-out maintenance cards detailing all required maintenance and frequency intervals.
- E. ***In addition to standard O&M Manuals, all manufacturers supplying equipment and products specified herein shall also submit their operation and maintenance manuals and data to the SCADA System Integrator for this Project on CD/DVD/BD's in Corel WordPerfect (latest version), Microsoft Word (latest version), or text, ".txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats (integrators preference for the system shall be required). All O&M Manual files shall also be submitted electronically on CD/DVD/BD's to the Engineer in both PDF and JPEG formats, no exceptions.***
- F. ***The SCADA System Integrator shall be responsible to configure and compile the O&M Manuals into "hypertext" window help files for use as computer "on-line" help screens for equipment operation and maintenance. The SCADA System Integrator shall return all hypertext files to the equipment and product manufacturer's for review and approval prior to introducing them into the SCADA System at the treatment facility.***

1.09 Warranty and Guarantees

- A. Provide a Contractor's ***special project warranty for a period of ten (10) years after the date of Final Project Acceptance by the Owner*** to include for water tightness of installation and coverage for seal failure, interpane dusting or misting, delamination including the replacement of failed units.

B. Manufacturer's Warranty on Coated Glass Products

1. Submit a written warranty signed by the coated glass manufacturer agreeing to furnish replacements for those coated glass units that deteriorate as defined in Article 1.02, "Definitions", f.o.b. from point of manufacture, freight allowed Project site, within the specified warranty period indicated below.
2. The warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.
3. The manufacturer's standard warranty period shall be for a period of **ten (10) years from the date of Final Project Acceptance by the Owner.**

C. Manufacturer's Warranty on Laminated Glass Products

1. Submit a written warranty signed by the laminated glass manufacturer agreeing to furnish replacements for those insulated glass units that deteriorate as defined in Article 1.02, "Definitions", f.o.b. from point of manufacture, freight allowed Project site, within the specified warranty period indicated below.
2. The warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.
3. The manufacturer's standard warranty period shall be for a period of **ten (10) years from the date of Final Project Acceptance by the Owner.**

D. Manufacturer's Warranty on Insulating Glass

1. **Submit a written warranty** signed by manufacturer of the insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in Article 1.02, "Definitions", f.o.b. from point of manufacture, freight allowed Project site, within specified warranty period indicated below.
2. The warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
3. **The manufacturer's standard warranty period shall be ten (10) years from the date of Final Project Acceptance by the Owner.**

- E. Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.
- F. The Contractor shall refer to Section 01740, "Warranties and Bonds" for additional requirements.

2. PRODUCTS

2.01 Manufacturers

A. Glass Fabricators

1. Acceptable Manufacturers

Manufacturer	Website
JE Berkowitz, LP	www.jeberkowitz.com
Trulite Glass and Aluminum Solutions	www.trulite.com
Viracon, Inc.	www.viracon.com
Or Approved Equal	---

B. Float Glass Manufacturers

1. Acceptable Manufacturers

Manufacturer	Website
Cardinal Glass Industries	www.cardinalcorp.com
Guardian Industries Corp	www.sunguardglass.com
Pilkington North America Inc.	www.pilkington.com/na
Viracon, Inc.	www.viracon.com
Or Approved Equal	---

C. Laminated Glass Manufacturers1. Acceptable Manufacturers

Manufacturer	Website
Cardinal Glass Industries	www.cardinalcorp.com
Viracon, Architectural Glass segment of Apogee Enterprises, Inc.	www.viracon.com
Or Approved Equal	---

D. Fire-Resistance-Rated Glass Manufacturers1. Acceptable Manufacturers

Manufacturer	Website
SAFTI FIRST, a division of O'Keeffe's Inc; SuperLite II-XL	www.safti.com
Technical Glass Products; Pilkington Pyrostop	www.fireglass.com
Vetrotech Saint-Gobain North America; Contraflam	www.vetrotechusa.com
Or Approved Equal	---

E. Mirrored Glass Manufacturers1. Acceptable Manufacturers

Manufacturer	Website
Pilkington North America Inc.	www.pilkington.com/na
Or Approved Equal	---

2.02 General

- A. All interior and exterior glass and glazing systems shall be designed to withstand wind and pressure loadings (internal and external) from ***hurricane force winds up to 150 mph. All interior and exterior windows shall have new, "impact resistant glazing" (large missile).***

- B. ***All exterior windows shall be fabricated with a deep, dark, low E, colored tinting*** to reduce the transmission of heat and UV energy into the buildings to which they are to be installed.

2.03 Performance Requirements - Exterior Glazing Assemblies

- A. Select the type and thickness of exterior glazing assemblies to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Design Pressure: Calculated in accordance with ASCE 7.
 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
 4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than $\frac{1}{175}$ of their lengths under specified design load.
 5. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals
1. Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
 2. In conjunction with vapor retarder and joint sealer materials described in other sections.
 3. To utilize the inner pane of multiple pane insulating glass units for the continuity of the vapor retarder and air barrier seal.
 4. To maintain a continuous vapor retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- C. Thermal and Optical Performance
1. Provide glass products with performance properties as indicated. Performance properties shall be in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

- a. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 5.2/6.3 computer program.
- b. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 5.2/6.3 computer program.
- c. Solar Optical Properties: Comply with NFRC 300 test method.

2.04 Glass Materials

A. Float Glass

- 1. Provide float glass based glazing unless noted otherwise.
- 2. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
- 3. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
- 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
- 5. Impact Resistant Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria; Class A/Category II.
- 6. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
- 7. One-Way Glass
 - a. Visible Transmittance: 11% - verify with the Engineer and Owner
 - b. Visible reflectance on coated side: 71%
 - c. The reflective coated glass shall meet the performance specifications as published by the manufacturer. The quality of the coating shall meet the requirements of ASTM C 1376-03 "Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass". The transparent mirror shall be installed with the coated surface facing the observed or subject side of the glazing. A light level ratio of at least 8 to 1 from bright side (subject) to dark (observer) side shall be maintained for effective operation.
- 8. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.

1. Laminated Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 test requirements for Category II.
2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.05 Insulating Glass Units

A. Insulating Glass Units Manufacturers

1. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
2. Basis of Design and Manufacturers

Manufacturer	Website
Viracon, Apogee Enterprises, Inc. *	www.viracon.com
Cardinal Glass Industries	www.cardinalcorp.com
Guardian Industries Corp	www.sunguardglass.com
Pilkington North America Inc	www.pilkington.com/na
Or Approved Equal	---

* Basis of Design

B. Insulating Glass Units - Types as indicated

1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Metal Edge Spacers: Aluminum, bent and soldered corners.
4. Spacer Color: Black.
5. Edge Seal
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.

6. Color: Black.
 7. Purge interpane space with dry air, hermetically sealed.
 8. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2,500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
 - a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.
 - b. Inert gas may be installed in the field into air space in accordance with insulating glass fabricator's and installer's requirements.
- C. Insulating Glass Units: Vision glass, double glazed. (1 5/16" Vue1-50 HS/HS/HS).
1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - b. Coating: Self-cleaning type, on #1 surface.
 - c. Coating: Vue-50 by Viiracon, on #2 surface.
 4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
 - a. Coating: clear PVB, on #3 surface.
 5. Total Thickness: 1 5/16 inch.
 6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.25, nominal.
 7. Visible Light Transmittance (VLT): 46 percent, nominal.
 8. Solar Heat Gain Coefficient (SHGC):.25 percent, nominal.
 9. Visible Light Reflectance, Outside: 11 percent, nominal.
 10. Glazing Method: Dry glazing method, gasket glazing.
 11. LSG: 1.84

2.06 Glazing Units

A. Monolithic Interior Vision Glazing

Parameter	Description
Applications	Interior glazing unless otherwise indicated
Glass Type	Laminated float glass
Tint	Clear
Thickness	1/4-inch, nominal

B. Fire-Resistance-Rated Glazing: Type, thickness, and configuration as required to achieve indicated ratings.

1. Applications

- a. Glazed lites in fire doors.
- b. Fire windows.
- c. Sidelights, borrowed lites, and other glazed openings in partitions indicated as having an hourly fire rating.
- d. Other locations as indicated on the drawings.

2. Glass Type: Laminated float glass.

3. Labeling: Provide permanent label on fire-rated glazing in compliance with ICC (IBC) and authorities having jurisdiction.

4. Provide products listed by Underwriters Laboratories or Intertek Warnock Hersey.

5. Safety Glazing Certification: 16 CFR 1201 Category II.

6. Glazing Method: As required for fire rating.

7. Fire-Resistance-Rating Period: As indicated on the drawings.

8. Markings for Fire-Rated Glazing Assemblies

- a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
- b. "OH" - meets fire window assembly criteria including the hose stream test of NFPA 257 or UL 9 fire test standards.

- c. "D" - meets fire door assembly criteria of 1, 2, or 3 fire test standards.
- d. "H" - meets fire door assembly "Hose Stream" test of 1, 2, or 3 fire test standards.
- e. "NH" - does not meet the hose stream test requirements of tests.
- f. "T" - meets 450°F temperature rise criteria for 30 minutes of 1, 2, or 3 fire test standards.
- g. "NT" - does not meet the temperature requirements of tests.

9. Acceptable Products

Acceptable Product	Website
SAFTI FIRST, a division of O'Keeffe's Inc; SuperLite II-XL	www.safti.com
SAFTI FIRST, a division of O'Keeffe's Inc; SuperLite III-XL	www.safti.com
Technical Glass Products; Pilkington Pyrostop	www.fireglass.com
Vetrotech Saint-Gobain North America; Contraflam	www.vetrotechusa.com
Or Approved Equal	---

C. Security Glazing

- 1. Security glazing shall be laminated glass, 2-Ply.
- 2. Applications: Locations as indicated on the drawings.
- 3. Tint: Clear.
- 4. Thickness: ½-inch.
- 5. Outer Lite: Annealed glass.
- 6. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
- 7. Inside Lite: Annealed glass.
- 8. Performance Criteria
 - a. Burglary Resistance: Pass UL 972 tests in compliance with level of burglary and forced-entry resistance indicated; Multiple Impact.

9. Glazing Method: As required to meet the performance criteria.

2.07 Glazing Compounds

A. Manufacturers

Manufacturer	Website
Bostick	www.bostik-us.com
Pecora Corporation	www.pecora.com
BASF Corporation	www.basf.com/us/en.html
Or Approved Equal	---

B. Butyl Sealant

1. Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A,
2. Shore A hardness of 10 to 20
3. Color: Black.

C. Silicone Sealant

1. Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25,
2. Uses M, A, and G; with cured Shore A hardness range of 15 to 25.
3. Color as selected by the Owner and Engineer.

2.08 Accessories

A. Setting Blocks

1. Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II.
2. Length of 0.1-inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus $\frac{1}{16}$ -inch x height to suit glazing method and pane weight and area.

B. Spacer Shims

1. Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II.
2. Continuous x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type

1. Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
 - a. Width: As required for application.
 - b. Thickness: As required for application.
 - c. Spacer Rod Diameter: As required for application.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.**E. Glazing Clips: Manufacturer's standard type.****F. Smoke Removal Window/Glazing Unit Markings: Adhesive backed markings affixed to manually operable or fixed windows of high-rise buildings to identify units intended for post-fire smoke removal in compliance with ICC (IBC) and local building officials.****2.09 Wired Glass**

- A. Wired glass shall conform to ASTM C-1036, Type II, Class 1 (clear), Quality q8 (glazing); 1/4-inch thick; of Polished Wired Glass, Form 1 (wired, polished both sides), with Mesh m2 (1 inch square minimum mesh opening).

2.10 Fabrication of Glass and Other Glazing Products

- A. Fabricate glass and other glazing products in the sizes required to glaze openings indicated for the Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of the product manufacturer and referenced glazing standard as required to comply with system performance requirements.

- B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with the indoor and outdoor faces.

3. EXECUTION

3.01 Standards and Performance

- A. ***Watertight and airtight installation of each piece of glass is required***, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, and other defects in the Work. ***All windows shall be installed with "Impact Resistant" and "Insulated" Glass and shall be able to withstand hurricane force winds of up to 150 mph (interior and exterior loadings).***
- B. ***All exterior windows shall be fabricated with a deep, dark, colored tinting*** to reduce the transmission of heat and UV energy into the buildings to which they are to be installed.
- C. ***Protect all glass from edge damage*** at all times during handling, installation and operation of the building.
- D. Glazing channel dimensions shall be determined by the manufacturer for the service required and shall be sized to provide the necessary intended bite on the glass, minimum edge clearance, and adequate sealant thickness with reasonable tolerances. The glazier is responsible for the correct glass size for each opening within the tolerances and necessary dimensions established.
- E. Comply with the combined recommendations of the glass manufacturer and the manufacturer of the sealants and other materials used in glazing and their technical representatives except where more stringent requirements are shown or specified.
- F. Comply with the quality assurance standard identified in Article 1.04(D) and the manufacturers of the glass and glazing materials, except as shown and specified elsewhere.
- G. Inspect each piece of glass immediately before installation and eliminate those which have observable edge damage or face imperfections.
- H. Unify the appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and blow oriented in the same direction as other pieces.

3.02 Precautions and Procedures

- A. Determine the sizes to provide the required clearances by measuring the actual opening to receive the glass.
- B. Grind smooth all edges of the glass that will be exposed in the finish work.
- C. Leave labels in place until the installation is approved, except remove applied labels on heat absorbing glass and on insulating glass units as soon as the glass is installed.
- D. Securely fix movable items or keep in a closed and locked position until the glazing compound has thoroughly set.

3.03 Verification of Conditions

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Do not proceed with glazing system installation until unsatisfactory conditions have been corrected to the satisfaction of the Engineer and Owner..

3.04 Preparation

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of twenty-four (24) hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.05 Installation - General

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA Sealant Manual, and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.06 Installation - Dry Glazing Method (Gasket Glazing)

- A. Application - Exterior and/or Interior Glazed
 - 1. Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at ¼-points with edge block no more than six (6) inches from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.07 Installation - Dry Glazing Method (Tape and Gasket Spline Glazing)

- A. Application - Exterior Glazed
 - 1. Set glazing infills from the exterior of the building.

- B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.
- C. Place setting blocks at $\frac{1}{4}$ -points with edge block no more than six (6) inches from corners.
- D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- F. Carefully trim protruding tape with knife.

3.08 Installation - Wet Glazing Method (Sealant and Sealant)

A. Application - Exterior Glazed

- 1. Set glazing infills from the exterior of the building.
- B. Place setting blocks at $\frac{1}{4}$ -points and install glazing pane or unit.
- C. Install removable stops with glazing centered in space by inserting spacer shims both sides at twenty-four (24) inch intervals, $\frac{1}{4}$ -inch below sight line.
- D. Fill gaps between glazing and stops with silicone type sealant to depth of bite on glazing, but not more than $\frac{3}{8}$ -inch below sight line to ensure full contact with glazing and continue the air and vapor seal.
- E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.09 Installation - Wet/Dry Glazing Method (Preformed Tape and Sealant)

A. Application - Exterior Glazed

- 1. Set glazing infills from the exterior of the building.
- B. Cut glazing tape to length and set against permanent stops, $\frac{3}{16}$ -inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

- C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- D. Place setting blocks at ¼-points with edge block no more than six (6) inch from corners.
- E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
- F. Install removable stops, with spacer strips inserted between glazing and applied stops ¼-inch below sight lines.
- G. Place glazing tape on glazing pane of unit with tape flush with sight line.
- H. Fill gap between glazing and stop with Silicone type sealant to depth equal to bite of frame on glazing, but not more than ⅜-inch below sight line.
- I. Apply cap bead of Silicone type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.10 Installation - Structural Silicone Glazing

A. Application - Factory (Shop) Glazed

- 1. Follow basic guidelines of structural silicone glazing for glazing application.
- B. Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.
- C. Provide only structural silicone sealant, tested and manufactured for structural glazing.

3.11 Field Quality Control

- A. Glass and glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

3.12 Cleaning and Protection

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels after glazing installation is complete.
- C. Clean all glass and adjacent surfaces after sealants are fully cured.
- D. Protect exterior glass from breakage immediately after installation and cleaning by attaching crossed streamers to framing held away from glass. Do not apply markers to the glass surface.
- E. **Protect glass from contact with contaminating substances** resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- F. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by the glass manufacturer.
- G. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period at no additional cost to the Owner.
- H. **Wash glass on both faces in each area of Project not more than two (2) days prior to the date scheduled for inspections** that establish the date of Final Project Acceptance by the Owner. Wash glass as recommended by the glass manufacturer.

END OF SECTION

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