ATTACHMENT A

CONTRACT DOCUMENTS

CITY OF PALM BAY

SOUTH REGIONAL WATER TREATMENT PLANT EXPANSION - 4 MGD TO 6 MGD

TECHNICAL SPECIFICATIONS

VOLUME I OF II

June 2020

Prepared For:

Palm Bay Utilities

Prepared By:

TETRA TECH

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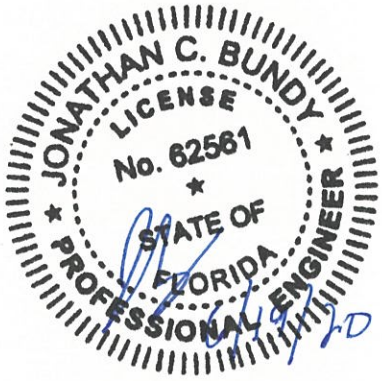
Tetra Tech #200-08507-19001

Bid Set

CITY OF PALM BAY
SOUTH REGIONAL WATER TREATMENT PLANT 4 MGD TO 6 MGD
CONTRACT DOCUMENTS

Portion of Engineering Documents for Which Responsible	Name and License Number	Company Name, Address, and Business No.	Signature, Seal, and Date
General	Jonathan C. Bundy, PE FL PE #62561	Tetra Tech, Inc. 201 E. Pine St., Suite 1000 Orlando, FL 32801 Engineering Business No. 2429	
Process	Jonathan C. Bundy, PE FL PE #62561	Tetra Tech, Inc. 201 E. Pine St., Suite 1000 Orlando, FL 32801 Engineering Business No. 2429	
Civil	Burl D. Reardon, PE FL PE #64037	Tetra Tech, Inc. 201 E. Pine St., Suite 1000 Orlando, FL 32801 Engineering Business No. 2429	

Palm Bay Utilities

CITY OF PALM BAY
SOUTH REGIONAL WATER TREATMENT PLANT 4 MGD TO 6 MGD
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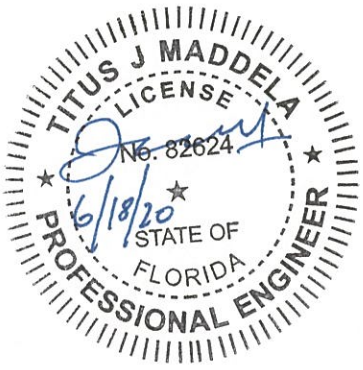
Structural	Titus J. Maddela, PE FL PE #82624	Tetra Tech, Inc. 201 E. Pine St., Suite 1000 Orlando, FL 32801 Engineering Business No. 2429	

CITY OF PALM BAY
SOUTH REGIONAL WATER TREATMENT PLANT 4 MGD TO 6 MGD
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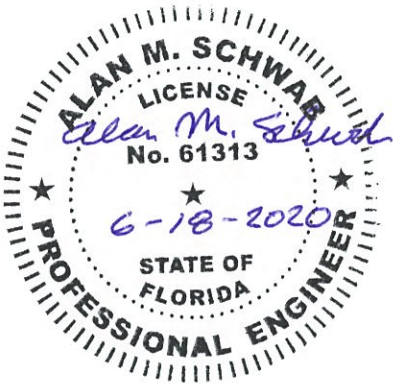
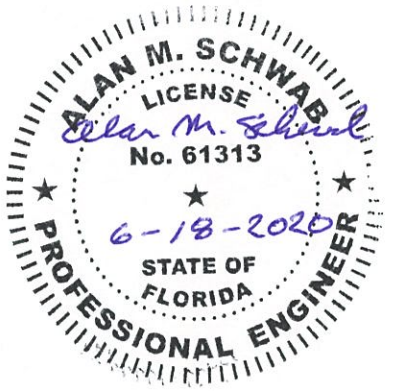
Portion of Engineering Documents for Which Responsible	Name and License Number	Company Name, Address, and Business No.	Signature, Seal, and Date
Electrical	Alan M. Schwab, PE FL PE #61313	Wade Trim 3790 Dixie Hwy NE Palm Bay, FL 32905	
Instrumentation	Alan Schwab, PE FL PE #61313	Wade Trim 3790 Dixie Hwy NE Palm Bay, FL 32905	

CITY OF PALM BAY
SOUTH REGIONAL WATER TREATMENT PLANT EXPANSION – 4 MGD TO 6 MGD

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Palm Bay Utilities

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01005

PROJECT REQUIREMENTS

PART 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. The summary of the work is presented in Section 01010: Summary of Work.

2. Work Included:

a. 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 and other regulatory permits, except as provided for 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. 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. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.

b. 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.

c. 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.

3. Public Utility Installations and Structures:

a. 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, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.

b. 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.

c. 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 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.

d. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various Contract Items. No separate payment shall be made therefor.

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

rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as extra work as provided in the Agreement.

f. 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.

g. The Contractor shall give written notice to Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least 48-hours in advance of breaking ground in any area or on any unit of the Work.

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

1.02 DRAWINGS AND PROJECT MANUAL

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

B. 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 Construction Drawings (24 inches by 36 inches) and one (1) reproducible copy of the Project Manual.

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.

C. Contractor to Check Drawings and Data:

1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, Supplementary Drawings, schedules, Specifications, or other data received from the Engineer, and shall notify him of all errors, omissions,

conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction, or improper operation resulting therefrom, nor from rectifying such conditions at his own expense. He 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.

D. Specifications: The Technical Specifications consist of three (3) parts: General, Products, and Execution. The General part of a Specification contains General Requirements which govern the Work. 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.

E. Intent:

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

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

1.03 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. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

2. 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 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 painted steel cases, properly labeled and equipped with grade 2 cylinder locks and duplicate keys.

2. Spare parts shall be furnished as specified herein 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, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight, and principal rate data.

D. Service of Manufacturer's Engineer:

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

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

1.04 INSPECTION AND TESTING

A. General:

1. 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. The reports shall be submitted electronically, 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. Contractor shall furnish to 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. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

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.

2. Electronic copies (PDFs) 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, chemicals, and all other materials, equipment, and instruments necessary for all demonstration tests, at no additional cost to the Owner. Contractor shall assist in the demonstration tests as applicable.

1.05 LINES AND GRADES

A. Grade:

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

2. Adjustments of grades shown on Drawings may be necessary to conform to actual field conditions or to maintain cover under proposed future grades. Such adjustments shall be considered part of the job conditions and no extra compensation will be allowed for such changes, except where specifically otherwise noted in the Drawings or Specifications. Such adjustments must be approved by the Engineer prior to being made.

3. 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.

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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01010

SUMMARY OF PROJECT

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. This Contract is for the City of Palm Bay South Regional Water Treatment Plant (SRWTP) Expansion from 4.0 MGD to 6.0 MGD as specified herein. The Work consists of furnishing all labor, equipment, and materials for the construction of the facilities consisting of, but not limited to, the following:

1. One (1) new Floridan supply well, well pump, and conveyance piping.

2. Two (2) new reverse osmosis (RO) pretreatment cartridge filter units.

3. One (1) new RO feed pump and one (1) existing spare RO feed pump (to be installed as a permanent RO feed pump).

4. Two (2) new RO skids.

5. One (1) new blower for the degasification system.

6. Addition of a clean-in-place system for the degasification system.

7. One (1) new finished water transfer pump.

8. One (1) new 2.0 MG finished water ground storage tank.

9. Two (2) new high service pumps.

10. Chemical Feed Systems, including:

a. New carbon dioxide storage and feed system.

b. Two (2) new sodium hydroxide feed pumps for pH adjustment.

c. One (1) new sodium hydroxide feed pump for odor control.

d. New sodium hydroxide feed room piping.

e. New sodium hydroxide bulk storage tank piping.

f. New sodium hypochlorite feed room piping.

g. New sulfuric acid bulk storage tank piping.

h. Inspection of the existing sodium hydroxide and sulfuric acid bulk storage tanks.

11. Expansion of electrical power and motor control center (MCC) facilities to accompany additional treatment equipment listed above.

12. Instrumentation and controls for additional equipment and systems listed above and replacement of existing PLCs.

13. Miscellaneous facility and process rehabilitation improvements, including but not limited to:

    a. Modifications to the RO Feed piping, including the addition of a RO Feed header and valves to allow for flexibility of using multiple feed pumps to feed each RO skid.

    b. Addition of a permeate to waste line to discharge to the existing stormwater pond.

    c. Replacement of PVC spool piece on the permeate manifold with SST spool piece between the existing chemical injection spool piece and the tie-in for the raw water blend.

    d. Replacement of buried chemical feed lines with containment boxes, containment piping and chemical tubing.

    e. Addition of a hydrogen sulfide sensor on the second stage odor control discharge.

    f. Replacement of the existing valve gear operators, stem extensions and hardware for the butterfly valves located in the existing degasifier clearwell.

14. Additive bid alternates include the following:

    a. Replacement of the membrane elements in the two (2) existing RO skids.

    b. Addition of a carbon dioxide feed panel, piping, instrumentation for a pre-degasifier carbon dioxide feed to adjust pH in the blended RO permeate ahead of the degasifiers.

1.02 CONTRACTOR'S USE OF PREMISES

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

1.03 PROJECT SEQUENCE

A. The Contractor shall establish his work sequence based on the use of crews to facilitate completion of construction and testing within the specified Contract Time. The proposed project sequence, including Contractor's plans for provision of temporary facilities, shall be submitted to the Engineer prior to construction.

B. All tie-ins to existing utilities shall be coordinated with and approved by the Owner.

C. Contractor shall establish his work sequence such that the installation of the well pump and associated above grade discharge piping, electrical and instrumentation does not commence until completion of the well drilling contract, which is anticipated to commence at the same time as this Contract and the FDEP construction permit modification is approved to include the new well. The permit modification cannot be submitted until the new well construction is completed and the well is sampled.

1.04 SEQUENCE OF PLANT OPERATION DURING CONSTRUCTION

A. The Contractor shall establish his work sequence based on maintaining plant operations as determined by the Owner prior to construction. Under no circumstances shall the plant be shut down for more than 12 hours for process, piping and equipment tie-ins upstream of the Ground Storage Tank and no more than 4 hours for process, piping and equipment tie-ins downstream of the Grounds Storage Tank. Contractor shall make every effort to minimize the number and duration of shutdowns by sequencing work such that multiple tie-ins/modifications are made during shutdowns where feasible. No shutdowns shall be allowed without prior approval from the City.

1. No plant shutdown time is anticipated for the addition of the supply well, well pump, and conveyance piping with the use of the wet tap and valve for connection to the existing 24-inch raw water line.

2. Plant shutdown time is anticipated for the addition of the two (2) new reverse osmosis (RO) pretreatment cartridge filter units, due to connection to the existing blind flanges on the 30-inch pretreated water line. During this time, the work shall be sequenced such that the plant will not be shut down for more than 12 hours.

3. No plant shutdown time is anticipated for the addition of one (1) new RO feed pump and relocation of the existing spare RO feed pump. No plant shutdown time is anticipated to replace the RO feed header for interconnection between pumps. This work shall be sequenced such that the a minimum of one (1) skid is operational at all times.

4. Plant shutdown time is not anticipated for the installation of the RO permeate to waste line. Modifications to the existing skids permeate line for connection to the proposed permeate to waste line shall be sequenced such that a minimum of one (1) skid is operational at all times.

5. Plant shutdown time is anticipated for the addition of two (2) new RO skids. This work also includes line connections to the existing permeate and concentrate manifolds. Work should be sequenced such that the installation 24" permeate ROP 90^{o} bend replacement is performed during this shutdown. During this time, the work shall be sequenced such that the plant will not be shut down for more than 12 hours.

6. Should the bid alternate for membrane replacement on the existing RO skids work be accepted by the City, no plant shutdown time is anticipated. This work shall be sequenced such that the a minimum of one (1) skid is operational at all times. This work shall also be sequenced such that it is performed following installation of the RO permeate to waste line.

7. No plant shutdown time is anticipated for the addition of one (1) new finished water transfer pump due to the existing 16-inch butterfly valve on the finished water line where the new transfer pump will be connected.

8. Plant shutdown time is anticipated for the addition of one (1) new blower for the degasification system due to the connection to the existing 42-inch FRP air supply duct. Installation of the hydrogen sulfide analyzer on the odor control scrubber discharge shall be coordinated with this work such that a separate shutdown is not required. During this time, the work shall be sequenced such that the plant will not be shut down for more than 12 hours.

9. No plant shutdown time is anticipated for the addition of a clean-in-place system for the degasification system. The chemical service modifications shall be coordinate such that no plant shutdown time is required. This work shall be sequenced and coordinated such that the a minimum of one (1) degasifier is operational at all times.

10. Plant shutdown time is anticipated for the for the replacement of the existing valve gear operators, stem extensions and hardware for the butterfly valves located in the existing degasifier clearwell. This work shall be coordinated with the carbon dioxide injection installation such that only one shutdown of the clearwell is required. During this time, the work shall be sequenced such that the plant will not be shut down for more than 12 hours.

11. No plant shutdown time is anticipated for the addition of chemical feed systems as listed in 1.01, A, 9 of this section. Chemical feed system work shall be sequenced to align with other plant work while the plant is shutdown, or so as to not interfere with active plant operations. Temporary chemical feed storage and piping shall be provided as needed to maintain chemical feed operations.

12. No plant shutdown time is anticipated for the addition of one (1) new 2.0 MG finished water ground storage tank. Piping connections for the tank inlet and out let piping are located at isolation valves to the existing inlet and outlet manifolds.

13. Plant shutdown time is anticipated for the addition of two (2) new high service pumps due to the connections to the existing finished water main. During this time, the work shall be sequenced such that the plant will not be shut down for more than 4 hours.

14. Plant shutdown time is anticipated for the expansion of electrical power and motor control center (MCC) facilities to accompany additional treatment equipment listed above, as well as instrumentation and controls and replacement of existing PLCs. During this time, the work shall be sequenced such that the plant will not be shut down for more than 12 hours. Any electrical modifications requiring a shutdown that impacts the high service pumps shall be limited to 4 hours.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 GENERAL INFORMATION

A. Refer to Section 01010 for a description of the work required for completion of the Work.

B. Subject to the provisions in the Contract General Conditions, all work and payment for the work is represented by the Total Bid amount shown on the Bid Form.

1.02 PAYMENT

A. Work under this contract will be paid for on a unit price and lump sum basis as outlined on the Bid Form. The amount of payment will be as defined in the General Conditions between OWNER and Contractor.

B. The prices shown on the Bid Form establish a total price cost for completing the Work in its entirety. Furnish all materials, equipment, transportation, tools, labor, services and supplies, plus any miscellaneous items and services that may not be specifically identified in the Contract Drawings and Specifications but that can be inferred from the Contract Drawings and Specifications and are necessary to produce a completed Work that is usable in a manner for which it was intended. If any items for a complete work are omitted or not shown, the Contractor shall furnish and install them without additional cost to the OWNER. No separate payment will be made for another Payment Item required to complete the work of a lump sum item.

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

D. Retainage shall apply to all Contractor payments prior to final acceptance as provided for in the Contract General Conditions.

1.03 MEASUREMENT FOR PAYMENT

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

1.04 PAYMENT ITEMS

A. Payment will be made at the lump sum price for each item shown in the Bid Proposal, stored and/or installed and accepted, which price and payment shall constitute full

compensation for furnishing all materials and performing all Work in connection therewith and incidental thereto. No separate payment will be made for the following Work and its cost shall be included in appropriate Payment Items:

1. Maintenance and replacement of plantings.
2. Record drawings.
3. Pre-construction video.
4. Field office(s) and storage facilities.
5. Clean up.
6. Testing materials and apparatus.
7. Appurtenant work.
8. Contractor fees associated with the performance of the Work.
9. Night work.

B. Items are as enumerated on the Bid Proposal.

1. Mobilization and Demobilization (Bid Item No. 1):

a. Payment for Mobilization/Demobilization will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for the 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, and for the establishment of field office, building, safety equipment and first aid supplies, sanitary and other facilities, as required by these Specifications, and State and local laws and regulations; and any other preconstruction expense necessary for the start of the Work; the cost of field engineering, permits and fees, construction schedules, shop drawings, temporary facilities, laydown storage area, construction aids, erosion control, work associated with contractor support during Owner/Engineer reviews and inspection, reinspection and any re-work resulting from same, as described in Section 01710: Cleaning; and Section 01720: Project Records Documents. The Contractor shall submit invoices substantiating the cost of mobilization with each pay request. Mobilization/demobilization shall not be more than five percent (5%) of the Total Base Bid price. Ten percent of the cost for mobilization will be withheld until substantial completion and site clean-up.

2. General Requirements (Bid Item No. 2):

a. Payment for General Requirements will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all insurance requirement costs, the cost of bonds,

fees and permits as defined in Section 1065, all administrative costs associated with acquiring and maintaining the necessary coverage as described in the Contract Documents, and the Contractor's Indemnity Agreement as set out in the Contract Documents. This item will be paid upon each payment request made by the Contractor. The Contractor shall attach with the pay request invoices to substantiate that appropriate insurance and bonds have been obtained by the Contractor.

3. All Work Related to Expansion of the South Regional Water Treatment Plant (Bid Item No. 3):

   a. Measurement for various items covered under All Work Related to Expansion of the South Regional Water Treatment Plant will not be made for payment, and all items shall be included in the lump sum price. Payment will be made at the contract lump sum price, based upon the approved schedule of values and progress payments.

   b. This item shall include all materials, equipment, testing, permits, appurtenances and work required for construction of the South Regional Water Treatment Plant Expansion excluding bid items listed elsewhere and excluding Additive Alternate bid items. This item shall include all items not included in Bid Items 1, 2, 4, Bid Alternate 1 and Bid Alternate 2.

4. All Work Related to Rehabilitation Improvements at the South Regional Water Treatment Plant (Bid Item No. 4):

   a. Measurement for various items covered under All Work Related to to Rehabilitation Improvements at the South Regional Water Treatment Plant will not be made for payment, and all items shall be included in the lump sum price. Payment will be made at the contract lump sum price, based upon the approved schedule of values and progress payments.

   b. This item shall include all materials, equipment, testing, permits, appurtenances and work required for construction of the Rehabilitation Improvements at the South Regional Water Treatment Plant excluding bid items listed elsewhere and excluding Additive Alternate bid items. This item shall include the following:

      - Sulfuric Acid Storage Tank Piping Replacement
      - Inspection and cleaning of the existing sodium hydroxide and sulfuric acid bulk storage tanks.
      - RO Feed Header Modifications
      - Addition of a permeate to waste line to discharge to the existing stormwater pond
      - RO Permeate Overpressure Protection Modifications

- Addition of a clean-in-place system for the degasification system.
- Degasification System Access Platforms
- Addition of a hydrogen sulfide sensor on the second stage odor control discharge
- Sodium Hypochlorite Feed Pump Room Piping Replacement
- Sodium Hydroxide Feed Room Piping Replacement
- Sodium Hydroxide Bulk Storage Tank Piping Replacement
- RO Permeate stainless steel manifold repair.
- RO Building FRP Grating Replacement and support beam.
- Replacement of buried chemical feed lines to post treatment with containment boxes, containment piping and chemical tubing.
- Chlorine Contact Chamber Valve Gear Box Replacement
- Finished Water Transfer Pump Flush Line.
- 40KVA UPS Replacement.

5. Bid Alternate 1 – Pre-Degasification CO_2 Feed System

   a. Measurement for Bid Alternate 1 – Pre-Degasification CO_2 Feed System, its inclusion in the Project at the discretion of the Owner, will not be made for payment, and all items (labor, materials, equipment, testing and transport) shall be included in the lump sum price. Refer to the drawings and Specification Section 13205 for more information.

6. Bid Alternate 2 – Existing Membranes Replacement

   a. Measurement for Bid Alternate 2 – Existing Membranes Replacement, its inclusion in the Project at the discretion of the Owner, will not be made for payment, and all items (labor, materials, equipment, testing and transport) shall be included in the lump sum price. Refer to the drawings and Specification Section 11250 for more information.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01041

PROJECT COORDINATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. 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 ensure the completion of the work within the Contract time. 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 order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PIPE LOCATIONS

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

3.02 OPEN EXCAVATIONS

A. Contractor shall adequately safeguard all open excavations by providing temporary barricades, caution signs, lights, and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by workmen. All open excavations shall comply with applicable OSHA Standards.

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 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. 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 other manner acceptable to the Engineer.

3.05 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from damage 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 no additional expense to the Owner.

B. Protect all structures in a suitable manner to prevent damage. Should any part of a structure become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the Contract.

C. 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.

3.06 MAINTENANCE OF TRAFFIC

A. Unless permission to close a street is received in writing from the proper authority (County, City, 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.

3.07 PRIVATE LAND

A. The Contractor shall not enter or occupy private land outside the site, except by written permission of the appropriate owners. Contractor shall provide Owner a copy of such written permission prior to entering private land.

3.08 COOPERATION WITHIN THIS CONTRACT

A. The Contractor shall, prior to interrupting a utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the Owner and make arrangements for the interruption, which will be satisfactory to the Owner.

3.09 COOPERATION WITH OTHER CONTRACTS

A. This Contract may require a portion of the work to be connected to work done under other contract(s). It will be necessary for the Contractor to plan his work and cooperate with other contractors insofar as possible to prevent any interference and delay.

B. Contractor shall coordinate and cooperate with other contractors performing work on or contiguous to the project. Work done under other contract(s) include, but not limited to:

1. South Regional WTP Expansion Well SRO-4

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The Contractor shall provide and pay for field engineering service for Project.

1. Survey work required in execution of Work.

2. Civil, structural, or other professional engineering services specified or required to execute Contractor's construction methods.

3. The method of field staking for the construction of the Work shall be at the option of the Contractor. The Owner has provided the engineering surveys necessary to establish reference points which in his judgement are necessary to enable the Contractor to proceed with his work.

4. The accuracy of any method of staking shall be the responsibility of the Contractor. All engineering for vertical and horizontal control shall be the responsibility of the Contractor.

5. The Contractor shall be held responsible for the preservation of all stakes and marks. If any stakes or marks are carelessly or willfully disturbed by the Contractor, the Contractor shall not proceed with any work until he has established such points, marks, lines, and elevations as may be necessary for the prosecution of the Work.

6. The Contractor shall retain the services of a registered land surveyor licensed in the State of Florida to identify existing control points and maintain a survey during construction.

B. Related Requirements Described Elsewhere:

1. Conditions of the Contract.

2. Summary of Project: Section 01010.

3. Project Record Documents: Section 01720.

1.02 QUALIFICATIONS OF SURVEYOR OR ENGINEER

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

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

1.03 SURVEY REFERENCE POINTS

A. Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction.

1. Make no changes or relocations without prior written notice to the Engineer.

2. Report to the Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

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

1.04 PROJECT SURVEY REQUIREMENTS

A. Establish a minimum of two (2) permanent bench marks on site (if not already on site), referenced to data established by survey control points.

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

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

1. Site improvements:

a. Stakes for grading, fill, and topsoil replacement.

b. Utility slopes and invert elevations.

2. Batter boards for structure.

3. Building foundation, column locations, and floor levels.

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

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

1.05 RECORDS

A. Maintain a complete, accurate log of all control and survey work as it progresses.

B. Survey all wells prior to equipping.

C. At the end of the project, submit a certified site survey at 1 inch equals 20 feet scale on 22 by 34 inch sheets, indicating the building corners and location of all new structures and elevations of stormwater facilities, pavement areas, sidewalks, finished floors, vaults, and above grade piping. Certified survey shall be submitted both electronically and with hard copies.

D. At the end of the project, submit a certified survey at the same scale as the Engineer's line drawings indicating elevations and stationing at 100-foot pipe increments and at all valve and fitting locations.

1.06 SUBMITTALS

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

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

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

D. Submit drawings showing locations of all structures constructed. This drawing shall be included with the Project Record Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01065

PERMITS AND FEES

PART 1 - GENERAL

A. The Contractor shall secure and pay for **all** permits and licenses related to his work, including but not limited to, necessary construction permits as provided for the General Conditions except as otherwise provided herein. This shall include application for Building Construction Permit through the City of Palm Bay Building Division.

B. The Contractor shall adhere to all permit requirements as contained in permits obtained by the Contractor and Owner.

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

Permitting Authority/Permit	Status
Florida Department of Environmental Protection Application for a Specific Permit to Construct PWS Components	Permit No. 0032426-378-WC
St. Johns River Water Management District Environmental Resource Permit	Permit No. 87977-5

END OF SECTION

SECTION 01070

ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 STANDARDS AND ABBREVIATIONS

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

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

B. Abbreviations:

AA	Aluminum Association
AAA	American Arbitration Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHO	The American Association of State Highway Officials
ABA	American Bar Association
ABMA	American Boiler Manufacturers Association
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIA	American Insurance Association
AIEE	American Institute of Electrical Engineers (Now IEEE)
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Condition Association
ANSI	American National Standard Institute
APA	American Plywood Association

API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ARI	American Refrigeration Institute
ASA	American Standards Association (Now ANSI)
ASAHC	American Society of Architectural Hardware Consultants
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASSHTO	American Association of State Highway Transportation Officials
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America (formerly SCPI)
CDA	Copper Development Association
CFS	Cubic Feet Per Second
CMAA	Crane Manufacturers Association of America
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
DOT Spec	Standard Specification for Road and Bridge Construction Florida Department of Transportation, 1982
E/A	Engineer and/or Architect
EDA	Economic Development Association
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
FCI	Fluid Control Institute
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
Fed Spec	Federal Specification
FGS	Florida Geological Survey
FPS	Feet Per Second
FS	Federal Standards
GPM	Gallons Per Minute
HMI	Hoist Manufacturers Institute
HP	Horsepower
HSBII	Hartford Steam Boiler Inspection and Insurance Co.
ID	Inside Diameter

IEEE	Institute of Electrical and Electronic Engineers
IFI	Industrial Fasteners Institute
IPCEA	Insulated Power Cable Engineers Association
IPS	Iron Pipe Size
MGD	Million Gallons Per Day
MHI	Materials Handling Institute
MMA	Monorail Manufacturers Association
N_aOCl	Sodium Hypochlorite
NBFU	National Board of Fire Underwriters
NBHA	National Builders' Hardware Association
NBS	National Bureau of Standards
NCSA	National Crushed Stone Association
NCSPA	National Corrugated Steel Pipe Association
ND	Nominal Diameter
NEC	National Electrical Code
NECA	National Electrical Contractors' Association
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association
NLA	National Lime Association
NPC	National Plumbing Code
NPT	National Pipe Threads
NSC	National Safety Council
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	U.S. Department of Labor, Occupational Safety and Health Act
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	United States Products Standards
PSI	Pounds per Square Inch
PSIA	Pounds per Square Inch Absolute
PSIG	Pounds per Square Inch Gauge
RAS	Return Activated Sludge
RPM	Revolutions Per Minute
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SWFWMD	Southwest Florida Water Management District
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSI	Scaffolding and Shoring Institute
SSPC	Steel Structures Painting Council
SSPC	Structural Steel Painting Council
STA	Station (100 feet)
TDH	Total Dynamic Head
TH	Total Head
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
USASI	United States of America Standards Institute

USGS	United States Geological Survey
WAS	Waste Activated Sludge

C. Additional abbreviations and symbols are shown on the Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01091

REFERENCE SPECIFICATIONS

PART 1 - GENERAL

1.01 GENERAL

A. Applicable Publications. 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. No requirements set forth herein or shown on the drawings shall be waived because of any provision of or omission from said standards or requirements.

B. Assignment of Specialists. In certain instances, 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. 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. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, 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 documents are not in conflict with the requirements of these specifications not the 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, 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. 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01100

SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.01 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including, but not limited to, encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.

B. Sound levels measured by the Engineer shall not exceed 50 dBA from 6 P.M. to 7 A.M. or 60 dBA 7 A.M. to 6 P.M. This sound level shall be measured at the exterior of the nearest exterior wall of the nearest residence. Levels at the equipment shall not exceed 85 dBA at any time. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or Owner for excessive noise shall not relieve the Contractor of the other portions of this Specification including, but not limited to, completion dates and bid amounts.

C. In addition to the requirements above, the Contractor shall also comply with all City of Palm Bay ordinances regarding noise, including “Section 3-1508.Noise”.

D. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.02 SANITARY SEWER PIPE AND EXISTING UTILITIES

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

B. Utility Conflicts. Contractor must identify all locations where there is the possibility of conflicts with existing utilities. Contractor will promptly notify the Owner and Engineer in writing in accordance with these documents. Contractor acknowledges that resolving utility conflicts can sometimes require permitting. The Owner will grant additional days to the Contractor to cover the length of unanticipated delay in writing. However, under no circumstances will the Contractor be eligible for remobilization costs.

1.03 LANDSCAPING RESTORATION

A. Contractor shall be responsible for replacing all landscaping disturbed during construction with landscaping of equal or better quality, quantity, material and size.

The extent of existing landscaping is not shown on drawing and shall be the responsibility of Contractor and field inspected prior to bidding.

1.04 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by workmen.

1.05 TEST PITS

A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor. Test pits shall be backfilled 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.

1.06 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 Drawings or specified herein in order to avoid any work stoppages due to jurisdictional disputes. 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.

1.07 INCLEMENT WEATHER

A. In the event of inclement weather, or whenever the Engineer directs; the Contractor shall, and shall cause subcontractors to protect carefully the Work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any portion of work or materials have been damaged or injured by reason of failure on the part of the Contractor or any subcontractors to so protect the Work, such Work and materials shall be removed and replaced at the expense of the Contractor.

1.08 COORDINATION OF WORK

A. The Contractor shall cooperate fully so as to eliminate or minimize the creation of conflicts. Adjustments from time to time may be required in the Contractor's work location and/or schedule provided a reasonable notice is given by the Owner or Engineer.

1.09 USE OF PUBLIC/PRIVATE STREETS

A. The use of public/private streets and roads shall be such as to provide a minimum of an inconvenience to the public and to other traffic. Any earth or other excavated materials

spilled from trucks shall be removed by the Contractor and the streets and roads cleaned to the satisfaction of the Owner.

B. Access to properties along the Project must be maintained at all times throughout the duration of the Project as shown in the Drawings.

1.10 TRAFFIC

A. All safety precautions shall be taken and all traffic controls be furnished satisfactorily to the City, FDOT, and/or other government agencies having jurisdiction, where partial or complete obstruction of highways, roadways, streets, drives or sidewalks is required in the performance of the Work.

1.11 CHEMICALS

A. All chemicals used during project construction, or furnished for project operations, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of the State Department of Health, Florida Department of Environmental Protection and if required, also the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with the manufacturer's instructions or recommended use procedures.

1.12 SAFETY AND HEALTH REGULATIONS

A. The Contractor shall comply with the Department of Labor Safety & Health Regulations for construction promulgated under the Occupational Safety & Health Act of 1970, (PL 91-596) and under Section 107 of the Contract Work Hours & Safety Standards Act (PL 91-54).

B. All equipment furnished and installed under this Contract shall comply to Part 1910, Occupational Safety & Health Standards & Amendments thereto.

C. The Contractor shall comply with the Florida Trench Safety Act (90-96, Florida Law).

1.13 STATE AND FEDERAL PERMITS

A. Construction in Florida Department of Transportation rights-of-way, wetlands and navigable water bodies will be governed by applicable State and Federal permits. All conditions set forth on the permits shall be a part of the Contract and they shall be attached by addendum.

1.14 INSPECTION

A. The authorized representatives and agents of the Environmental Protection Agency and Controlling State and Local Pollution Control Agencies shall be permitted to inspect all work, material, payrolls, personnel records, invoices of materials and any other relevant data and records. The Owner and Engineer shall be permitted access to any work area

for the inspection of work and materials. The Owner may, at the Contractor's expense, order the uncovering or removal of any finished work if circumstances indicate faulty work or materials were used in the original installation. The Owner and Engineer shall also be permitted to inspect material invoices, payrolls or any other relevant data or records as may be necessary or required to satisfy the requirements of the Contract.

1.15 ENVIRONMENTAL PROTECTION

A. General:

1. Contractor shall comply with all Federal, State and Local laws and regulations controlling pollution of the environment. He shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter. In the event of conflict between such laws and regulations and the requirements of the Specifications, the more restrictive requirements shall apply. Environmental protection requirements specified in other Sections shall be considered as supplementing the requirements of this Section.

2. Failure of the Contractor to fulfill any of the requirements of this Section may result in the Owner ordering the stopping of construction operations.

3. Failure on the part of the Contractor to perform the necessary measures to control erosion, siltation, and pollution will result in the Owner notifying the Contractor to take such measures. In the event that the Contractor fails to perform such measures within 24 hours after receipt of such notice, the Owner may stop the Work as provided above, or may proceed to have such measures performed by others. The cost of such work performed by others plus related fees by the Engineer will be deducted from monies due the Contractor on his Contract.

4. All erosion and pollution control features installed by the Contractor shall be acceptably maintained by the Contractor during the time that construction work is being done.

5. Repair or replace damaged or inoperative erosion and pollution control devices as directed by the Engineer or the Owner.

6. Where there is a high potential for erosion and possible water pollution, the Contractor shall not expose, by his construction methods or procedures, an area of erosive land at any one time larger than the minimum amount required for the proper and efficient construction operation. If the exposure of any incomplete work corresponding to the exposure period required for erosion is anticipated, temporary protective measures shall be taken to prevent the erosion or collapse of land in that immediate construction area.

B. Erosion and Pollution Control Schedule: At or prior to the preconstruction conference, the Contractor shall submit to the Owner for his information, three (3) copies of his erosion and pollution control work schedule. This schedule shall show the time relationship between phases of the Work which must be coordinated to reduce erosion and pollution, and shall describe construction practices and temporary control measures which will be used to minimize erosion and pollution. The schedule shall also show the Contractor's proposed method of erosion control on haul roads and borrow and material pits, and his plan for disposal of waste materials or other sources of pollution. Maps or other documents may also be required to show the proposed final surface gradient of proposed borrow pits, soil type base course pits, and waste areas. No work shall be started until the erosion and pollution control schedules and methods of operations have been submitted to the Owner for his information.

C. Air Pollution Controls:

1. Contractor shall control dust caused by his operations in the construction of the Project, including but not specifically limited to the following:

    a. Clearing, grubbing, and stripping.

    b. Excavation and placement of embankment.

    c. Cement and aggregate handling.

    d. Limerock stabilization.

    e. Use of haul roads.

    f. Sandblasting or grinding.

2. Contractor shall control air pollution from the following causes in constructing the project:

    a. Volatiles escaping from asphalt and cutback materials.

    b. Use of herbicides or fertilizers.

3. Control of dust and other air pollutants by the Contractor shall include:

    a. Exposing the minimum area of land.

    b. Applying temporary mulch with or without seeding.

    c. Use of water sprinkler trucks.

    d. Use of covered haul trucks.

e. Use of stabilizing agents in solution.

f. Use dust palliatives and penetration asphalt on temporary roads.

g. Use of wood chips in traffic and work areas.

h. Use of vacuum-equipped sandblasting systems.

i. Use of plastic sheet coverings.

j. Restricting the application rate of herbicides to recommended dosage. Materials shall be covered and protected from the elements. Application equipment and empty containers shall not be rinsed and discharged so as to pollute a stream, river, lake, pond, water impoundment, or the ground water.

k. Relay of operations until climate or wind conditions dissipate or inhibit the potential pollutants.

D. Open Burning of Combustible Wastes: No open burning of combustible waste materials or vegetation shall be permitted. All waste materials shall be removed from the site or within public rights-of-way and disposed in a legal manner.

E. Permanent and Temporary Water Pollution Control (Soil Erosion):

1. Sufficient precautions shall be taken during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride, or other polluting materials harmful to humans, fish, or other life, into the supplies and surface waters of the State. Control measures must be adequate to assure that turbidity in the receiving water will not be increased more than allowed by the State or controlling agency. Such measures may consist of construction of berms, dikes, dams, drains and sediment basins, or use of fiber mats, woven plastic filter cloths, gravel, mulches, quick growing grasses, sod, bituminous spray and other erosion control devices or methods approved by the State or controlling agency.

2. The Contractor shall promptly clear all waterways and drainage patterns of false work, piling, debris, or other obstructions placed during construction work and not a part of the finished work.

3. The Contractor shall remove and dispose of silt accumulations as directed by the Engineer or the Owner.

4. If new and additional erosion control structures are to be installed, under this project, to prevent possible future erosion as a result of work under this contract, they shall be constructed concurrently with the other work, as early as possible, and as conditions permit.

F. Noise Control: The Contractor shall provide adequate protection against objectionable noise levels caused by the operation of construction equipment in order to comply with all current City ordinances and these Specifications. Sound levels shall be measured at the exterior of the nearest exterior wall of the nearest residence or building. Levels at construction equipment shall not exceed 85 dBA at any time. Sound levels in excess of allowable values are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or Owner for excessive noise shall not relieve the Contractor of the other portions of this Specification including, but not limited to completion dates and bid amounts.

1.16 SITE CLEANUP AND RESTORATION

A. The Contractor shall keep the working area free at all times of tools, materials and equipment not essential to the progress of the Work. Debris, waste materials, and rubbish shall be properly disposed of and not allowed to accumulate. If the Contractor should fail to do this, the Owner will make the necessary arrangements to effect the cleanup by others and will back charge the cost to the Contractor. If such action becomes necessary on the part of and in the opinion of the Owner, the Owner will not be responsible for the inadvertent removal of material which the Contractor would not have disposed of had he effected the required cleanup.

B. Where material or debris has washed or flowed into or been placed in watercourses, ditches, gutters, drains, catch basins, or elsewhere as result of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the Work, and the ditches, channels, drains etc., kept in a clean and neat condition.

C. On or before the completion of the Work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations, in a neat and satisfactory condition.

D. The Contractor shall restore the entire project site to its original or better condition, with the exception of any area(s) designated for alteration by the Contract Documents. The Contractor shall restore or replace; when and as directed, any public or private property damaged by his work, equipment, or employees to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration.

E. The Contractor shall thoroughly clean all materials and equipment installed by him and his subcontractors and on completion of the Work shall deliver it undamaged and in fresh and new appearing condition.

1.17 LAWS AND REGULATIONS

A. It shall be the responsibility of the Contractor to give all notices and comply with all the laws, rules, regulations, ordinances, etc., that may be applicable at the time the Work is started on the project. Should the Contractor discover the Drawings or Specifications are contradictory to, or in variance with the above, he shall notify the Engineer immediately, in writing, in order that any required changes or modifications can be made. It is not the Contractor's responsibility to make certain that the Drawings or Specifications are in non-compliance with any of the above; however, should he be aware of any existing discrepancy, or have reason to believe such may exist and performs work without proper notice to the Engineer, the Contractor shall be responsible for any cost involved in making the necessary alterations or corrections.

1.18 CONTRACTOR'S USE OF PREMISES

A. All project construction work will be accomplished on the Owner's property, public/private rights-of-way/easements or within temporary construction easements and the Contractor shall confine his activity to those designated areas. The Contractor shall not enter upon private property for any reason without securing prior permission from the property owner. Such permission, including any stipulations, shall be in writing and a copy shall be delivered to the Engineer prior to the Contractor's entry or occupation of the subject property. This requirement will be rigidly enforced, particularly with regard to the utilization of vacant areas adjacent to the work site for the storage of materials or parking equipment.

B. The Contractor shall perform his work in such manner that he will not damage adjacent public or private property. Any damage to existing physical structures or utility services shall be repaired or restored promptly at no expense to the Owner.

C. The Contractor shall avoid damage to and preserve all existing vegetation (grass, shrubs, trees, etc.) on or near the work area which do not, within reason, interfere with construction. The Contractor will be responsible for and required to replace or restore all such vegetation damaged or destroyed at no cost to the Owner. The Contractor will also be responsible for any unauthorized cutting or damage to trees, shrubs, etc., and also damage caused by careless operation of equipment, storage of materials and rutting or tracking of grass by equipment.

D. 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 are designated as follows: Suitable material, as approved by Engineer, from excavations for project structures. Any additional borrow material required shall be provided by the Contractor from off-site.

2. On-site spoil areas will become property of the Contractor and are to be disposed off-site.

E. Construct all fill areas so runoff will not flood improved areas.

F. All connections to existing piping systems shall be made as shown or indicated on the Drawings after consultation, cooperation, and coordination with the Owner. Some such connections may have to be made during off-peak hours (late night or early morning hours). The Contractor shall give a minimum of 72 hours notice to the Owner when tie-ins with the existing plant utilities are required and shall provide additional advance notice where directed by the Drawings or Specifications.

1.19 HAZARDOUS LOCATIONS

A. The Contractor shall be responsible for identification of hazardous locations, appropriate construction methods, and all other safety issues.

1.20 ADDITIONAL PROVISIONS

A. The Contractor shall provide at his own cost all necessary temporary facilities for access to, and for protection of, all existing structures. 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 Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

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

a. Make physical arrangements to attend meetings (if required).
b. Attend Progress meetings.

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

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

4. The Contractor shall record the preconstruction meeting and each progress meeting in its entirety, and shall provide the Engineer with a copy of such recording, having good quality and clarity.

B. Related Requirements Described Elsewhere:

1. Construction Progress Schedules: Section 01310.

2. Shop Drawings, Working Drawings, and Samples: Section 01340.

3. Project Record Documents: Section 01720.

1.02 PRECONSTRUCTION MEETING

A. Engineer will schedule a preconstruction meeting no later than thirty (30) days after date of Notice to Proceed. The meeting shall be scheduled at the convenience of all parties.

B. Location: South Regional Campus Administration Building (Bldg A)

C. Attendance:

1. Owner.

2. Engineer and his professional consultants.

3. Resident project representative.

4. Contractor and his superintendent.

5. Major subcontractors.

6. Representatives of major suppliers and manufacturers as appropriate.

7. Governmental representatives as appropriate.

8. Others as requested by the Contractor, Owner, and Engineer.

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

E. Contractor shall provide a preliminary construction schedule to demonstrate complete fulfillment of contract requirements utilizing critical path method at the Pre-Construction Meeting.

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

1. Distribution and discussion of:

   a. List of major subcontractors and suppliers.
   b. Projected schedules.
   c. Schedule of Values.

2. Critical work sequencing: Relationships and coordination with other contracts and/or work.

3. Major equipment deliveries and priorities.

4. Project coordination: Designation and responsible personnel.

5. Procedures and processing of:

   a. Field decisions.
   b. Proposal requests.

c. Request for Information.
d. Submittals.
d. Change Orders.
f. Applications for Payment.

6. Submittal of Shop Drawings, project data and samples.

7. Adequacy of distribution of Contract Documents.

8. Procedures for maintaining Record Documents

9. Use of premises:

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

10. Construction facilities, controls, and construction aids.

11. Temporary utilities.

12. Safety and first aid procedures.

13. Check of required Bond and Insurance certifications.

14. Completion time for contract and liquidated damages.

15. Request for extension of Contract Time.

16. Procedures for periodic monthly (or whatever interval is deemed appropriate or necessary, however, a minimum of monthly meetings will be required) progress meetings, for all involved.

17. Security procedures.

18. Procedures for making partial payments.

19. Guarantees on completed work.

20. Equipment to be used.

21. Project layout and staking of work.

22. Project inspection.

23. Labor requirements.

24. Laboratory testing of material requirements.

25. Provisions for material stored on site and monthly inventory of materials stored.

26. Requirements of other organizations such as utilities, railroads, highway departments, building departments.

27. Rights-of-way and easements.

28. Housekeeping procedures.

29. Liquidated damages.

30. Posting of signs and installation of Project Sign.

31. Pay request submittal dates.

32. Equal opportunity requirements.

1.03 PROGRESS MEETINGS

A. The Engineer shall schedule regular periodic meetings. The progress meetings will be held as needed 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.

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

C. Location of the meetings: South Regional Campus Administration Building (Bldg A).

D. Attendance:

1. Engineer and his professional Subconsultants as needed.

2. Resident Project Representative.

3. Contractor and his Superintendent.

4. Owner's representatives.

5. Subcontractors (active on the site, as appropriate to the agenda).

6. Others as appropriate to the agenda (suppliers, manufacturers, other subcontractors, etc.).

E. The Engineer shall preside at the meetings and provide for keeping minutes and distribution of the minutes to the Owner, Engineer, and others. The purpose of the

meetings will be to review the progress of the Work. Contractor shall provide updated progress construction schedule at each progress meeting.

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

1. Review approval of minutes of previous meeting.

2. Review of Work progress since previous meeting and Work scheduled (3-week look ahead schedule).

3. Field observations, problems, conflicts.

4. Problems which impede construction schedule.

5. Review of off-site fabrication, delivery schedules.

6. Corrective measures and procedures to regain projected schedule.

7. Status of approved Construction Schedule and revisions to the Construction Schedule as appropriate.

8. Progress schedule during succeeding work period.

9. Coordination of schedules.

10. Review status of submittals and submittal schedule, expedite as required.

11. Maintenance of quality standards.

12. Pending changes and substitutions.

13. Shop drawing problems.

14. Review proposed changes for:

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

15. Critical/long lead items.

16. Other business.

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

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

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

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

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

H. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01340: Shop Drawings, Working Drawings, and Samples.

PART 2- PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01310

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Promptly after award of the Contract, prepare and submit to the Engineer estimated construction progress schedules 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, The Use of CPM in Construction, A Manual for General Contractors and the Construction Industry, Copyright 1976, but the provisions of this Specification shall govern the planning, coordinating, and performance of the Work.

2. Submit revised progress schedules on a monthly basis. No partial payments shall be approved until there is an updated construction progress schedule on hand.

B. Related Requirements Described Elsewhere:

1. Conditions of the Contract.

2. Summary of Project: Section 01010.

3. Project Meetings: Section 01200.

4. Shop Drawings, Working Drawings, and Samples: Section 01340.

5. Schedule of Values: Section 01370.

1.02 QUALIFICATIONS

A. A statement of computerized CPM capability shall be submitted 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.

1.03 FORM OF SCHEDULES

A. Prepare schedules in the form of a horizontal bar chart.

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) Identify the first work day of each month.

3. Scale and Spacing: Sufficient to allow space for notations and future revisions.

4. Maximum Sheet Size: 24 inches by 36 inches.

B. Format of Listings: The chronological order of the start of each item of work for each structure.

C. Identification of Listings: 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., Microsoft Project, or approved equal.

1.04 CONTENT OF SCHEDULES

A. Construction Progress Schedule:

1. Show the complete sequence of construction by activity and by structure.

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.

3. Show projected percentage of completion for each item, as of the first day of each month.

4. Show projected dollar cash flow requirements for each month of construction and for each activity as indicated by the approved Schedule of Values.

B. Submittals for construction progress schedules shall be in accordance with Section 01340: Shop Drawings, Work Drawings, and Samples. Indicate on the schedule the following:

1. The dates for 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 typewritten list of all long lead items (equipment, materials, etc.).

D. Failure to include any element of work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date.

E. Scheduling Constraints: The work within Owner's property must be completed within the maximum number of days start to finish, as indicated in the Contract. Additionally, work must proceed on a continuous basis, without stoppages, except for nights and weekends. There shall be no lapses between phases of construction.

1.05 PROGRESS REVISIONS

A. Indicate progress of each activity to date of submission.

B. Show changes occurring since previous submission of schedule:

1. Major changes in scope.

2. Activities modified since previous submission.

3. Revised projections of progress and completion.

4. Other identifiable changes.

C. Provide a narrative report as needed to define:

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 prime contractors.

D. If the Work falls behind the critical path schedule by two (2) weeks or more, the Contractor shall prepare a recovery schedule.

1.06 SUBMISSIONS

A. Submittal Requirements.

1. Logic network and/or time-phased bar chart, computer generated.

3. Narrative description of the logic and reasoning of the schedule.

B. Time of Submittals: Within ten (10) working days after Notice to Proceed, Contractor shall submit a network diagram describing the activities to be accomplished in the project and their dependency relationships, (predecessor/successor) as well as a tabulated schedule as herein defined. The total length of time indicated on the initial CPM schedule shall equal the exact number of days as defined in the Contract. 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. 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 Contractor to review the proposed plan and schedule to discuss any clarifications that may be necessary.

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

D. Acceptance. The finalized schedule will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates an orderly progression of the Work to completion in accordance with the Contract Documents. Such acceptance will neither impose on the Engineer responsibility for the progress or scheduling of the Work nor relieve Contractor from full responsibility therefore. The finalized schedule 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. 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. When the network diagram and tabulated schedule have been accepted, the Contractor shall submit to the Engineer electronic copies (PDF) of the time-scaled network diagram, computerized tabulated schedule in which the activities have been sequenced by numbers, computerized tabulated schedule in which the activities have been sequenced by early starting date, computerized, tabulated schedule in which activities have been sequenced by total float, and an electronic copy (PDF) sorted by predecessor/successor.

E. Revised Work Schedules. Contractor, if requested by the Engineer, shall provide a revised work schedule if, at any time, the Engineer considers the completion date to be in jeopardy because of "activities behind schedule." The revised work schedule shall include a new diagram and tabulated schedule conforming to the requirements of Paragraph 1.09 herein, designed to show how Contractor intends to accomplish the

Work to meet the completion date. The form and method employed by Contractor shall be the same as for the original work schedule. No payment will be made if activities fall more than two (2) weeks behind schedule and a revised work schedule is not furnished.

F. Schedule Revisions. The Engineer may require Contractor to modify any portions of the work schedule that become infeasible because of "activities behind schedule" or for any other valid reason. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule. No change may be made to the sequence, duration, or relationships of any activity without approval of the Engineer.

1.07 DISTRIBUTION

A. Distribute copies of the reviewed schedules to:

1. Engineer.

2. Jobsite file.

3. Subcontractors.

4. Other concerned parties.

5. Owner (two copies).

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

1.08 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 schedule by the Contractor.

1.09 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, The Use of CPM in Construction, A Manual for General Contractors and the Construction Industry, Copyright 1976.

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 in Paragraph 1.09, D. herein.

2. All construction activities and procurement shall be indicted 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 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. The initial schedule shall include the following minimum data for each activity.

1. Activity Beginning and Ending Numbers (i-j numbers) (single activity numbers may be used).

2. Duration.

3. Activity Description.

4. Early Start Date (Calendar Dated).

5. Late Start Date (Calendar Dated).

6. Early Finish Date (Calendar Dated).

7. Late Finish Date (Calendar Dated).

8. Identified Critical Path.

9. Total Float (Note: No activity may show more than 20 days float).

10. Cost of Activity.

11. Equipment Hours, by type; Man-Power Hours, by crew or trade.

F. Project Information. Each tabulation shall be prefaced with the following summary data.

1. Project Name.

2. Contractor.

3. Type of Tabulation (Initial or Updated).

4. Project Duration.

5. Project Scheduled Completion Date.

6. Effective or Starting Date of the Schedule.

7. New Project Completion Date and Project Status (if an updated or revised schedule).

8. Actual Start Date and Actual Finish Date (for all updated schedules.)

1.10 SCHEDULE MONITORING

A. At not less than monthly intervals or when specifically requested by Engineer, Contractor shall submit to the Engineer a PDF of an updated schedule for those activities that remain to be completed. Typically, the updated schedule will be submitted with the application for payment as specified below.

B. The updated schedule shall be submitted in the form, sequence, and number of copies requested for the initial schedule.

1.11 PROGRESS MEETINGS

For the monthly progress meeting, Contractor shall submit a revised CPM schedule and a three-week look-ahead schedule, showing all activities completed, in progress, uncompleted, or scheduled to be worked during the weeks. The three weeks include the current week plus the next two weeks. All activities shall be from the approved CPM and must be as shown on the

CPM unless behind or ahead of schedule. One copy of the revised CPM schedule shall be submitted with each copy of that month's application for payment, six (6) copies minimum.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01340

SHOP DRAWINGS, WORKING DRAWINGS, AND SAMPLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. 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 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, Data, and Samples for materials and equipment specified elsewhere in the Specifications and in the Drawings.

2. Within fourteen (14) calendar days after the Effective Date of the Agreement, the Contractor shall submit to the Engineer a complete list of preliminary 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 in order to expedite final review of Shop Drawings.

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

a. Submittal description and number assigned.

b. Date to Engineer.

c. Date returned to Contractor (from Engineer).

d. Status of submittal (Approved, Approved as Noted, Amend and Resubmit, and Rejected).

e. Date of resubmittal and return (as applicable).

f. Date material release (for fabrication).

g. Projected date of fabrication.

h. Projected date of delivery to site.

i. Status of O&M manuals submittal.

j. Specification Section.

k. Drawings sheet number.

B. Related Requirements Described Elsewhere:

1. General Conditions.

2. Construction Progress Schedules: Section 01310.

3. Material and Equipment: Section 01600.

4. Project Record Documents: Section 01720.

1.02 CONTRACTOR'S RESPONSIBILITY

A. It is the responsibility of the Contractor to check all drawings, data and samples prepared before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents. If the Contractor takes exception to the specifications, the Contractor shall note the exception in the letter of transmittal to the Engineer.

B. Determine and verify:

1. Field measurements.

2. Field construction criteria

3. Catalog numbers and similar data.

4. Conformance with Specifications.

C. The Contractor shall furnish the Engineer a schedule of 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.

D. The Contractor shall not begin any of the work covered by a Shop Drawing, Data, or a Sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with approval.

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

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

1. Date.

2. Project Title and Number.

3. Contractor's name and address.

4. The number of each Shop Drawings, 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 submittal of shop drawing if there is a deviation from the Drawings, Specifications, or referenced specifications or codes.

b. The Contractor shall also list any deviations from the Drawings, Specifications, or referenced specifications or codes and identify in green ink prominently on the applicable Shop Drawings.

6. Submittal Log Number conforming to Specification Section Number.

G. The Contractor shall submit shop drawings of descriptive or product data information to the Engineer electronically for review and provide up to five (5) hard copies of approved submittals.

H. The Contractor shall be responsible for and bear all costs of damages which may result from the ordering of any material or from proceeding with any part of Work prior to the completion of the review by the Engineer of the necessary Shop Drawings.

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

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

K. Each submittal will bear a stamp indicating that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and

approval of that submittal. The Contractor stamp shall be similar to the sample given below.

(OWNER'S NAME)
(PROJECT NAME)
(PROJECT NUMBER)

SHOP DRAWING NO.:_____

SPECIFICATION SECTION:_____ 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 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 AND THE CONTRACT DOCUMENTS.

_____ NO VARIATION FROM CONTRACT DOCUMENTS

_____ VARIATION FROM CONTRACT DOCUMENTS AS SHOWN

(CONTRACTOR'S NAME)
(CONTRACTOR'S ADDRESS)

BY: _____ DATE:_____
AUTHORIZED SIGNATURE

L. 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.

1.03 ENGINEER'S REVIEW OF SHOP DRAWINGS

A. The Engineer's review of Shop Drawings, Data, and Samples as submitted by the Contractor will be to determine if the items(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 dimensions, connections, quantities, and details of the material, equipment, device, or item shown.

B. The review of drawings and schedules will be general, and shall not be construed:

1. As permitting any departure from the Contract Documents.

2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.

3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract 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.

D. "Approved As Noted" - Contractor shall incorporate Engineer's comments into the submittal before release to manufacturer. The Contractor shall send a letter to the Engineer acknowledging the comments and their incorporation into the Shop Drawing.

E. "Amend And Resubmit" - Contractor shall resubmit the Shop Drawing to the Engineer. The resubmittal shall incorporate the Engineer's comments highlighted on the Shop Drawing.

F. "Rejected" - Contractor shall correct, revise and resubmit Shop Drawing for review by Engineer.

G. 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 make any corrections required by the Engineer.

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

I. 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.

J. 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 Specifications Sections.

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. Only the Engineer shall utilize the color "red" in marking Shop Drawing submittals.

L. Shop drawing and submittal data shall be reviewed by the Engineer for each original submittal and first resubmittal; thereafter review time for subsequent resubmittals shall be charged to the Contractor and the Contractor shall reimburse the Owner for services rendered by the Engineer as specified in the Supplementary Conditions.

1.04 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawing" shall be considered to mean Contractor's plans for materials and equipment which become an integral part of the Project. Shop Drawings shall be complete and detailed and shall consist of fabrication, erection, setting and schedule drawings, manufacturer's scale drawings, and wiring and control diagrams. Catalogs cuts, catalogs, pamphlets, descriptive literature, and performance and test data shall be considered only as supportive information to required Shop Drawings as defined above. 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.

B. 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.

C. Each Shop Drawing shall be submitted with an 8-1/2" by 11" cover sheet which shall include a title block for the submittal. Each Shop Drawing cover sheet shall have a blank area 3-1/2 inches high by 4-1/2 inches wide, located adjacent to the title block. The title block/cover sheet shall display the following:

1. Project Title and Number.

2. Name of project building or structure.

3. Number and title of the Shop Drawing.

4. Date of Shop Drawing or revision.

5. Name of Contractor and subcontractor submitting drawing.

6. Supplier/manufacturer.

7. Separate detailer when pertinent.

8. Specification title and Section number.

9. Applicable Drawing number.

D. 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 Data.

E. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, and address, and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

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

G. 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.

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, 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 paragraph 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.

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, calculations or other sufficient information to completely explain the structure,

machine, or system described and its intended manner of use. 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. 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 two (2) 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 Project.

7. Submittal and specification numbers.

(Samples of finished materials shall have additional marking that will identify them under the finished schedules.)

D. 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 Paragraphs 1.06B and 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.

E. 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Submit to the Engineer a Schedule of Values allocated to the various lump sum portions of the Work, at the Pre-Construction Conference.

2. Upon request of the Engineer support the values with data which 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.

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

B. Related Requirements Described Elsewhere:

1. Conditions of the Construction Contract.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

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

1. Title of project and location.

2. Owner and purchase order number.

3. Engineer and project number.

4. Name and address of Contractor.

5. Contract designation.

6. Date of submission.

B. Schedule shall list the installed 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.

C. Identify each line item with the number and the title of the respective section of the Specifications.

D. For each major item of the Work, list sub-values of major products or operations under the major item.

E. For the various portions of the Work:

1. The amount for each item shall reflect a total installed cost including a directly proportional amount of the Contractor's overhead and profit.

2. For items on which progress payments will be requested for stored materials, break down the value into:

a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials. Payment for materials shall be limited to the invoiced amount only.

b. The total installed value.

F. Round off figures to nearest dollar amount.

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

H. For each item which has an installed value of more than $15,000, provide a breakdown of costs to list major products or operations under each item.

1.03 SUBSCHEDULE 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 unit values for the materials shall be broken down into:

1. Cost of the material, delivered and unloaded at the site, with taxes paid.

2. Copies of paid invoices for component material shall be included with the payment request in which the material first appears.

C. 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.

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

1.04 REVIEW AND RESUBMITTAL

A. After review by Engineer, revise and resubmit Schedule of Values and Schedule of Unit Material Values as required.

B. Resubmit revised schedules in same manner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 SCOPE OF WORK

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

B. Related Requirements Described Elsewhere:

1. Project Requirements: Section 01005.

2. Summary of Project: Section 01010.

3. Project Record Documents: Section 01720.

1.02 PHOTOGRAPHY REQUIRED

A. Photographs taken in conformance with this Section shall be furnished to the Engineer with each pay request.

B. Photographs shall be taken at each of the major stages of construction and as directed by the Engineer.

C. Non-Aerial photographs may be taken by the Contractor's personnel but must be of professional quality as herein specified. Photographs which are deemed unsatisfactory by the Engineer will be rejected and retakes will be required at no additional cost to the Owner.

D. Aerial photographs shall be taken and reproduced by a professional aerial photography service. Aerial photos reproduced by the Contractor will not be accepted. Photographs which are deemed unsatisfactory by the Engineer will be rejected and retakes will be required at no additional cost to the Owner.

E. Views and Quantities Required:

1. Digital photos one (1) view of each activity as directed by the Resident Project Representative, up to a limit of fifteen (15) activities photographed per month.

2. Digital photos of five (5) views of overall Project site monthly, as directed by the Resident Project Representative.

3. Aerial photography required: none.

4. Provide up to six (6) prints upon request at no additional cost to the Owner.

F. Digital Photograph Files:

1. On a monthly basis, provide digital image files for each photo specified above in JPEG (.jpg) format or approved equal.

2. Digital files shall be maintained in the original file size as taken. Digital photograph files which are deemed unsatisfactory by the Engineer will be rejected, and retakes will be required at no additional cost to the Owner.

1.03 COST OF PHOTOGRAPHY

A. The Contractor shall pay costs for specified photography and prints. Parties requiring additional photography or prints will pay the photographer directly.

PART 2 - PRODUCTS

2.01 PRINTS

A. Type of Print:

1. Paper: Single weight, color print paper.

2. Finish: Smooth surface, glossy.

3. Size: 8 inch x 10 inch for construction photos and preliminary aerial photos, 16 inch x 20 inch for selected aerial photos.

B. Identify each print on back, listing:

1. Name of project.

2. Detailed description of view, including point from which exposure made, compass direction of view, vertical direction of view (horizontal, looking up, looking down, etc.), identification of main features in view and any other data and information pertinent to the purpose and identification the exposure photographer feels necessary to include.

3. Date and time of exposure.

4. Name and address of photographer.

5. Photographer's numbered identification of exposure.

6. Weather conditions under which exposure made.

C. Print Mounting

1. Each print to be inserted in a clear plastic envelope designed for the purpose.

a. Print deterioration not to be caused by envelope material or fabrication.

b. Designed to prevent print from accidently slipping out of the envelope.

c. Front and back of print to be visible through the plastic envelope.

d. Permit convenience removal and insertion of print.

e. To have 1 inch hinged binding edge suitable for binder insertion.

PART 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 to adequately illustrate condition of construction and state of progress.

1. At successive periods of photography, take at least one photograph from the same overall view as previously photographed.

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

3.03 DELIVERY OF PRINTS

A. Provide link to digital files to the Engineer to accompany each Application for Payment.

B. Distribution of construction prints (when requested) as soon as processed is anticipated to be as follows:

1. Owner: two (2) sets.

2. Engineer: two (2) sets.

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

4. Contractor: one (1) set.

END OF SECTION

SECTION 01390

PRE-CONSTRUCTION AUDIO-VIDEO RECORD

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section outlines in general the work necessary to provide a continuous color audio-video DVD recording covering the entire length of the Project and at all proposed construction sites within the Project area prior to construction to serve as a record of pre-construction conditions and periodic color photographs during the course of construction.

1.02 RELATED REQUIREMENTS

A. Section 01010: Summary of Work.

1.03 QUALIFICATIONS

A. The pre-construction audio-video recording shall be of a professional quality that will clearly log an accurate visual description of existing conditions. The recording shall be high quality DVD. The audio-visual recording shall clearly show the date and time of recording. Any portion of the DVD not acceptable for the determination of the existing condition shall be rerecorded at no additional cost to the Owner.

1.04 SCHEDULING

A. The audio-visual recording shall be done and furnished to the Owner and Engineer prior to placement of materials or equipment in any of the construction or construction access areas.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PRECONSTRUCTION AUDIO-VIDEO RECORDING

A. Technique

1. Factual presentation.

2. Correct exposure and focus.

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

B. Coverage

1. The recording shall include all existing buildings, driveways, sidewalks, curbs, ditches, shrubbery or other structures located in the vicinity of the proposed construction and site access.

C. Visibility

1. The DVD recording shall be recorded during a time of good visibility. Recordings will not be made during periods of precipitation or when conditions are obscured.

D. DVD Identification and Security

1. All DVD recordings shall be permanently labeled and shall be properly identified by DVD number and project title.

2. To preclude the possibility of tampering or editing in any manner, all 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. For example, 13:24:10. This transparent information shall appear on the screen.

E. DVD Camera Operation

1. Camera Height and Stability: When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed 10 feet. The camera shall be firmly shock mounted such that the transport of the camera during the recording process will not cause an unsteady picture.

2. Camera Control: Camera pan, tilt, zoom-in and zoom-out rates shall be sufficiently controlled such that recorded objects will be clearly viewed during DVD playback. In addition, all other camera and recording system controls, such as lens focus and aperture, video level, pedestal, chrome, white balance, and electrical focus shall be properly controlled or adjusted to maximize picture quality.

3. Viewer Orientation Technique: The audio and video portions of the recording shall maintain viewer orientation through the entire area of proposed construction.

3.02 DELIVERY OF DVD

A. Color audio-video recording in DVD Format to be delivered to Owner prior to start of construction as a shop drawing submittal.

END OF SECTION

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

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

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

3. The Contractor shall provide Engineer with all test results herein within five (5) days of receipt.

B. Related Requirements Described Elsewhere:

1. Conditions of the Contract.

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

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

4. Testing laboratory inspection, sampling and testing is required for, but not limited to the following:

a. Excavating, Backfilling, and Compaction.

b. Cast-in-Place Concrete.

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

Test	Notes	Paid for By
Soil Compaction	Pipe Work: every 300 ft. at each lift of compaction minimum. Beneath Structures: each 500 SF each lift of compaction minimum.	Contractor
Concrete	Slump test each delivery and compression test five cylinders every 50 C.Y. minimum. Compression test required for all concrete deliveries.	Contractor
Pressure	Per project manual Specifications	Contractor
Bacteriological	Per FDEP/DOH Specifications	Contractor
LBR	Each 2,400 SF of pavement minimum, and every 300 feet in roadway	Contractor
Asphaltic Concrete Pavement	Field Density – Every 300 feet in roadway, minimum of one (1) per parking/maneuvering area Thickness Test - Every 500 ft, minimum of one (1) per parking/maneuvering area	Contractor

1.02 LABORATORY DUTIES: LIMITATIONS OF AUTHORITY

A. Cooperate with Engineer and Contractor; provide qualified personnel promptly on notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction:

1. Comply with specific standards; ASTM, other recognized authorities, and as specified.

2. Determine and report on compliance with requirements of Contract Documents.

C. Promptly notify the Engineer and Contractor of material or operations which do not meet the specifications.

D. Promptly submit five (5) copies of reports of inspections and tests to the Engineer including:

1. Date issued.

2. Project title and Engineer's job number.

3. Testing Laboratory name and address.

4. Name and signature of inspector.

5. Date of inspection or sampling.

6. Record of temperature and weather.

7. Date of test.

8. Identification of product and Specification section.

9. Location in project.

10. Type of inspection or test.

11. Compliance with Contract Documents or not.

E. Perform additional services as required by Owner.

F. Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of 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 laboratory personnel. Provide access to Work and manufacturer's operations.

B. Secure and deliver to the laboratory adequate representational samples of materials proposed to be used and which require testing.

C. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacturer or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The Engineer may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of providing

statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.

D. Furnish incidental labor and facilities:

1. To provide access to Work to be tested.

2. To 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.

E. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall provide temporary facilities to expedite the Work. Temporary facilities shall include the following items:

1. By Contractor:

a. Temporary water service.
b. Temporary electrical service.
c. Temporary sanitary facilities.
d. Contractor's Field office.
e. Engineer's Field office.

2. By Owner:

a. None.

1.02 TEMPORARY WATER

A. The Contractor shall furnish and install temporary water service at each site for use throughout construction period. Temporary water service shall be provided as

1. Water for construction purposes.

2. Water for other purposes.

a. Testing.
b. Temporary sanitary facilities.
c. Cleaning.
d. Potable uses

B. The Contractor shall maintain adequate volume and quality of water for all purposes.

C. Water Source:

1. Supplier: City of Palm Bay

2. Potable water used shall be separately metered and protected with approved back flow prevention devices. Water for drinking and other potable uses shall be provided by the Contractor. Potable water may be provided at each sit e as

bottled water supplied and serviced by a bottled water service company in 5-gallon carbouys, or may be supplied using an approved filtration and treatment system. No less than 15 gallons of potable water shall be supplied per week.

D. The Contractor shall maintain strict supervision of use of temporary services.

1. Enforce conformance with applicable codes and standards.

2. Enforce sanitary practices.

3. Prevent waste of water.

4. Prevent abuse of services.

E. Costs of Installation and Operation:

1. The Contractor shall pay costs for water used by all trades, including costs of installation, maintenance, and removal of pipe, meters, and equipment.

F. Requirements of Regulatory Agencies:

1. The Contractor shall obtain and pay for permits, fees, and deposits required by regulatory authorities.

2. The Contractor shall comply with federal, state, and local codes.

1.03 TEMPORARY ELECTRICITY

A. The Contractor shall furnish and install temporary electric power service at each site for construction needs throughout construction period.

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 100 feet extension.
b. Provide weatherproof distribution box with 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 foP entire system.
e. Users shall provide grounded, Underwriters Laboratories, Inc. (UL) approved extension cords from power center to point 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, Subcontractors and Owner/Engineer's field offices.

B. Capacity:

1. Adequate electrical service for construction use by all trades during construction period.

2. Notify 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 & Light

2. Provide minimum 240 volt, single phase, 60 hertz power service to each project (if not available, a portable generator shall be provided). The use of portable generators is allowed, however, it is recommended to disconnect the temporary power from metered power supply prior to using portable generators.

D. The Contractor shall 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: The Contractor shall pay costs of temporary electrical power used, including costs of installation, meter, maintenance, and removal of temporary services from point of connection.

F. The Contractor shall comply with the requirements of regulatory agencies:

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

2. Comply with applicable codes.

a. National Electrical Code.
b. National Electrical Safety Code.
c. National Fire Protection Association.

d. Federal, state, and local codes and utility company regulations.

1.04 TEMPORARY SANITARY FACILITIES

A. The Contractor shall furnish and install temporary sanitary facilities for use throughout the period of Work at each site.

1. Work-site potable water for construction personnel:

a. Insulated portable containers to dispense drinking water.

b. Maintain water temperature between 45 degrees Fahrenheit (°F) (7.5 ºC) and 55 °F (13 ºC).

2. Enclosed toilet facilities for construction personnel.

3. General employee washing facilities.

B. The minimum number of fixtures at each site shall be:

1. Toilets and Urinals

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

2. Washing Facilities: Adequate for number of employees, for type of work requiring washing facilities.

C. The Contractor shall 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.

D. The Contractor shall pay the costs of installation and operation at all sites.

1. The Contractor shall pay the costs of temporary sanitary facilities, including costs of installation, maintenance, and removal.

2. The Contractor shall pay the costs of Water as specified in Paragraph 1.02C.2. herein.

3. The Contractor shall pay service charges for use of portable sanitary units.

E. Facility Locations:

1. At each site, the facilities shall be within the project site.

2. Drinking water containers shall be convenient to work stations.

3. Toilet and washing facilities shall be:

a. Secluded from public observation.
b. Convenient for use of personnel in relation to work stations.

4. The Contractor shall submit proposed locations for sanitary facilities to the Engineer and Owner for review and approval.

F. The Contractor shall provide enclosures for toilet facilities at each site:

1. Weatherproof, sightproof, sturdy temporary enclosures.

2. Insect-proof screening, adequate natural ventilation.

G. The Contractor shall ensure that sanitary facilities are clean and maintained at all times.

1. Sanitary facilities shall be serviced by the supplier, at a minimum, twice per work week.

H. Requirements of Regulatory Agencies:

1. The Contractor shall obtain and pay for permits as required by regulatory authorities.

2. The Contractor shall comply with federal, state, and local codes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. Materials may be new or used, but must be adequate for purpose required, and must not violate requirements of applicable codes.

2. At Contractor's option, patented specialty products may be used, in compliance with applicable codes.

2.02 ELECTRICITY (See Section 1.03)

A. The Contractor shall provide required facilities, including transformers, conductors, poles, conduits, raceways, breakers, fuses and switches.

B. The Contractor shall provide appropriate enclosures for environment in which used, in compliance with NEMA standards.

2.03 TEMPORARY SANITARY FACILITIES (See Section 1.04)

A. Drinking Water Facilities (Portable Containers):

1. Shall be tightly closed and equipped with a dispensing tap.

2. Shall be clearly label as “Potable Water”.

3. Shall not be used for other purposes.

4. The Contractor shall provide single-service disposable cups, with sanitary container for unused cups, and waste receptacles for used cups.

B. Toilet Facilities

1. Portable Toilets may be either:

a. Chemical toilets.

b. Recirculating toilets.

c. Combustion toilets.

2. Toilet Tissue: Provide at each toilet, on suitable dispenser.

2.04 CONTRACTOR'S FIELD OFFICE AND FACILITIES

A. Specific Requirements: The Contractor’s Field Office shall have equipment and facilities sufficient for effective communication with the Owner and Engineer, for organization and control of the Work, and for efficient record keeping. The Contractor’s field office shall

1. At each site, the Contractor shall provide either a separate building or a trailer of adequate floor space for Contractor's use.

2. The trailer shall be weather-tight, have a tight, level floor at least 8 inches off the ground, and shall be insulated, have suitable screened ventilation and a solid door.

3. The office shall be provided with janitor service, heating equipment, water, electrical wiring, outlets, and fixtures suitable to light the tables and desk adequately. Toilet facilities are to be included with a holding tank to be pumped clean weekly by the Contractor. Garbage shall be collected weekly and clean-up of the trailer shall be provided one (1) time per week.

4. Lighting and Temperature Control: Window air conditioning unit capable of maintaining the trailer at 70 to 80°F, but a minimum of 12,000 BTU (1 ton) rating.

B. Furniture and Equipment: The office shall have the following furniture and equipment:

1. Racks and file for Project Record Documents.

2. Facsimile machine on a dedicated line.

3. Other furniture and furnishings: Contractor's option.

C. Within ten (10) days after Notice to Proceed, the Contractor shall submit a sketch showing proposed number and locations; including storage sheds and trailers for each site. The Contractor shall locate all temporary construction offices and storage trailers where approved by the Owner and the Engineer.

2.05 ENGINEER'S FIELD OFFICE

A. General:

1. At each site, the Contractor shall provide a temporary office for the exclusive use of the Engineer at a mutually agreed location at each site.

2. The Contractor shall locate the temporary office at each site in a position acceptable to the Owner and the Engineer and shall adequately furnish and maintain each temporary office in a clean and orderly condition.

B. Specific Requirements:

1. At each site, the Contractor shall provide either a separate building or a trailer of at least 400 square feet of floor space for the exclusive use of the Owner and Engineer throughout the period of construction.

2. The Engineer's field office at each site shall be weathertight, have a watertight floor at least 8 inches off the ground, and shall be insulated, have suitable screened ventilation and a solid door provided with a cylinder lock and three keys. The Contractor shall provide temporary wooden, steel, or aluminum steps and landing with handrailing for ingress and egress to the office. The landing, steps, and handrail shall be constructed in accordance with local building codes and ordinances.

3. At each site, the office shall be provided with janitor service, heating equipment, water, toilet facilities, electrical wiring, outlets, and fixtures suitable to light the tables, desk, and work areas at levels appropriate for the intended uses.

4. Each office shall be provided with central air conditioning or with a window air conditioning unit capable of maintaining the office at 75 ^{o}F to 80^{o}F, but a minimum of 12,000 BTU (1 ton) rating.

5. Separate toilet facilities shall be provided within each office building or trailer for the exclusive use of the Engineer. If a temporary sewer connection is unavailable, a holding tank shall be provided with the trailer which shall be pumped clean weekly by the Contractor.

6. Garbage shall be collected weekly and clean up of the trailer shall be provided one (1) time per week.

C. Furniture and Equipment: At each site, the Engineer's office shall have the following furniture and equipment:

1. One (1) table, 3 feet by 5 feet, and one (1) adjustable chair with back rest.

2. Two (2) additional desk chairs to match chairs furnished with desks.

3. Two (2) all-purpose tables, 36 inches wide by 8 feet long, with four (4) portable chairs.

4. Two (2) folding work tables, 3 feet by 6 feet for interior use.

5. One (1) exterior sample-preparation work bench, 4 feet by 8 feet by 36-inch high, for initial sample preparation. The work bench work surface shall be constructed of unfinished clear marine grade 5/8-inch plywood. It shall be built on pressure treated (and weather resistant) 4" x 4" supporting a 2" x 6" pressure treated frame with a framed plywood shelf (as above) located midway between the work surface and ground level.

6. Two (2) adjustable drafting lights rated for 100 watt incandescent bulbs (or equivalent light output fluorescent or other bulb).

7. Two book shelves, metallic, 6 foot high, 36 inches wide, 1 foot deep, with up to five adjustable shelf leaves.

8. Two (2) four-drawer legal-width filing cabinets with locks and keys.

9. Bottled water cooler with replacement water bottles as required in Section 1.03.C, herein.

10. A multi-function laser printer capable of printing, scanning, copying, and faxing. The multi-function printer shall be a Hewlett-Packard HP 2035, or equivalent and shall have a dedicated fax telephone service line.

D. Operating Expense: The Contractor shall supply all fuel or power for cooling and heating and pay all electrical bills for the Engineer's field office.

E. Telephone Service (Optional):

1. At each site, the Contractor shall furnish and install a telephone with at least one (1) separate service line to the Engineer's field office for the exclusive use of the Engineer.

2. The Contractor shall pay all bills charged against the Engineer's telephone including installation changes and all monthly charges throughout the construction period, with the exception of long distance and toll call charges.

F. Broadband Internet Connection:

1. At each site, the Contractor shall furnish a broadband internet connection capable of DSL speeds for download and upload.

2. The Contractor shall pay all bills charged for the broad-band connection service including installation changes and all monthly charges throughout the construction period.

2.06 TEMPORARY PARKING

A. The Contractor shall provide at a location approved by the Engineer, a gravel or other suitably surfaced vehicle parking area for Contractor's employees, Engineer representatives, and visitors. Personal vehicles will be restricted from the work area.

B. The Contractor shall provide gravel parking space at the Contractor's trailer for a minimum of eight (8) vehicles and shall provide gravel parking space at the Engineer's field office for a minimum of four (4) vehicles.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall:

1. Execute work in a neat and orderly manner.

2. Make structurally sound throughout.

3. Maintain to provide continuous service.

4. Modify and extend service as work progress requires.

3.02 TEMPORARY WATER

A. The Contractor shall install temporary water service, including locating piping and outlets to:

1. Provide service convenient to work stations, including the exterior work bench.

2. Avoid interference with:

a. Traffic and work areas.
b. Materials handling equipment.
c. Storage areas.

B. The Contractor shall ensure that pipes are not located on floor or on ground.

C. The Contractor shall maintain pressure using temporary pumps, tanks, and compressors.

3.03 TEMPORARY ELECTRICITY

A. Temporary electrical service and distribution may be overhead or underground.

B. Temporary electrical service shall be locate to avoid interference with:

1. Traffic and work areas.

2. Cranes and construction equipment.

3. Material handling equipment.

4. Storage areas.

C. Temporary electrical service branch circuits shall not be run on floor or on ground.

D. Temporary electrical service shall be wired for all safety devices specified for final operation of equipment.

E. The Contractor shall check operation of safety devices.

3.04 TEMPORARY SANITARY FACILITIES

A. Portable Toilets:

1. The Contractor shall erect securely, and anchor to prevent dislocation or tipping.

2. The Contractor shall service portable toilets twice weekly, or more often, as necessary to prevent accumulation of wastes, and creation of unsanitary conditions.

3. Contractor cannot use City staff facilities.

B. Washing Facilities: Provide faucets, drains and other washing facilities suitable for maintenance of sanitary conditions and for the type of work requiring washing.

3.05 REMOVAL

A. The Contractor shall completely remove temporary materials and equipment upon completion of construction.

B. The Contractor shall clean and repair damage caused by installation and restore to the specified or original condition.

END OF SECTION

SECTION 01505

MOBILIZATION

PART 1 - GENERAL

1.01 DEFINITION AND SCOPE

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

1. Move onto the site all Contractor's plant and equipment required for first month operations.

2. Provide a temporary field office for the Contractor's use.

3. Provide a temporary field office for the Engineer’s use.

4. Install temporary construction power, wiring, and lighting facilities.

5. Establish fire protection plan and safety program.

6. Secure construction water supply.

7. Provide on-site sanitary facilities and potable water facilities as required by agencies having jurisdiction.

8. Arrange for and erect Contractor's work and storage yard and employee's parking facilities.

9. Submit all required insurance certificates and bonds.

10. Obtain all required permits.

11. Post all OSHA, EPA, FDEP, Department of Labor, and all other required notices.

12. Submit a detailed construction schedule acceptable to the Engineer as specified.

13. Submit a schedule of values of the Work. Mobilization and Demobilization shall not be more than 5.0% of the bid amount.

14. Submit a schedule of submittals.

15. Install project sign (If required).

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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01525

CONSTRUCTION AIDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish, install and maintain required construction aids, remove on completion of Work.

B. Related Requirements Described Elsewhere:

1. Summary of Project: Section 01010.

C. Comply with applicable requirements specified in Sections of Divisions 2 through 16.

PART 2 - PRODUCTS

2.01 MATERIALS

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

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 Sections for 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 first-class condition.

PART 3 - EXECUTION

3.01 PREPARATION

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

3.02 GENERAL

A. Comply with applicable requirements specified in sections of Divisions 2 through 16.

B. Relocate construction aids as required by 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 work.

B. Clean and restore areas damaged by installation by use of temporary facilities.

1. Remove foundations and underground installations for construction aids.

2. Grade and grass areas of site affected by temporary installations to required elevations, slopes, ground cover and clean the area.

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

END OF SECTION

SECTION 01568

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 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 applicable rules and regulations and permit conditions.

2. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, 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.

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.

4. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

B. Related Work Described Elsewhere:

1. Clearing, Grubbing and Stripping: Section 02110.

2. Excavation, Backfilling, and Compaction: Section 02220.

3. Solid Sodding: Section 02822

PART 2 - PRODUCTS

2.01 EROSION CONTROL

A. Sodding is specified in Section 02822.

B. Netting shall be fabricated of material acceptable to the 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 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 1-inch thick.

PART 3 - EXECUTION

3.01 EROSION CONTROL

A. Minimum procedures for grassing are:

1. Scarify slopes to a depth of not less than 6 inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.

2. Sow seed within 24 hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.

3. Apply mulch loosely and to a thickness of between 3/4 inch and 1-1/2 inches.

4. Apply netting over mulched areas on sloped surfaces.

5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed 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. 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 which comply with the requirements of the State of Florida, the Owner or Engineer, the Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

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

1. Manufactured and fabricated products:

a. Design, fabricate and assemble in accord with the best engineering and shop practices.

b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

c. Two (2) or more items of the same kind shall be identical, by the same manufacturer.

d. Products shall be suitable for service conditions.

e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

2. Do not use material or equipment for any purpose other than that for which it is designed or specified.

1.02 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

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

1. Maintain one (1) set of complete instructions at the job site during installation and until completion.

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

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

2. Do not proceed with work without clear instructions.

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

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with progress schedules, coordinate to avoid conflict with work and conditions at the site. City employees will not accept deliveries, sign receipts for materials, inspect deliveries, assist in unloading or participate in any activities related to the Contractor receiving materials or equipment. Deliveries shall be scheduled during normal working hours and a representative of the Contractor must be present to receive all shipments.

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

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

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

1.04 STORAGE AND PROTECTION

A. The Contractor shall furnish a covered, weather-protected storage structure providing a clean, dry, noncorrosive 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 shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate.

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

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

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

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

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

C. 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.

D. 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.

E. All materials, which, in the 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.

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

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

H. 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.

I. 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.

1.05 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 one month prior to installation without written authorization from the Engineer. Materials shipped to the site, or temporarily stored off-site in approved locations, shall be stored in accordance with Paragraph 1.04, herein.

2. 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.

3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.

4. 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.

5. 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.

6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. 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 extra cost to the Owner.

7. 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 and replaced at the Contractor's expense.

1.06 SPARE PARTS

A. Spare parts for certain equipment provided under Divisions 11: Equipment; 13: Special Construction; 15: Mechanical; and 16: Electrical have been specified in the pertinent sections of the Specifications. The Contractor shall collect and store all spare parts so required in an area to be designated by the Engineer. In addition, the Contractor shall furnish to the Engineer an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost.

1.07 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 year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.

B. 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01650

START-UP AND DEMONSTRATION

PART 1 - GENERAL

1.01 DESCRIPTION

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

B. Contractor shall provide all materials, personnel, equipment and expendables as needed and as specified to perform the required start-up and demonstration tests.

C. Related Work Described Elsewhere:

1. Progress Schedules: Section 01310.
2. Operating and Maintenance Data: Section 01730.
3. Equipment: Division 11.
4. Special Equipment, Instrumentation and Controls: Division 13.
5. Mechanical: Division 15.
6. Electrical: Division 16.

PART 2 - PRODUCTS

2.01 START-UP PLAN

A. Submit for approval by the Engineer and the Owner a detailed start-up plan outlining the schedule and sequence of all tests and start-up activities, including submittal of checkout forms, submittal of demonstration test procedures, start-up, demonstration and testing, submittal of certification of completed demonstration and instruction of the Owner's personnel. Start-up and commissioning shall not begin until the plan is approved by the Engineer and the Owner.

B. Instruction of the Owner's Personnel (e.g. training) shall be an integral component of the start-up plan. The following requirements shall be met prior to conducting such training:

1. Operation and maintenance manuals as specified in Section 01730 shall be provided for all equipment where such are specified prior to the Contractor commencing the start-up plan.

2. Equipment or systems for which training is to be provided shall be fully functional and available to demonstrate various modes of operations and to facilitate hands-on instruction. The Contractor will be permitted to conduct training in parallel with periods of performance testing or demonstration

testing, however such training shall not interfere with or cause interruption to such testing.

3. The Contractor shall provide a detailed training plan, with the order of training to coincide with the sequence of proposed process start-up and commencement activities. Training shall be scheduled to occur on weekdays as approved by the Owner to facilitate maximum participation by the Owner's personnel. Under no circumstances shall training be scheduled to occur on weekend days or on dates that are recognized by the City of Palm Bay as government holidays.

4. All training videos to be provided under Section 01730 shall be transmitted to the Owner prior to conclusion of the startup and demonstration testing in order for testing to be considered completed.

C. Provide adequate chemicals to perform start-up services. After completion and acceptance of the performance testing, all bulk chemical tanks shall be completely filled.

PART 3 - EXECUTION

3.01 COMPONENT TEST AND CHECK-OUT

A. Start-up Certification: Prior to system start-up, successfully complete all the testing required of the individual components of the Work. Submit six (6) copies of check out forms for each individual component or piece of equipment, signed by the Contractor or the subcontractor and the manufacturer's representative.

B. All copies of the Operation and Maintenance Manuals must be provided before start-up may begin. These forms shall be completed and submitted before Instruction in Operation to Owner or a request for initiating any final inspections. Insert one (1) copy of this form into the applicable section of each Operation and Maintenance Manual.

c. Demonstrate to the Engineer and the Owner's representative, that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their own controls as designated.

D. Coordinate start-up activities at the treatment plant site with the Engineer prior to commencing system start-up.

3.02 START-UP

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

B. Confirm that all process systems have been tested and are ready for operation. The process systems are listed below:

1. Electrical and Process Control Subsystems. Verify the performance of the electrical equipment and process and control systems.

2. RO Treatment System: Perform the RO membrane treatment system functional and performance testing as described in specification Section 11250. Functional testing shall include all automated operations including RO pretreatment chemical addition, the automated RO permeate to waste flushing system and all associated chemical feed systems. Conveyance and disposal of low TDS water via the deep injection well shall be minimized to the extent possible during start-up activities. The RO Permeate water that is produced during this testing shall be discharged to the existing stormwater basin via the RO permeate to waste line.

9. Chemical Feed Subsystems: Verify the control, operation, and performance of the newly installed chemical feed pumps and piping.

B. Slowly fill each hydrostatic structure in the process flow stream with water.

C. Initiate start-up and training in accordance with the use of the facility in accordance with Section 01730: Operation and Maintenance Data. Training shall not begin

D. Observe the component operation and make adjustments as necessary to optimize the performance of the Work.

E. Coordinate with Engineer and Owner for any adjustments desired or operational problems requiring debugging.

F. Make adjustments as necessary.

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 Specifications and manufacturer requirements, and after all Check-Out Forms have been completed and submitted, perform the Start-Up Demonstration and Testing. The demonstration period shall be held upon completion of all systems at a starting date to be agreed upon in writing by the Owner or his representative. 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 Technical Sections of the Specifications.

B. The Start-Up Demonstration Testing will be conducted for seven (7) consecutive 24-hour days. The Work must operate successfully during the seven (7) day testing period in the manner intended. If the Work does not operate successfully, or if the start-up is

interrupted due to other contracts, the problems shall be corrected and the test shall start over from day one. The party causing the interruption shall be subject to the assessment of actual damages due to delay.

C. During the start-up demonstration period, operate the Work and cause various operational circumstances to occur. As a minimum, these circumstances will include average and peak daily flows, random equipment or process failures, alarm conditions, 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 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.

D. Acceptability of the Work's performance will be based on the Work performing as specified under these actual and simulated operating conditions, to provide facilities 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 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.

E. Demonstrate the essential features of the whole system as it applies to the Work, including the mechanical equipment, piping, structures, finishes, controls, instrumentation, 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 only once, after completion of start-up tests. If circumstances arise that interrupt the test procedures (such as weather, unforeseen process problems, or problems caused by the Contractor whether or not the problems are the fault of the Contractor, etc.,) then the test shall be terminated and rescheduled to a later date after the problem is corrected. The test shall be run in its entirety if so directed by the Engineer.

F. Demonstrate the essential features of all mechanical systems including, but not limited to, the following as they apply to the Work:

1. RO Treatment System, Cartridge Filters and associated Chemical Feed Systems

2. Carbon Dioxide Storage and Pressurized Solution Feed System

3. Degasifier and Air Quality Control System

4. Prestressed Circular Concrete Ground Storage Tank

5. Mechanical Systems

    a. Valves

b. Pumps

G. Demonstrate the essential features of all electrical and instrumentation 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 devices.
c. Relays.
d. Special transformers.
e. Starting devices.

2. Communications systems.

3. Panelboards.

a. Distribution panels.
b. Lighting panels.
c. Main panels, power panels.
d. Switchboard.

4. Wiring devices.

a. Face plates.
b. Low-voltage controls.
c. Outlets: convenience, special purpose.
d. Switches: regular, time.

H. Upon successful completion of the Start-up, Demonstration and Testing, the Owner's personnel will 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 specified operator training, the Contractor shall submit to the Engineer six (6) copies of the Certificate of Completed Demonstration Form, 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. Samples of the Check Out Form and Certificate of Completed Demonstration Form are provided at the end of this Section.

CHECK OUT FORM

[]	OWNER	City of Palm Bay	No. Copies	2	CHECK-OUT
[]	ENGINEER:	Tetra Tech	No. Copies	2	MEMO NO. _____
[]	ARCHITECT:	_____	No. Copies	_____	
[]	CONTRACTOR:	_____	No. Copies	_____	
[]	FIELD:	TBD	No. Copies	2	
[]	OTHER:	_____	No. Copies	1	

PROJECT DATA

NAME: _____
LOCATION: _____
OWNER: _____
OTHER: _____

CONTRACT DATA

NUMBER: _____
DATE: _____
DRAWING NO: _____
SPECIFICATION SECTION: _____

Name of equipment checked:

Name of manufacturer of equipment:

1. The equipment furnished by us has been checked on the job by us. We have reviewed, where applicable, the performance verification information submitted to us by the Contractor.

2. The equipment is properly installed, except for items noted below.*

3. The equipment is operating satisfactorily, except for items noted below.*

4. The written operating and maintenance information, where applicable, has been presented to the Contractor, and been discussed with him in detail. All applicable operating and maintenance information and parts lists have been furnished to him electronically.

5. Provide a checklist demonstrating that all requirements of the individual equipment specification(s) have been met.

Checked By:

_____	_____
Name of Manufacturer's Rep.	Name of General Contractor
_____	_____
Address and Phone # of Rep.	Authorized Sig./Title/Date
_____	_____
Sig./Title/Pers. Making Chk.	Name of Subcontractor
_____	_____
Date Checked	Authorized Sig./Title/Date

Manufacturer's Representative Notations: Exceptions noted at time of check were:

_____

_____

_____

_____

Manufacturer's Representative to note adequacy of related equipment that directly affects operation, performance or function of equipment checked. (No comment presented herein will indicate adequacy of related systems or equipment):

_____

_____

_____

_____

Manufacturer's Checklist demonstrating that all requirements of the equipment specifications have been met (list below or add attachment of specification with confirmation of each requirement).

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

CERTIFICATE OF COMPLETED DEMONSTRATION FORM

[]	OWNER	City of Palm Bay	No. Copies	2	CERTIFICATE
[]	ENGINEER:	Tetra Tech	No. Copies	2	OF COMPLETED
[]	ARCHITECT:		No. Copies		DEMONSTRATION
[]	CONTRACTOR:		No. Copies		MEMO NO. _____
[]	FIELD:	TBD	No. Copies	2	
[]	OTHER:		No. Copies	1	

PROJECT DATA

NAME: _____
LOCATION: _____
OWNER: _____
OTHER: _____

CONTRACT DATA

NUMBER: _____
DATE: _____
DRAWING NO: _____
SPECIFICATION SECTION: _____

NOTE TO CONTRACTOR:

Submit five (5) copies of all information listed below for checking at least one (1) week before scheduled demonstration of the Work. After all information has been approved by the Engineer, give the Owner a Demonstration of Completed Systems as specified and have the Owner sign five (5) copies of this form. After this has been done, a written request for a final inspection of the system shall be made.

MEMORANDUM:

This memo is for the information of all concerned that the Owner has been given a Demonstration of Completed Systems on the work covered under this Specification Section. This conference consisted of the system operation, a tour on which all major items of equipment were explained and demonstrated, and the following items were given to the Owner:

(a) Owner's copy of Operation and Maintenance Manual for equipment or systems specified under this Section containing approved submittal sheets on all items, including the following:

(1) Maintenance information published by manufacturer on equipment items.

(2) Printed warranties by manufacturers of equipment items.

(3) Performance verification information as recorded by the Contractor.

(4) Check-Out Memo on equipment by manufacturer's representative.

(5) Written operating instructions on any specialized items.

(6) Explanation of guarantees and warranties on the system.

(b) Prints showing actual "As-Built" conditions.

(c) A demonstration of the system in operation and of the maintenance procedures which will be required.

_____
(Name of General Contractor)

By: _____
(Authorized Signature, Title and Date

_____
(Name of Subcontractor)

By: _____
(Authorized Signature, Title and Date

Operation and Maintenance Manuals, Instruction Prints, Demonstration and Instruction in Operation Received:

_____
(Name of Owner)

By: _____
(Authorized Signature/Title/Date

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

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

B. Related Requirements Described Elsewhere:

1. Contract Closeout: Section 01700.
2. Project Housekeeping/Cleaning: Section 01710.
3. Project Record Documents: Section 01720.
4. Warranties and Bonds: Section 01740.

1.02 SUBSTANTIAL COMPLETION

A. The Work will not be substantially complete, and Contractor may not request substantial completion inspection unless the following submittals and work is completed:

1. Project Record Documents are complete and have been submitted and reviewed to the requirements of Section 01720.

2. All areas to be used and occupied are safe, operable in automatic and complete.

3. All building occupancy certificates have been issued by the appropriate building permitting agency.

4. All painting, finishes, fencing, cleanup, final grading, grassing, planting, sidewalk construction, and paving shall have been completed and are ready for inspection.

5. All deficiencies noted on inspection reports or nonconformances are corrected or the correction plan approved.

B. When the conditions of paragraph 1.02 A. are met the Contractor shall submit to the Engineer:

1. A written notice that he considers the Work, or portion thereof, is substantially complete, and request an inspection.

2. A punchlist of items to be corrected. (Uncompleted work which is not related to the safe, effective, efficient use of the Project may be allowed on the punchlist with the Engineer's approval.)

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

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

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

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

3. The Engineer will within reasonable time, reinspect the Work. The Contractor will be liable for reinspection fees as described in Paragraph 1.04, herein.

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

1. Schedule a walk-through of the facility to include the Owner. Engineer shall determine the completeness of the punchlist and readiness of the facility for occupancy by the Owner.

2. Prepare and deliver to Owner a tentative Certificate of Substantial Completion with the tentative punchlist of items to be completed or corrected before final inspection. A copy shall be provided to the District.

3. After consideration of any objections made by the Owner as provided in 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 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 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 and maintenance materials must be suitably delivered to the Owner per the requirements of the Technical Sections of the Specifications. Spare parts shall be properly stored by the Contractor until substantial

completion is reached. Spare parts shall be delivered to the Owner at one time only as a complete set of spares.

3. Contractor to submit evidence of compliance with requirements of governing authorities.

B. After satisfying the requirements of Paragraph 1.03 A. and when Contractor considers the Work complete, he shall submit written certification that:

1. Contract Document requirements have been met.

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

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

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

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

C. The Engineer will, within reasonable time, make an inspection to verify the status of completion 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. 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 Paragraph 1.04, herein.

E. When the Engineer finds that the Work is acceptable under the Contract Documents, the Contractor may make closeout submittals.

1.04 REINSPECTION FEES

A. Should the Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. Contractor will compensate the Owner for such additional services.

2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS

A. Warranties and Bonds: To requirements of Section 01740.

B. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.

C. Certificate of Insurance for Products and Completed Operations.

1.06 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the Engineer.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:

a. Previous change orders or written amendments.
b. Allowances.
c. Unit prices.
d. Deductions for uncorrected work.
e. Penalties and bonuses.
f. Deductions for liquidated damages.
g. Deductions for reinspection payments.
h. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

1.07 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Agreement between City and Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01710

PROJECT HOUSEKEEPING/CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Execute cleaning, during progress of the Work and at completion of the Work.

1.02 DISPOSAL REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

A. Execute 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.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically, or as directed by the Owner, and dispose of at legal disposal areas away from the site.

D. Remove vehicle track-out on a daily basis at all points of access to the construction site(s).

3.02 DUST CONTROL

A. The Contractor shall employ construction techniques that minimize the production and distribution of dust.

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

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

3.03 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.

C. Prior to final completion, or Owner acceptance, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that the entire Work area is clean.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Maintain at the site for the Owner one (l) record copy of:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications of the Contract.

5. Engineer's Field Orders or written instructions.

6. Approved Shop Drawings, Working Drawings and Samples.

7. Field test records.

8. Construction photographs.

B. Related Requirements Described Elsewhere:

1. Field Engineering: Section 01050.

2. Shop Drawings, Working Drawings and Samples: Section 01340.

3. Preconstruction Audio-Video: Section 01380.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.

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

B. File documents and samples in accordance with CSI format with section numbers as provided herein.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer or the Owner.

E. As a prerequisite for monthly Progress payments, the Contractor is to exhibit the currently updated "Record Documents" for review by the Engineer and Owner. Payment may be withheld if record documents are not satisfactorily maintained.

1.03 MARKING DEVICES

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

1.04 RECORDING

A. Label each document "PROJECT RECORD" with a rubber stamp having one (1) inch high letters.

B. Record information concurrently with construction progress.

1. Do not conceal any work until required information is recorded.

C. Drawings: Legibly and clearly mark, to scale, each drawing to record actual construction:

1. Depths of various elements of foundation in relation to finish first floor datum.

2. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc.

3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

4. Field changes of dimension and detail.

5. Changes made by Field Order or by Change Order.

6. Details not on original Contract Drawings.

7. Equipment and piping relocations.

8. Major architectural and structural changes including relocation of doors, windows, etc.

9. Architectural schedule changes according to Contractor's records and shop drawings.

D. Specifications and Addenda: Legibly mark each section to record:

1. Manufacturer, trade name, catalog number of Supplier of each product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

E. Shop Drawings (after final review and approval): Provide six (6) sets of record shop drawings, for each process equipment, piping, electrical system and instrumentation system (see Section 01340).

1.05 SUBMITTAL

A. At Contract closeout, deliver Record Documents to the Engineer for the Owner.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date.

2. Project title and number.

3. Contractor's name and address.

4. Title and number of each Record Document.

5. Signature of Contractor or his authorized representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED

END OF SECTION

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.

a. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.

2. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

B. Related Requirements Described Elsewhere:

1. General Requirements: Division 1.

2. Equipment: Division 11.

3. Special Construction: Division 13.

4. Mechanical: Division 15.

5. Electrical: Division 16.

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of described products.

2. Familiar with requirements of this Section.

3. Skilled as technical writer to the extent required to communicate essential data.

4. Skilled as draftsman competent to prepare required drawings.

1.03 FORM OF SUBMITTALS

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

B. Format:

1. Size: 8-1/2 inches x 11 inches.

2. Paper: 20 pound minimum, white, for typed pages.

3. Text: Manufacturer's printed data, or neatly typewritten.

4. Drawings:

a. Provide reinforced punched binder tab, bind in with text.

b. Reduce larger drawings and fold to size of text pages but not larger than 14 inches x 17 inches.

5. Provide fly-leaf for each separate product, or each piece of operating equipment.

a. Provide typed description of projects and major component parts of equipment.

b. Provide identified tabs.

6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

a. Title of Project.

b. Identity of separate structure as applicable.

c. Identity of general subject matter covered in the manual.

7. Provide electronic versions of each submittal in an editable and searchable PDF format with bookmarks for each section.

C. Binders:

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

2. Maximum D-ring width: 2 inches.

3. When multiple binders are used, correlate the data into related consistent groupings.

1.04 CONTENT OF MANUAL

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

1. Contractor, name of responsible principal, address and telephone number.

2. A list of each product required to be included, indexed to content of the volume.

3. List, with each product, name, address and telephone number of:

a. Subcontractor, manufacturer and installer name, addresses and telephone numbers.

b. A list of each product required to be included, indexed to content of the volume.

c. Identify area of responsibility of each.

d. Local source of supply for parts and replacement equipment including name, address and telephone number.

4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product.

2. Annotate each sheet to:

a. Clearly identify specific product or part installed.

b. Clearly identify data applicable to installation.

c. Delete references to inapplicable information.

3. Operation and maintenance information as herein specified.

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

C. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:

a. Relations of component parts of equipment and systems.

b. Control and flow diagrams.

2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.

3. Do not use Project Record Documents as maintenance drawings.

D. Written test, as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.

2. Provide logical sequence of instruction of each procedure.

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

1. Provide information sheet for Owner's personnel, give:

a. Proper procedures in event of failure.

b. Instances which might affect validity of warranties or bonds.

1.05 MANUAL FOR MATERIALS AND FINISHES

A. Submit two (2) hard copies of complete manual in final form and an electronic copy in PDF format with bookmarks for each section.

B. Content: for architectural products, applied materials and finishes:

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

a. Catalog number, size, composition.

b. Color and texture designations.

c. Information required for reordering special manufacturing products.

2. Instructions for care and maintenance.

a. Manufacturer's recommendation for types of cleaning agents and methods.

b. Cautions against cleaning agents and methods which are detrimental to product.

c. Recommended schedule for cleaning and maintenance.

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

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

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

2. Instructions for inspection, maintenance and repair.

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

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two (2) copies of complete manual in final form and an electronic copy (PDF format with bookmarks for each section).

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

1. Description of unit and component parts.

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

2. Operating procedures:

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

3. Maintenance procedures:

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

4. Servicing and lubrication required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

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

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

8. As-installed control diagrams by controls manufacturer.

9. Each Contractor's coordination drawings.

    a. As-installed color coded piping diagrams.

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

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

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

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

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

1. Description of system and component parts.

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

2. Circuit directories and panelboards.

    a. Electrical service.
    b. Controls.
    c. Communications.

3. As installed color coded wiring diagrams.

4. Operating procedures:

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

5. Maintenance procedures:

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

6. Manufacturer's printed operating and maintenance instructions.

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

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

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

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

1.07 SUBMITTAL SCHEDULE

A. Submit two (2) copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 90 days after Notice to Proceed.

B. Submit two (2) copies of completed data in preliminary form no later than 20 days following Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01340, but no later than delivery of equipment. One (1) copy will be returned with comments to be incorporated into the final copies and the other copy will be retained on-site for use in any early training.

C. Submit two (2) hard copies and an electronic copy of approved manual in final form directly to the offices of the Engineer within 10 days after the reviewed copy or last item of the reviewed copy is returned.

D. Provide two (2) hard copies and an electronic copy of addenda to the operation and maintenance manuals as applicable and certificates as specified within 30 days after final inspection.

1.08 INSTRUCTION OF OWNER'S PERSONNEL

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

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

C. All on-site training shall require both classroom instruction and field instruction. Allow designated Owner's personnel to attend each session for each major system and equipment. A minimum of two (2) days shall be allotted for each session, unless additional time is required in the individual equipment specifications.

D. Instructors shall be fully qualified personnel as outlined within the individual equipment specifications. If no specific training specifications are listed with the equipment, the Contractor shall provide the instruction with qualified Contractor personnel.

E. The Contractor shall provide a list to the Owner indicating the proposed date, time and instructors that will be present for all training sessions. The Owner will review and approve the training schedule prior to training events and facilitate the classroom training location as needed.

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

G. All instruction sessions shall be recorded using high definition, 1080p quality recording equipment. The Contractor shall provide training videos that are produced in both standard definition (DVD format) as well as a master recording that is provided in high definition (BluRay Disc) format. Recordings shall be made by the Contractor under the direction of the Owner and shall include audio recording.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Described Elsewhere:

1. Contract Closeout: Section 01700.

1.02 SUBMITTAL REQUIREMENTS

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

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

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

1. Product of work item.

2. Firm, with name of principal, address and telephone number.

3. Scope.

4. Date of beginning of warranty, bond or service and maintenance contract.

5. Duration of warranty, bond or service maintenance contract.

6. Provide information for Owner's personnel:

a. Proper procedure in case of failure.
b. Instances which might affect the validity or warranty or bond.

7. Contractor, name of responsible principal, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 inches by 11 inches, punch sheets for standard three (3) ring binder.

a. Fold larger sheets to fit into binders.

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

a. Title of Project.
b. Name of Contractor.

C. Binders: Commercial quality, three (3) D-ring type binders with durable and cleanable white plastic covers and maximum D-ring width of two (2) inches. Binders shall be presentation type with clear vinyl covers on front, back, and spine. Binders shall include two sheet lifters and two horizontal inside pockets.

1.04 WARRANTY SUBMITTALS REQUIREMENTS

A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the Contractor's for one (1) year, unless otherwise specified, commencing at the time of final acceptance by the Owner.

B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment. Electrical and which has at least a 1 hp motor or which lists for more than $1,000. The Engineer reserves the right to request warranties for equipment not classified as major. The Contractor shall still warrant equipment not considered to be "major" in the Contractor's one-year warranty period even though certificates of warranty may not be required.

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

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

E. 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01800

MISCELLANEOUS WORK AND CLEANUP

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

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

2. The work of this Section includes, but is not limited to, the following:

a. Restoring of fences.

b. Cleaning up.

c. Incidental work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials required for this Section shall be of the same quality as materials that are to be restored. Where possible, the Contractor shall reuse existing materials that are removed and then replaced.

PART 3 - EXECUTION

3.01 RESTORING OF FENCES

A. The Contractor shall remove, store and replace existing fences during construction. Only the sections directed by the Engineer shall be removed. 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.

3.02 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. All suitable excess excavated material shall remain on site.

3.03 INCIDENTAL WORK

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

END OF SECTION

Palm Bay Utilities

DIVISION 2

SITEWORK

SECTION 02110

CLEARING, GRUBBING, AND STRIPPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section describes the work included in clearing, grubbing, stripping, and otherwise preparing the project site for construction operations.

B. Related Work Specified Elsewhere:

1. Earthwork: Section 02200.

C. Definitions:

1. 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.

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

3. 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.

PART 2 - MATERIALS

2.01 GENERAL

A. Trees and Shrubbery: Existing trees, shrubbery, and other vegetative material is not be shown on the 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 Drawings and designated to be preserved.

B. Preservation of Trees, Shrubs, and Other Plant Material:

1. All plant materials (trees, shrubbery, and plants) beyond the limits of clearing and grubbing and/or labeled for preservation shall be saved and protected from damage resulting from the work. 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.

2. Trees identified on-site for preservation shall be fenced off by the Contractor at the dripline to protect the tree(s) during construction.

3. When trees are close together, restrict entry to area within drip line by fencing. In areas where no fence is erected, the trunks of all trees 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 6 feet. 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.

PART 3 - EXECUTION

3.01 GENERAL

A. Clearing and Grubbing Limits: All excavation areas associated with new structures, slabs, and roadways shall be cleared and grubbed to the following depths:

1. Roadway and Paved Area: 2 feet below existing grade and replace with compacted backfill.

2. Proposed Structures: 2 feet below existing grade within a 5 foot margin of each structure and replaced with compacted backfill as specified herein.

3. Building Site Areas not specifically noted above: 2 feet below existing grade and replaced with compacted backfill as specified herein.

4. All other areas: 1 foot below completed surface.

B. Disposal of Clearing and Grubbing Debris: Do not burn combustible materials. Remove all cleared and grubbed material from the work site and dispose of in accordance with all local laws, codes, and ordinances.

C. Areas to be Stripped: All excavation and embankment areas associated with new structures, slabs, walks, and roadways shall be stripped. Stockpile areas shall be stripped.

D. Disposal of Strippings: Remove all stripped material and dispose off-site, unless otherwise directed to stockpile material.

END OF SECTION

SECTION 02140

DEWATERING (DURING CONSTRUCTION)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work to be performed under this Section shall include the design and installation of a temporary wellpoint system until completion of construction to dewater subsurface waters from structures as required.

B. Related Work Described Elsewhere:

1. Shop Drawings, Working Drawings, and Samples: Section 01340.
2. Earthwork: Section 02200.

C. The Contractor, if required, shall obtain necessary permits from the Water Management District for dewatering.

1.02 QUALITY ASSURANCE

A. Qualifications: 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. The firm shall have a successful record of operation for a minimum of five (5) years prior to bid date.

B. In lieu of experience, the dewatering firm shall provide a performance and warranty bond for 1.5 times the total installed cost of the temporary dewatering system. This bond shall be executed prior to award and/or contract execution.

C. Standards: 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.

1.03 SUBMITTALS

A. Materials and Shop Drawings: Shop drawings required to establish compliance with the Specifications shall be submitted in accordance with the provisions of Section 01340: Shop Drawings, Working Drawings, and Samples. Submittals shall include at minimum the following:

1. Design notes and drawings.
2. Descriptive literature of the temporary dewatering system.
3. Layout of all piping involved.
4. Bill of materials.
5. Water Management District permit, if required.

1.04 CRITERIA

A. The wellpoint system shall be developed to the point that is capable of dewatering such that groundwater levels are maintained at least three (3) feet below the bottom of excavations. Each wellpoint system shall be capable of dewatering and maintaining groundwater levels at the respective structures. Observation wells shall be constructed for the purpose of testing each system.

PART 2 - PRODUCTS

2.01 GENERAL

A. The equipment specified herein shall be standard dewatering equipment of proven ability as designed and manufactured 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 be required to monitor the performance of the dewatering system during the progress of the work and require such modifications as may be required to assure that the systems will perform satisfactorily. Dewatering systems shall be designed in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils and to preserve the integrity of adjacent structures.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Dewatering: The Contractor shall install a temporary wellpoint dewatering system for the removal of subsurface water encountered during construction of the proposed structures.

3.02 PROTECTION AND SITE CLEAN-UP

A. At all times during the progress of the Work the Contractor shall use all reasonable precautions to prevent either tampering with the wellpoints or the entrance of foreign material.

B. After the wellpoint system is no longer needed, 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 work started. The site shall be thoroughly cleaned and approved by the Engineer.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of dewatering, excavating, trenching, sheeting/shoring, filling, grading, backfilling, and compacting those soil materials required for the construction of the embankments, structures, piping, ditches, utility structures and appurtenances as shown on the Drawings and specified herein.

B. Definitions

1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material as determined by ASTM D1557.

2. Optimum Moisture Content: The optimum moisture content shall be determined by ASTM D 1557 to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the 3/4-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 similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.

4. Suitable: Suitable material shall be non-cohesive, non-plastic granular local sand that is free from vegetation, organic material, marl, silt or muck. The materials shall also meet detailed requirements specified herein. 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-8 in accordance with AASHTO Designation M 145.

C. 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 which can in any way affect the work.

2. Prior to commencing the excavation, the Contractor shall submit a 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.

D. Trench Safety Act: 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.

E. Related Work Described Elsewhere

1. Shop Drawings, Working Drawings, and Samples: Section 01340.

2. Testing and Testing Laboratory Services: Section 01410.

3. Temporary Erosion and Sedimentation Control: Section 01568.

4. Clearing, Grubbing, and Stripping: Section 02110.

5. Dewatering: Section 02140.

6. Division 15: Mechanical.

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.

1.04 FEDERAL AND STATE REGULATORY REQUIREMENTS

A. All trench excavations which exceed 5 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 soils report, an adjustment will be made in the contract price.

1.06 SUBMITTALS

A. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction and backfilling for the various portions of the work. Review shall be for information only. The Contractor shall remain responsible for the adequacy and safety of the methods. Where sheeting and bracing is required for construction, the design shall be performed by a Professional Geotechnical Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. All fill material from on and off-site sources shall be subject to the approval of the Engineer.

2. All fill material shall be unfrozen and free of organic material, trash, or other objectionable material. Excess or unsuitable material shall be removed from the job site by the Contractor.

B. Common Fill Material

1. Common Fill shall be sand not containing stones, rock, concrete or other rubble larger than 2 inches in diameter. No more than 10% of the material, by weight, shall pass a 200 mesh sieve and organic matter in the material shall be less than 1% by weight.
2. The Contractor shall utilize as much excavated material as possible for reuse in accordance with the Drawings and Specifications or as directed by the Engineer.

3. The Engineer shall direct the Contractor on the type of material allowed in certain sections of the earthwork operations.

C. Select Common Fill

1. Select Common Fill material shall be free from stones larger than 1 1/2 inches and no more than 5% of the material shall pass a 200 mesh sieve. The amount of organic matter in the material shall not exceed 1% by weight.

2. The Contractor shall utilize as much excavated material as possible for reuse in accordance with the Drawings and Specifications or as directed by the Engineer.

3. The Engineer shall direct the Contractor on the type of material allowed in certain sections of the earthwork operations.

D. 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

E. Bedding Rock: Manufactured angular, granular material, 1/4 to 1-1/2 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.

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

U.S. Sieve Size	Percent Passing By Weight
1/2	100
3/8	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 50	0-5

F. Other Material: 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.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearing and grubbing shall be performed in accordance with Section 02110.

B. Protection

1. Sheeting 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, braced wood lagging and soldier beams or other approved methods. 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 expense to the Owner.

b. The Contractor shall construct sheeting outside the neat lines of the foundation unless another configuration is desirable 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 for construction, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall conform with the design, and certification of this shall be provided by the Professional Geotechnical 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 Contractor shall leave in place to be embedded in the backfill, all sheeting and bracing not shown on the Drawings but which the Owner directs him 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. The Owner may direct that timber used for sheeting and bracing be cut off at any specified elevation.

f. 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.

g. 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.

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

2. 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 extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels as stipulated in Section 02140. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing work. The installed dewatering system shall be in conformity with the overall construction plan. The Contractor 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.

b. 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.

c. 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.

d. The Contractor shall take all additional precautions to prevent buoyant uplift of any structure during construction.

e. 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.

f. 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.

g. 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.

h. 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.

3.02 EXCAVATION

A. General

1. Excavation consists of removal, storage and disposal, if necessary, of material encountered when establishing required grade elevations and in accordance with the notes shown in the Drawings.

2. Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

3. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of the Engineer. Unauthorized excavation, as well as remedial work shall be at the Contractor's expense. Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise specified or directed by the Engineer.

4. When excavation has reached required subgrade elevations, make an inspection of conditions. If the material is unsuitable or has clay and/or organic material, and if authorized by Engineer to remove, carry excavation deeper and replace excavated material with Bedding Rock. Removal and replacement of unsuitable subgrade material, as directed by the Engineer, will be paid for as extra work by unit prices established in the Bid Form.

5. If the Contractor excavates below grade through error or for his own convenience or through failure to properly dewater the excavation or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the Engineer to excavate below grade as set forth in the preceding paragraph, in which case the work of excavating below grade and finishing and placing the refill shall be performed at his own expense.

6. Stockpile satisfactory excavated materials at a location approved by the Engineer until required for backfill or fill. Stockpiles shall be placed and graded for proper drainage. All soil materials shall be located away from the edge of excavations. Excess soil materials shall be disposed of by the Contractor.

B. Trench Excavation

1. Excavation for all trenches required for the installation of pipes shall be made to the depths indicated on the Drawings and in such a manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities. The bottom of the excavations shall be firm and dry.

2. Excavation shall not exceed normal trench width. Normal trench width is defined as indicated on the Drawings. Any excavation which exceeds the normal trench width, shall require special backfill requirements as determined by the Engineer.

3. Rock shall be removed to provide at least eight inches clearance around the bottom and sides of the pipe being laid.

4. Where pipe is to be laid in Bedding Rock or encased in concrete, the trench may be excavated to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

5. Where the pipes are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. Manually trim and shape trench bottom to receive pipe at correct line and grade. Shape trench to provide a uniform, continuous support along the entire length of the barrel of each pipe section. Hand-shape firm unyielding bedding so that the bottom segment will be in continuous contact with the pipe barrel.

3.03 PLACEMENT OF MATERIALS

A. Fills

1. Material placed in fill areas shall be deposited within the lines and to the grades shown on the Drawings making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved. If sufficient Common Fill material is not available from excavation on site, the Contractor shall provide borrow as required.

2. Fill shall be brought up in substantially level lifts not exceeding 8 inches in depth. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.

3. During the process of placing fill, all roots, debris and stones greater in size than specified herein shall be removed from the fill areas and the Contractor shall assign a sufficient number of employees to this work to insure satisfactory compliance with these requirements.

4. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.

5. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas as required to perform the work in such a manner that will preserve the undisturbed state of the natural soils. The Contractor shall not claim excavated material as unsuitable due to moisture content. The Contractor shall sufficiently dewater excavated materials for use as backfill.

6. Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials. Plow strip or break up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with the existing surface.

7. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each classification.

B. Bedding and Backfilling for Pipes

1. Bedding for pipe shall be as shown on the Drawings. The Contractor shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

2. Backfilling over and around pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with suitable material to the mid-diameter of the pipe. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.

3. After the pipe is laid to line and grade, place and carefully compact pipe bedding material for the full width of the trench to the springline of the pipe. Place the material around the pipe in 6-inch layers and thoroughly hand tamp with approved tamping equipment supplemented by "walking in" and slicing with a shovel to assure that all voids are filled. Place backfill in 6-inch layers and carefully compact the area above the pipe springline with pipe cover material to a point 12 inches above the top outside surface of the pipe barrel. Pipe bedding material may, at the Contractor's option, be substituted for pipe cover material. The backfilling shall be carried up evenly on both sides of the pipe. The remainder of the trench backfill shall then be filled and thoroughly compacted in uniform layers not exceeding 12 inches in depth.

C. Backfill around structures shall be placed in uniform layers not exceeding 8 inches in depth. Backfill material shall be Common Fill meeting requirements set forth in Paragraph 2.01. All backfill shall be placed and compacted "in-the-dry." Backfill operations around structures shall not be started until the concrete has attained sufficient strength to resist the loads imposed by the backfill material.

3.04 COMPACTION

A. General

1. The Contractor shall control soil compaction during construction to provide the densities specified. It shall be the Contractor's responsibility to notify the Engineer in writing that compaction tests can be performed. Written notice from the Contractor shall precede completion of compaction operations by at least two (2) working days.

2. Material which is too wet shall be spread over the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied to provide a satisfactory moisture content. If too much water is added, the area shall be permitted to dry before compaction is continued. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and other materials and equipment necessary to place water in the fill in the manner specified.

3. When a trench or excavation bottom has a density less than that specified herein for the particular area classification, the Contractor shall compact the material to the required depth and percentage of maximum density.

B. Percentage of Maximum Density Requirements

1. All fill and backfill in unpaved areas shall be densified to at least 95% of the maximum dry density as determined by ASTM D1557, unless specified otherwise.

2. All fill and backfill under roadways, driveways, sidewalks, or any other type of paving, shall be densified to at least 98% of the maximum dry density as determined by ASTM D1557.

C. Special Foundation Preparation Requirements for Process Structures and Buildings

1. Following excavation, the Contractor shall proof-roll the exposed subgrade with a rubber-tired roller having a weight of at least 10 to 15 tons.

2. Any soft soils shall be excavated in accordance with Paragraph 3.02 and replaced with Structural Fill placed in lifts not exceeding 8 inches in depth.

3. After proof-rolling and placement and compaction of the replacement material, the sub-grade shall be compacted using a 10 to 15 ton vibratory roller to at least 95% of the maximum density as determined by ASTM D1557, to a depth at least two (2) feet below the surface of the subgrade.

3.05 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers.

B. If, in the opinion of the Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.06 FINAL GRADING

A. After other earthwork work has been finished, and filling and backfilling operations are completed, all areas on the site of the work which are to be graded shall be brought to grade within a tolerance of +/- 0.1 feet at the indicated elevations, slopes, and contours where seeding or sodding is not required or, where sodding is required, within three (3) inches of finished grade. 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 percent shall be provided.

3.07 EXCESS EXCAVATED MATERIALS

A. Insofar as needed, suitable excavated materials shall be used in fills and embankments shown on the Drawings. All excess excavated material shall be disposed of off-site by the Contractor.

B. The Contractor shall segregate different types of excavated materials (i.e. sands, clayey sands) in the stockpile area. All unsuitable materials shall be disposed of by the Contractor offsite in a legal manner.

C. The Contractor shall slope and compact the stockpile with a light roller to maintain stability.

D. The Contractor shall maintain proper soil and erosion control measures.

END OF SECTION

SECTION 02210

SITE GRADING

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work

The Work of this Section consists of furnishing all necessary labor, equipment, material and transportation necessary to bring the roads, embankments, building sites, paved areas and open areas to the lines and grades shown on the Drawings. The Work includes removal of existing pavement, slabs, walks, footings, structures and debris.

B. The Contractor must determine the volume of material required for the site.

C. Definitions

1. Open Areas: Open areas shall be those areas that do not include embankments, roadways, structures and other similar load bearing improvements.

2. Maximum Density: Maximum weight in pounds per cubic foot 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 special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Suitable Materials

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.

1. Select Fill: Not more than 20 percent by weight of fill material shall pass the No. 200 sieve.

2. Common Fill: Not more than 40 percent by weight of fill material shall pass the No. 200 sieve.

B. Suitable material for fills to be placed in water shall be classified as A-1 or A-3 in accordance with AASHTO Designation A-145.

C. Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A4, A-5, A-6, A-7 and A-8 in accordance with AASHTO Designation M 145.

PART 3 – EXECUTION

3.01 PERFORMANCE

A. Excavation

1. Excavation shall conform to the limits indicated on the plans 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. Unsuitable material shall be removed to the required depth and replaced to the satisfaction of the Engineer with suitable material.

B. Fills

1. Fills shall be formed of suitable material place in layers of not more than 12 inches in depth 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 layers to specified densities.

2. Rock that will not pass through a 6-inch diameter ring shall not be placed within the top 12 inches of the surface of the completed fill. Rock that will not pass through a 3-inch diameter ring shall not be placed within the top 4 inches of the completed fill- Broken concrete or asphaltic pavement shall not be used in fills.

3. Fill within roadways, structures, buildings, berms and other improvements shall be compacted to a density of not less than 95 percent of its maximum density as determined by AASHTO Method T 180, and fill within other areas shall be compacted to a density of not less than 90 percent of its maximum density as determined by AASHTO Method T 180. Unsuitable material (muck) located with

the footprint of roadways, structures, buildings, and embankments shall be removed and replaced with compacted common fill materials.

4. Final elevations shall be within 0. 1± foot of the required elevation for all improvements such as embankments, roads, and grading around structures. All open areas shall be graded within 0.25± feet of the required elevation. Surfaces shall be sloped to drain as shown on the Drawings.

C. Roadway Subgrades

1. The construction of roadway 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 plans, of uniform density, ready to receive the base course.

2. All material of the subgrade within the indicated limits shown on the Drawings which provide a Limerock Bearing Ratio of less than 40 shall be stabilized per Specifications.

3. 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 3-wheel power roller weighing not less than 10 tons. All areas inaccessible to the roller shall be thoroughly compacted with hand tampers weighing not less than 50 pounds, the face of which shall not exceed 100 square inches 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.

4. The top 12 inches of the subgrade, including cut and fill sections, shall be compacted to a density of not less than 95 percent of the maximum density as determined by the AASHTO Method T 180.

5. After the roadway 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. 1 foot of the required elevation.

END OF SECTION

SECTION 02212

FINISH GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Finish grade sub-soil.

2. Cut out areas to receive stabilizing base course materials for paving and/or sidewalks.

3. Place, finish grade and compact topsoil.

B. Related Work Described Elsewhere:

1. Earthwork: Section 02200.
2. Site Grading: Section 02210.
3. Solid Sodding: Section 02822.

1.02 PROTECTION

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amounts of weeds, stones, and foreign matter; acidity ranges (pH) of 5.5 to 7.5; containing a minimum of 4 percent (4%) and a maximum of 25 percent (25%) organic matter. Use topsoil stockpiles on site if conforming to these requirements.

PART 3 - EXECUTION

3.01 SUB-SOIL PREPARATION

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

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

B. Cut out areas to sub-grade elevations, which are to receive stabilizing base for paving and/or sidewalks.

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

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

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

3.02 PLACING TOPSOIL

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

1. 6 inches for seeded areas.

2. 4-1/2 inches for sodded areas.

3. 24 inches for shrub beds.

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

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

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

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

F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

A. Remove surplus sub-soil and topsoil from site.

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

END OF SECTION

SECTION 02220

EXCAVATION, BACKFILLING, AND COMPACTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of dewatering, excavating, trenching, sheeting/shoring, grading, backfilling, and compacting those soil materials required for the construction of the structures, piping, ditches, utility structures and appurtenances as shown on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Clearing, Grubbing and Stripping: Section 02110.

2. Earthwork: Section 02200.

3. Site Grading: Section 02210.

4. Testing and Testing Laboratory Services: Section 01410.

5. Dewatering During Construction: Section 02140.

C. Definitions:

1. Maximum Density: Maximum weight in pounds per cubic foot 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 3/4-inch sieve.

3. Rock Excavation: Excavation of any hard natural substance which requires the use of special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.

4. Suitable: Suitable materials for fills shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M-145 and shall be free from vegetation, organic material, marl, silt or muck. Not more than 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 classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, and A-8 in accordance with AASHTO Designation M-145.

D. 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 which can in any way affect the work under this Contract according to the General Conditions.

2. Prior to commencing the excavation, the Contractor shall submit a 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.

E. Trench Safety Act: 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. 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 NONRESPONSIVE. Failure to comply with the provisions of the Act shall result in a per item penalty of $1,000 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 is specified in Section 01410: Testing and Testing Laboratory Services.

1.04 FEDERAL AND STATE REGULATORY REQUIREMENTS

A. All trench excavations which exceed 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 soils report, an adjustment will be made in the contract price, as provided in the General and Special Conditions.

1.06 PROTECTION

A. Pre-Construction Survey:

1. 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.

2. The Contractor shall 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 the previous condition to the satisfaction of the Engineer. Costs shall be paid by the Contractor.

1.07 SUBMITTALS

A. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction and backfilling for the various portions of the work. Review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. All fill material from on and off-site sources shall be subject to the approval of the Engineer.

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 from the job site by the Contractor.

B. Common Fill Material:

1. Common fill shall be sand not containing stones, rock, concrete or other rubble larger than 2 inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.

2. The Contractor shall utilize as much excavated material as possible for reuse in accordance with the contract drawings and specifications or as directed by the Engineer.

3. The Engineer shall direct the Contractor on the type of material allowed in certain sections of the earthwork operations.

C. 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

D. Class I Soils[1] : Manufactured angular, granular material, 1/4 to 1-1/2 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.

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

U.S. Sieve Size	Percent Passing By Weight
1/2	100
3/8	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 50	0-5

E. Class II Soils[2] :

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

[1] Soils defined as Class I soils are not defined in ASTM D2487.
[2] In accordance with ASTM D2487, less than 5 percent pass No. 200 sieve.

2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

3. SW: Well-graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

4. SP: Poorly graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

F. Coarse Sand: 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

G. Other Material: 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.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearing and Grubbing:

1. Clearing and grubbing shall be performed in accordance with Section 02110.

2. Strip and dispose of topsoil off-site, unless otherwise directed to stockpile the material by the Engineer

3.02 PROTECTION

A. Sheeting and Bracing:

1. The Contractor may, at his option, furnish steel sheeting and bracing 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 expense to the Owner.

2. The Contractor shall construct sheeting outside the neat lines of the foundation unless deemed otherwise for his method of operation. Sheeting shall be plumb. 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.

3. 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 shall be provided by the Professional Structural Engineer.

4. 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.

5. Owner may direct the Contractor in writing to leave in place sheeting at any time, during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private.

6. 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.

7. 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.

B. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and

shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels as stipulated in Section 02140. The Contractor shall engage 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 and recharge systems prior to commencing work. 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.

2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the 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.

3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.

4. The Contractor shall take all additional precautions to prevent buoyant uplift of any structure during construction.

5. 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.

6. 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.

7. 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.

8. 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.

3.03 EXCAVATION

A. Excavating for Structures and Utilities:

1. 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.

2. 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.

a) 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 backfill material.

b) Excavation for structures constructed or cast-in-place in dewatered or dry excavations shall be carried down to the 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 Class B concrete.

3. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.

4. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the work.

5. Encounters with subsurface obstructions shall be hand excavated.

6. 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 12” and replaced with FDOT No. 57 Stone as required by the Engineer at the Contractor's expense.

7. 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. The bedding schedule for pipes shall be as shown in Table 02220-B.

8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered by placement.

9. All structure and pipe locations and elevations as required herein must be permanently documented by the Contractor, on the Record Drawings prior to the Engineer's approval of the Application for Payment for that work.

3.04 DRAINAGE

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

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

C. No construction, including pipe laying, shall be allowed in water. Groundwater shall be maintained at least 12 inches below excavation. No water shall be allowed to come into contact with masonry or concrete within 24 hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

D. The Contractor will be required at his expense to excavate below grade and refill with approved fill material if the Owner determines that adequate drainage has not been provided.

3.05 UNDERCUT

A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, he shall refill to normal grade with fill at his own cost. Fill material and compaction method shall be 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 becomes mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. Not more than 1/2 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 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 2 inches 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 not to exceed 8 inches 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 95 percent of relative density at optimum moisture content as determined by Modified Proctor Method, ASTM D1557 (latest edition).

3. Whenever a trench passes through a backfill or embankment, material shall be placed and compacted to an elevation 12 inches above the top of the pipe before the trench is excavated.

C. Compact and backfill schedule for structures according to the schedule listed in Table 02220-A. Backfill schedule for pipes is listed in Table 02220-B. (Modified Proctor shall be ASTM D-1557, latest edition):

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

E. Excavations shall be backfilled to the original grade or as indicated on the 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 plans or ordered by the Owner. Embankments shall be placed in successive layers of not more than 8 inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.

G. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the 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 10 passes of a self-propelled vibratory roller that impacts a dynamic force of not less than 40,000 pounds per drum to the soils. To minimize the effects of compaction induced vibrations on adjacent existing structures the compaction operation should be limited to a distance no closer than 25-feet from the existing structures. Each pass should overlap the preceding pass by 30 percent to insure complete coverage. Backfilled areas shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557 (latest edition) for a depth of not less than 2-feet below the bottom of the foundations or concrete slabs. Any unsuitable foundation material shall be removed and replaced with suitable material.

2. Slabs On Grade: Subgrades for concrete slabs shall be removed, backfilled, and compacted to the required grade. The top 2-feet of concrete slab subgrade in cut sections and all fill material shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557, (latest edition).

3.08 TRENCH EXCAVATION (SEE DRAWINGS FOR DETAIL)

A. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. Four hundred (400) feet shall be the maximum length of open trench on any line under construction. All trench excavation shall be open cut from the surface.

1. Alignment, Grade, and Minimum Cover: The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. 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 42 inches where in paved or graded streets where surface grades are definitely established and 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 which 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	Minimum Sidewall Clearance
60	24
54	21
48	19
36 or smaller	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 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 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 6 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. 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.

E. Artificial Foundations in Trenches: 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. All piling, concrete, or other foundations made necessary by unstable soil shall be installed as directed by the Engineer. 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.

F. Bell Holes: Bell holes shall provide adequate clearance for tools and methods used in installing pipe. 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. Testing is specified in Section 01410: Testing and Testing Laboratory Services.

3.10 DRAINAGE

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. 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. 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 +/- 0.1 feet at the indicated elevations, slopes, and contours where seeding or sodding is not required or, where sodding is required within three (3) inches of finished grade. 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 percent shall be provided.

B. After grading and where seeding is required, topsoil shall be evenly spread to a minimum depth of six (6) inches. Topsoil shall be from an Engineer approved source and shall be clear of trash, debris and surface vegetation more than six (6) inches in height.

C. 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 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) as possible in the stockpile area. All unsuitable materials shall be disposed of by the Contractor offsite in a legal manner.

C. The Contractor shall slope and compact the stockpile with a light roller type vehicle to maintain stability.

D. 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 the General Conditions.

B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer or Owner.

END OF SECTION

TABLE 02220-A

COMPACTION AND BACKFILL SCHEDULE
FOR STRUCTURES

Area	Material	Compaction
Beneath structures, foundations, slabs, and pavements. (minimum 5-foot depth below concrete foundation)	Structural Fill (Para. 2.01 C)	8-inch lifts, compacted to 95% Modified Proctor maximum dry density. Fill should not be placed over any in-place soils until those layers have been compacted to 95% Modified Proctor maximum dry density.
Around structures, foundations and slabs (minimum 5-foot spacing)	Structural Fill (para. 2.01 C)	8-inch lifts, compacted to 95% 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 (Para. 2.01 B)	12-inch lifts, compacted to 95% Modified proctor maximum dry density.
Pipeline trenches from the bottom of the trench to the grade.	See Table 02220-B	6-inch lifts, compacted to 95% Modified proctor maximum dry density.

TABLE 02220-B
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	0.5 O.D.	Coarse Sand	0.5 O.D.+12"	
		Special[b]	Class I	Coarse Sand	0.5 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".
		Special[b]	Class I	Common Fill	0.25 O.D.	Common Fill	--	Organic content <1.1% by wt.
Fiberglass, PVC and Other Plastic Pipe	<6"	Normal[a]	Coarse Sand	Coarse Sand	0.7 O.D.	Coarse Sand	0.3. O.D.+12"	
		Special[b]	Class I	Coarse Sand	0.7 O.D.	Coarse Sand	0.3. O.D.+12"	
	≥16"	Normal[a]	Class II	Class II	0.7. O.D.	Class II	0.3. O.D.+12"	
		Special[b]	Class I	Class II	0.7. O.D.	Class II	0.3. O.D.+12"	
R.C.P.	<48"	Normal[a]	Class I	Common Fill	0.5 O.D.	Common Fill	--	
and		Special[b]	Class I	Class II	0.5 O.D.	Common Fill	--	
C.C.P.	≥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"	

TABLE 02220-B (Continued)
BACKFILL SCHEDULE FOR GRAVITY
AND PRESSURE PIPING

				PIPE ENVELOPE				
				PRIMARY ZONE		SECONDARY ZONE		
Pipe Material	Pipe Size	Trench Condition	Bedding Material	Material	Depth[c]	Material	Depth	Others
Pipe laid in rock (min. trench requirements) except for fiberglass and PVC pipe		Rock	Class I	Class II	0.5 O.D.	Common Fill with max. stone size ≤2"	0.5 O.D.+12"	
Gravity pipe (not specified above)		Normal	Coarse Sand	Coarse Sand	0.5 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"	0.5 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 case of suitable undisturbed earth type trench bottom.
2. Bedding thickness shall be 12 inches unless specified otherwise.
3. The backfill shall be compacted to 95% Modified Proctor maximum dry density and shall be placed in 6-inch lifts for pipe envelope and in 12-inch lifts from 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 method shall be placed within 4 feet of the bedding level or within 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. When indicated on the Drawings, the Contractor shall remove unsuitable material below bedding level to the limits indicated and replace with coarse sand or other acceptable stabilization method up to the bedding level without any additional cost to the Owner.

SECTION 02240

STABILIZED SUBGRADE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work specified in this Section consists of the construction of a stabilized roadway subgrade where indicated on the Drawings. Construction shall be to the uniformity, density and bearing ratio specified hereinafter. Parking areas shall be stabilized to a minimum depth of 12 inches below the bottom grade of the base material and to a width 6 inches outside each pavement or concrete curb edge. Roadways and streets shall be stabilized to the depths and dimensions indicated on the Drawings.

B. Related Work Described Elsewhere:

1. Clearing, Grubbing and Stripping: Section 02110.

2. Earthwork: Section 02200.

3. Site Grading: Section 02210.

4. Testing and Testing Laboratory Services: Section 01410.

PART 2 - PRODUCTS

2.01 GENERAL

A. The particular type of stabilizing material to be used shall be in accordance with City of Palm Bay Specification Section 702-2.

2.02 MATERIALS AND EQUIPMENT

A. Use of Materials from Existing Base:

1. When the utilization of materials from an existing base is called for, (as all, or a portion, of the stabilizing additives) the Engineer will direct the locations, placing and distribution of such materials, and this work shall be done prior to the spreading of any additional commercial or local materials. Removal of any section of existing base will not be required until the need for it in maintaining traffic is fulfilled.

2. The utilization of materials from an existing base may be called for in combination with the designated type of stabilizing.

B. Commercial Materials:

1. General: Materials which are designated as Commercial Materials which are to be used for this stabilizing shall be in accordance with City of Palm Bay and FDOT specifications as well as the Geotechnical Report prepared by Driggers Engineering dated December 14, 2016.

C. Local Material:

1. General: Local materials used for this stabilizing may be high-bearing value soils or sand-clay material. The material passing the 40-mesh sieve shall have a liquid not greater than 30 and a plasticity index not greater than 10.

2. Blending: No blending of materials to meet these requirements will be permitted unless authorized by the Engineer. When blending is permitted, the blended material shall be tested and approved before being spread on the roadway.

D. Stabilization:

1. The type of materials, Commercial or Local, shall be at the Contractor's option.

2. No separate payment for stabilizing materials will be made.

3. Bearing Value determinations will be made by the Limerock Bearing Ratio (LBR) Method. For this project, a minimum LBR of 40 shall be required for any base material selected by the Contractor in Section 2.02.D.1.

4. Under this method, it shall be the Contractor's responsibility that the finished roadbed section meets the bearing value requirements, regardless of the quantity of stabilizing materials necessary to be added. Also under this method, full payment will be made for any areas where the existing sub-grade materials meet the design bearing value requirements without the addition of stabilizing additives, as well as areas where the Contractor may elect to place select high-bearing materials from other sources, within the limits of the stabilizing.

5. After the roadbed grading operations have been substantially completed, the Contractor shall make his own determination as to the quantity (if any) of stabilizing material, of the type selected by him, necessary for compliance with the bearing value requirements. The Contractor shall notify the Engineer of the approximate quantity to be added, and the spreading and mixing in of such quantity of materials shall meet the approval of the Engineer as to uniformity and effectiveness.

2.03 QUALITY CONTROL (Manufacturer & Supplier product quality control specifics required for project)

A. Material testing shall be performed as directed in Section 01410, Testing and Testing Laboratory Services.

PART 3 - EXECUTION

3.01 PREPARATION

A. General:

1. Prior to the beginning of stabilizing operations, the area to be stabilized shall have been constructed to an elevation such that upon completion of stabilizing operations the completed stabilized subgrade will conform to the lines, grades and cross sections shown in the plans. Prior to the spreading of any additive stabilizing material, the surface of the roadbed shall be bought to a plane approximately parallel to the plane of the proposed finished surface.

2. The subgrade to be stabilized may be processed in one (1) course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction and other desired results, in which case, the Engineer will direct that the processing be done in more than one (1) course.

3.02 INSTALLATION

A. Stabilizing Material:

1. When additive stabilizing materials are required, the designated quantity shall be spread uniformly over the area to be stabilized.

2. When materials from an existing base are to be utilized in the stabilizing at a particular location, all of such materials shall be placed and spread prior to the addition of other stabilizing additives.

3. Commercial stabilizing material shall be spread by the use of mechanical material spreaders except that where use of such equipment is not practicable other means of spreading may be used, but only upon written approval of the proposed alternate method.

B. Mixing:

1. The mixing shall be done with rotary tillers, or other equipment meeting the approval of the Engineer. The area to be stabilized shall be thoroughly mixed throughout the entire depth and width of the stabilizing limits.

2. The mixing operations, as specified, will be required regardless of whether the existing soils, or any select soils placed within the limits of the stabilized sections, have the required bearing value without the addition of stabilizing materials.

3. As an exception to the above mixing requirements, where the subgrade is of rock, the Engineer may direct that the mixing operations (and the work of stabilizing) be waived and no payment for stabilization will be made for such sections of the roadway.

C. Maximum Particle Size of Mixed Materials: At the completion of mixing, all particles of material within the limits of the area to be stabilized shall pass a 3-1/2 inch ring. Any particles not meeting this requirement shall be removed from the stabilized area or shall be broken down so as to meet this requirement.

D. Compaction: After the mixing operations have been completed and requirements for bearing value, uniformity and particle size have been satisfied, the stabilized area shall be compacted, in accordance with Paragraph 3.03B., hereinafter. The materials shall be compacted at a moisture content permitting the specified compaction. If the moisture content of the material is improper for attaining the specified density, either water shall be added or the material shall be permitted to dry until the proper moisture content for the specified compaction is reached.

E. Finish Grading: The completed stabilized subgrade shall be shaped to conform with the finished lines, grades and cross-section indicated in the Drawings. The subgrade shall be checked by the use of elevation stakes, or other means approved by the Engineer.

F. Requirements for Condition of Completed Subgrade:

1. After the stabilizing and compacting operations have been completed, the subgrade shall be firm and substantially unyielding, to the extend that it will support construction equipment and will have the bearing value required by the Drawings.

2. All safe and yielding material, and any other portions of the subgrade which will not compact readily, shall be removed and replaced with suitable material and the whole subgrade brought to line and grade, with proper allowance for subsequent compaction.

G. Maintenance of Completed Subgrade: After the subgrade has been completed as specified above, the Contractor shall maintain it free from ruts, depressions and any damage resulting from the hauling or handling of materials, equipment, tools, etc. It shall be the Contractor's responsibility to maintain the required density until the subsequent base or pavement is in place. Such responsibility shall include any repairs, replacement, etc. of curb and gutter, sidewalk, etc. which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. Any such work required for recompaction shall

be at the Contractor's expense. Ditches and drains shall be constructed and maintained along the completed subgrade section.

3.03 INSPECTION AND TESTING (FIELD QUALITY CONTROL)

A. Bearing Value Requirements:

1. General: Bearing value samples will be obtained and tested by the Testing Laboratory at completion of satisfactory mixing of the stabilized area. For any area where the bearing value obtained is deficient from the value indicated in the Drawings, in excess of the tolerances established herein, additional stabilizing material shall be spread and mixed in accordance with Paragraphs 3.02A.3., 3.02B.1. and 3.02B.2., herein. This reprocessing shall be done for the full width of the roadway being stabilized and longitudinally for a distance of 50 feet beyond the limits of the area in which the bearing value is deficient.

2. Tolerances In Bearing Value Requirements: The following undertolerances from the specified bearing value will be allowed as based on tests performed on samples obtained after mixing operations have been completed:

Specified Bearing Value	Undertolerances
Lime Bedrock Ratio 40	5.0

B. Density Requirements - General: Within the entire limits of the width and depth of the areas to be stabilized, the minimum density acceptable at any location will be 98 percent (98%) of the maximum density as determined by AASHTO T-180, Test Method D: Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 Kg (10 lb) Rammer and a 457 mm (18 in) Drop.

C. Testing Frequency: Tests for Bearing Values and Density will be taken at intervals not to exceed 500 feet on center. Test shall be taken alternating between left, right, and center to insure a uniform sample of the product.

END OF SECTION

SECTION 02500

PAVING AND SURFACING

PART 1- GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Work consists of the application of bituminous material on a previously prepared base and overlay of existing asphalt areas in accordance with these Specifications and in accordance with the lines, grades, dimensions, and notes shown on the Drawings.

2. The Work specified in this section consists of the construction of asphaltic concrete surface course composed of a mixture of aggregates, mineral filler and asphalt cement properly laid upon a prepared base or a newly constructed binder course in accordance with these Specifications and in conformity with the lines, grades, thickness, and typical cross section shown on the Drawings. The Contractor shall furnish SP 12.5 asphaltic concrete as indicated on the Drawings.

1.02 QUALITY ASSURANCE

A. Laboratory analysis on all materials by a Certified Testing Laboratory shall be complete and the materials accepted by the Engineer prior to placement.

1.03 SUBMITTALS

A. The following submittals are required on all asphaltic concrete:

1. Aggregate Analysis: One (1) per design per FDOT Standard Specifications.

2. Design Mix: One (1) per type per FDOT Standard Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Prime Coat: Unless otherwise indicated, the material used for the prime coat shall be cutback asphalt, Grade RC-70 or EC-250 and shall conform to the requirements specified in AASHTO Designation M-81-75 (1982). Unless otherwise indicated, the use of either RC-70 or RC-250 shall be at the Contractor's option.

B. Tack Coat: The material used for the tack coat shall be emulsified asphalt, Grade RS-2 and shall conform to the requirements specified in AASHTO Designation M-140-82.

C. SP 12.5 Asphaltic Concrete: Materials used in the SP 12.5 asphaltic concrete pavement mix shall conform to the applicable DOT requirements. No construction of this type shall be started until the Contractor has submitted a job mix formula prepared by the approved testing agency and has obtained approval from the Engineer. In general, the mix proportions shall be in the following range by weight:

Material	Percent
Mineral Aggregate*	91 - 95.5
Asphaltic Cement (Bitumen)	9 - 4.5
Total Mix	100

*Maximum recycle mixture of Aggregate is 25%.

1. The bituminous material shall be asphalt cement, viscosity grade AC-20. The aggregate shall be clean and shall contain no deleterious substances. Coarse or fine aggregate containing any appreciable amount of phosphate shall not be used.

2. For the purpose of proportioning the paving mixture, all material passing the No. 10 sieve and retained on the No. 200 sieve shall be considered as fine aggregate and the material passing the No. 200 sieve shall be considered as mineral filler.

3. Any screenings used in the combination of aggregates shall contain not more than 15 percent of material passing the No. 200 sieve. When two (2) screenings are blended to produce the screening component of the aggregate, the combined total of material passing the No. 200 sieve must not exceed 15 percent. Screenings may be washed to meet these requirements.

4. Mineral filler, if needed, shall consist, in general, of lime rock dust, portland cement, slag dust, hydrated lime, or any other inert mineral matter from sources approved by the Engineer. The mineral filler shall be thoroughly dry and free from lumps consisting of aggregations of fine particles. Ground phosphate will not be allowed as a mineral filler.

5. The laboratory compacted mixture shall have a density of not less than 95 nor more than 98 percent of the calculated theoretical density of a voidless mixture composed of the same materials in like proportions. Samples of the mixture in use shall be taken as many times daily as is necessary and the mixture shall be maintained uniform throughout the Project.

2.02 EQUIPMENT FOR PRIME AND TACK COATING

A. The pressure distributor for placing the tack or prime coat shall be equipped with pneumatic tires having sufficient width of rubber in contact with the road surface to avoid breaking the bond of or forming a rut in the surface.

B. The distance between the centers of openings of the outside nozzles of the spray bar shall be equal to the width of the application required, within an allowable variation of 2 inches.

C. The outside nozzle at each end of the spray bar shall have an area opening of not less than 25 percent, nor more than 75 percent in excess of the other nozzles which shall have uniform openings.

D. When the application covers less than the full width, the normal opening of the end nozzle at the junction line may remain the same as those of the interior nozzle.

PART 3 - EXECUTION

3.01 PREPARATION AND PRIMING

A. Cleaning the Base: Before any bituminous material is applied, remove to the shoulders all loose material, dust, caked clay, and foreign material which might prevent proper bond with existing surface. Take particular care to clean the outer edges of the strip to be treated to insure that tack coat will adhere. Where the prime or tack coat is applied adjacent to curb-and-gutter or valley gutter, such concrete surfaces are to be protected and kept free of bituminous material.

3.02 WEATHER LIMITATIONS

A. Prime and Tack Coats: No bituminous material shall be applied when the air temperature is less than 50 degrees Fahrenheit (^{o}F) in the shade, or when the weather conditions or the condition of the existing surface is unsuitable. In no case shall bituminous material be applied while rain is falling or when there is water on the surface to be covered.

B. Asphaltic Concrete SP 12.5:

1. The mixture shall be spread only when the surface upon which it is to be laid has been previously prepared, is intact, firm and properly cured, and is dry. Unless otherwise approved by the Engineer, no mixture shall be spread that cannot be finished and compacted during daylight hours.

2. The mixture shall not be spread when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc. are being deposited on the surface being paved, to the extent that the bond between layers will be diminished.

3.03 APPLICATION OF PRIME COAT

A. After the base has been finished, the full width of surface shall be swept with a power broom supplemented with hand brooms and mechanical blowers prior to the application of the prime coat. Care shall be taken to remove all loose dust, dirt and objectionable matter. If deemed necessary, the base shall be lightly sprinkled with water immediately in advance of the prime coat. The prime coat shall be applied to the full width of the base.

B. The temperature of the prime material shall be such as to insure uniform distribution. The material shall be applied with a pressure distributor as specified above. The amount to be applied shall be sufficient to coat the surface thoroughly and uniformly without any excess to form pools or to flow off the base. For limerock base, the rate of application shall not be less than 0.10 gallons per square yard; for shell base, the rate of application shall not be less than 0.15 gallons per square yard.

C. If the roadway is to be opened for use following the application of the prime material, a light uniform application of clean sand shall be applied and rolled. The sand shall be nonplastic, shall be free from silt and rock particles and shall not contain any sticks, vegetation, grass, roots or organic matter. After the sand covering has been applied, the surface may be opened to traffic.

3.04 APPLICATION OF TACK COAT

A. In general, a tack coat will be used on primed bases except in areas where the prime has not cured and lost its bonding effect.

B. No tack coat shall be applied until the primed base or leveling course has been cleaned and is free from sand, dust, or other objectionable material.

C. The tack coat shall be applied with a pressure distributor as specified above. It shall be heated to a suitable consistency and applied in a thin uniform layer at the rate of between 0.02 gallons and 0.08 gallons per square yard.

D. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying, but shall not be applied so far in advance or over such an area as to lose its adhesiveness as a result of being covered with dust or other foreign material. Suitable precautions shall be taken by the Contractor to protect the surface while the tack coat is drying and until the wearing surface is applied.

3.05 GENERAL CONSTRUCTION REQUIREMENTS HOT BITUMINOUS MIXTURES

A. This section specifies the general construction requirements for the plant-mixed hot bituminous pavements and bases.

1. The mixture shall be transported in tight vehicles previously cleaned of all foreign material and, if necessary, each load shall be covered. The cover shall

be used during cool and cloudy weather and at any time where there is probability of rain. The inside surface of the truck bodies shall be thinly coated with soapy water or an approved emulsion containing not over 5 percent oil, but no excess of either shall be used. Kerosene, gasoline, or similar products shall not be used. After the truck bodies are coated and before any mixture is placed therein, they shall be raised so that all excess liquids will be drained out.

2. A tack coat will be required on the following surfaces:

   a. Between successive surface courses.

   b. Between successive leveling courses.

   c. Between leveling and surface courses tack coat shall also be applied as specified hereinbefore.

3. All hot bituminous plant-mixed material other than adjacent to curb and gutter or other true edges, shall be laid by the stringline method, to assure the obtaining of an accurate, uniform alignment of the pavement edge. The temperature of the mixture at the time of spreading shall be within 25^{o}F of the temperature set by the Engineer.

   a. Any mixture caught in transit by rain may be laid only at the Contractor's risk. Should such mixture prove unsatisfactory, it shall be removed and replaced with satisfactory mixture. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.

   b. In limited areas where the use of the spreader is impossible or impracticable, the mixture may be spread and finished by hand. Straight-edging and back-patching shall be done after initial compaction has been obtained and while the material is still hot.

4. Surface course materials upon arrival shall be dumped into the approved mechanical spreader and immediately spread and struck-off to the full width required and to such loose depth for each course that, when the work is completed, the required weight of mixture per square yard, or specified thickness, will be secured.

   a. An excess amount of mixture shall be carried ahead of the screen at all times. Hand raking shall be done behind the machine as required.

   b. Where a surface course is constructed to a thickness greater than 2 inches, it shall be constructed in approximately equal layers and no layer shall be more than 2 inches in thickness when compacted.

c. Before any rolling is started, the surface shall be checked, any irregularities adjusted and all drippings, fat sandy accumulations from the screen and fat spots from any source shall be removed and replaced with satisfactory material. No skin patching shall be done. When a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture.

5. For each paving train in operation, the Contractor shall furnish a separate set of rollers and operators. The rolling shall be done in the following sequence, with the equipment as shown, unless otherwise permitted by the Engineer.

   a. Seal rolling, using tandem steel rollers weighing 5 to 12 tons, and following as close behind the spreaders as possible without pickup, undue displacement or blistering of the material.

   b. Rolling with self-propelled, pneumatic-tired rollers, following as close behind the seal rolling as the mix will permit. The roller shall cover every portion of the surface with at least five (5) passes.

   c. Final rolling with the 8- to 12-ton tandem steel roller is to be done after the seal rolling and pneumatic-tired rolling have been completed, but before the pavement temperature has dropped below 140^{o}F.

Areas which are inaccessible to a roller shall be compacted by the use of hand tamps or other satisfactory means.

6. The roller shall not be allowed to deposit gasoline, oil, or grease onto the pavement and any areas damaged by such deposits shall be removed and replaced as directed by the Engineer. While the rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements.

   a. All drippings, fat or lean areas, and defective construction of any description shall be removed and replaced. Depressions which develop before the completion of the rolling shall be remedied by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depression remain after the final compaction has been performed, the material around the depression shall be replaced with sufficient new mixture to form a true and even surface. All high spots, high joints and honeycomb shall be corrected as directed by the Engineer.

   b. Any mixture remaining unbonded after rolling shall be removed and replaced. Any mixture which becomes loose or broken, mixed or coated with dirt or in any way defective, prior to laying the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area.

c. Areas of defective surface may be repaired by the use of indirect heat. No method of repair involving open flame heaters shall be used.

7. After final compaction, the density required for SP 12.5 asphaltic concrete shall be at least 95 percent of the laboratory compacted density of the paving mixture, per ASTM 02950-81.

8. The final surface course will be required to be checked by the use of a rolling or manual straightedge. As soon as the rolling has been completed and the surface has hardened sufficiently to be walked on, the entire surface shall be checked. The finished surface shall not vary more than 1/4 inch from the template cut to the cross-section of the road nor more than 3/16-inch from the straightedge applied parallel to the center line of pavement. Any surface irregularities exceeding these limits shall be corrected. In areas where a reverse crown is used, the asphalt shall be placed so that the lip of the inlets within the road have no more than 1/8" exposed. A maximum of ¼" above the rim will be allowed.

9. The finished surface shall be of uniform texture and compaction. The surface shall have no pulled, torn, or loosened portions and shall be free of sand streaks, sand spots or ripples. (These requirements shall also apply to any areas where it is necessary to apply hand work.)

10. Any areas which the surface does not meet above requirements for texture, sand streaks, ripples, pulled or loosened portions, or for uniformity of compaction; or does not meet the straight-edging requirements, shall be corrected.

    a. Such corrections may be made either by replacing the surface course (to full depth) or by overlaying with the type of asphaltic concrete mixture being placed.

    b. Within the longitudinal limits where such defective areas occur, such corrections shall be made for the full width of the roadway and for longitudinal distances in both directions beyond such defective areas in accordance with the following:

        (1) If the correction is made by replacing the full thickness, it shall extend to at least 50 feet each side of the defective area.

        (2) If the Contractor elects to effect the correction by overlaying, the overlay shall consist of at least 100 pounds of mixture per square yard at the defective section, and shall taper uniformly down from the full thickness of such weight to zero thickness at the end of a minimum length of 50 feet each side of the defective area.

(3) The transverse thickness at any section shall be such as to provide the design cross section.

(4) Sections of newly compacted asphalt concrete which are to be covered by additional courses shall be kept clean until the successive course is laid.

11. Upon completion of the finished pavement, no dumping of any material directly on the pavement will be permitted. When shoulders are constructed after completion of the final surface, blade graders operating adjacent to the pavement during shoulder construction shall have a 2-inch by 8-inch (or larger) board (or other attachment providing essentially the same results) attached to their blades in such manner that it extends below the blade edge, in order to protect the pavement surface from damage by the grader blade. Vehicular traffic shall not be permitted on any pavement which has not set sufficiently to prevent rutting or other distortion.

3.06 TESTING REQUIREMENTS

A. Field Density Tests are to be located no further than 300 feet apart on center with a minimum of one (1) per roadway or parking/maneuvering area.

B. Thickness Tests are to be located no further than 500 feet apart on centers with a minimum of one (1) per roadway or parking/maneuvering area.

END OF SECTION

SECTION 02509

CONCRETE SIDEWALKS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included in this Section consists of furnishing all labor, material, equipment and transportation for the construction of the sidewalks to the lines and grades as shown on the Drawings.

B. Related Work Described Elsewhere:

1. Excavation, Backfilling, and Compacting: Section 02220.

2. Cast-In-Place Concrete: Section 03300.

1.02 SUBMITTALS

A. All materials specified shall be certified by the producer or manufacturer that the furnished material meets the specific requirements of the Specifications.

1.03 TESTING

A. Testing requirements and frequencies for concrete sidewalks shall be as outlined in Section 03300: Cast-In-Place Concrete.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete: Concrete shall have a 28 day compressive strength of 3,000 pounds per square inch (psi).

B. Welded Wire Fabric: Welded wire fabric shall conform to the requirements of Section 03300: Cast-in-Place Concrete.

C. Preformed Joint Filler: Preformed joint filler shall be non-extruding and resilient bituminous type and shall conform to the requirements of ASTM Designation D-1751.

D. Membrane Curing Compound: Membrane curing compound shall be clear fugitive dye and conform to the requirements of AASHTO Designation M-148, Type l-D.

PART 3 - EXECUTION

3.01 PREPARATION

A. Subgrade Condition:

1. The subgrade compaction shall achieve at least 95% of the modified proctor maximum density to a depth of 12 inches, or as otherwise recommended by a Geotechnical Engineer. 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. Large boulders and other obstructions shall be removed to a minimum depth of 6 inches below the finished subgrade elevation, and the space shall be backfilled with sand. Base course material or other suitable material shall be thoroughly compacted by rolling or tamping.

2. The subgrade shall be accurately trimmed to the required elevation with a 1/4 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.

B. Setting Forms: The forms shall be accurately set to line and grade and such that they rest firmly, throughout their entire length upon the compacted subgrade surface. Forms shall be joined neatly and tightly and braced to resist the pressure of the concrete and the finished operations. The alignment and grade of all forms shall be approved before and immediately prior to the placing of concrete.

C. Slipforming: The slipforming method will be allowed, provided that an acceptable finished product, true to line, grade, and cross section is consistently produced.

D. Mixing Concrete: Concrete shall be mixed in accordance with the requirements of Section 03300: Cast-In-Place Concrete.

3.02 INSTALLATION

A. Placing Concrete:

1. The concrete shall be distributed on the subgrade to such depth that, when it is consolidated and finished, the thickness required by the Drawings will be obtained at all points and the surface will at no point be below the grade specified for the finished surface. The concrete shall be deposited on the subgrade in a manner which will require as little rehandling as possible. Placing of the concrete shall be continuous between transverse joints, without the use of intermediate bulkheads.

2. Reinforcement shall be placed as shown on the Drawings and shall be maintained at this location during the placing and finishing operations.

3. Concrete shall be thoroughly consolidated against and along the faces of all forms by means of vibrators. Vibrators 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. In no case shall the vibrator be operated longer than 15 seconds in any one location.

B. Striking-off, Consolidating and Finishing Concrete: 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 Drawings and Specifications.

C. 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 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 10 foot straightedge span shall be corrected.

D. Final Finish: 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. Finally, all edges, including expansion joint edges, shall be finished with an edging tool having a radius of 1/4 inch.

E. Joints:

1. Transverse Construction Joints: 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 30 minutes. Construction joints, however, shall not be placed within 5 feet of any other transverse joint or of either end of a section of walk. If sufficient concrete has not been placed to form a slab at

least five feet long, the excess concrete, back to the last preceding joint, shall be removed. 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. Construction joints shall have tooled edges with a 1/4 inch radius.

2. Transverse Contraction Joints: Transverse contraction joints shall be formed at five foot intervals and shall consist of planes of weakness created by an edging tool. The cut in the fresh concrete shall be perpendicular to the surface of the walk, shall extend to a depth of 1-1/2 inches below the top surface and shall have 1/4 inch radius tooled edges.

3. Transverse Expansion Joints: 1/2 inch expansion joints shall be formed by placing preformed joint filler around all structures and at intervals not exceeding 100 feet.

F. Curing:

1. 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.

2. Curing compound shall be uniformly applied to the surfaces to be cured, in a single coat, continuous film, at the rate of one gallon to not more than 200 square feet, by a sprayer.

3. 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.

G. Form Removal: After the concrete has sufficiently set a minimum of 12 hours, the Contractor shall remove the forms and shall backfill the space on each side. The earth shall be compacted and graded in a satisfactory manner without damage to the concrete work. Honeycombs shall be filled with sand cement mortar. Plastering will not be allowed on the face of the walk. Rejected walk shall be removed and replaced by the Contractor without additional compensation.

END OF SECTION

SECTION 02525

CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials and construction of curbs, valley gutters, curb and gutter, and Miami curb.

B. Related Work Described Elsewhere:

1. Earthwork: Section 02200.

C. Standards

1. Determine the density of soil in place by the sand cone method, ASTM D1556; by nuclear methods, ASTM D2922 or D3017.

2. Determine laboratory moisture-density relations of soils by ASTM D1557 (Modified Proctor).

3. Determine the relative density of cohesionless soils by ASTM D2049.

4. Sample backfill material by ASTM D75.

5. "Relative density" is the ratio, expressed as a percentage, of the inplace dry density to the laboratory maximum dry density as determined by ASTM D1557 (Modified Proctor).

6. Testing: An independent testing laboratory will make density tests for determination of specific compaction and concrete cylinder tests. The Contractor is responsible for the costs of testing to determine conformance with these specifications.

1.02 SUBMITTALS

A. All materials specified shall be certified by the producer or manufacturer that the furnished materials meet specified requirements of the specification.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Make all concrete curbs with Class 1 concrete, minimum 28-day compressive strength of 3000 psi, in accordance with the applicable sections of these specifications.

B. Concrete shall comply with the requirements of these specifications.

C. Reinforcement, Joint Materials, and Forms: Comply with applicable sections of these specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Foundation: Excavate or backfill to the required depth. Stabilize the foundation material upon which the curb is to be set as shown on the construction plans with an even surface, true to line, grade and cross section, and soaking wet at the time that the concrete is placed.

B. Forms: Place forms straight, free from warp or bends, and set to the line and grades shown on the drawings.

C. Placing Concrete: Place concrete in the forms. Tamp and spade until mortar entirely covers its surface. Float the top of the concrete smooth and round the edges to the radius shown in the plans.

D. Joints: Except for machine-placed items, at the option of the Contractor, contraction joints may be formed by the use of dummy joints (either formed or sawed) or by the use of sheet metal templates. If sheet metal templates are used, make them 1/4-inch thick and other dimensions same as cross section of form. Hold templates firmly during the placing of the concrete and leave in place until the concrete has set sufficiently to hold its shape, but remove while the forms are still in place.

For machine-placed items, unless otherwise approved, saw contraction joints approximately 3/16-inch wide and 1-1/2-inch deep in curb and gutter as soon as the concrete has hardened to the degree that excessive raveling will not occur and before uncontrolled shrinkage cracking begins. Space contraction joints at intervals of 10 feet, except where lesser interval is required for closure, but make no section less than 4 feet in length.

Construct expansion joints at all inlets, at all radius points, in other locations indicated in the plans at intervals of 500 feet between other expansion joints or ends of a run. The joints shall be 1/2-inch in width.

E. Finishing: Finish all exposed surfaces while the concrete is still green. In general, only a brush finish will be required. For any surface areas, however, which are too rough or have other surface defects which make additional finishing necessary, rub the curb to a smooth surface with a soft brick or wood block, with water used liberally.

F. Curing: Continuously cure the concrete for a period of at least 72 hours. Commence curing after finishing has been completed and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Replace immediately any curing material removed or damaged during the 72-hour period. Curing will be done by the membrane curing compound method.

To cure by the membrane curing compound method, apply clear membrane curing compound or white pigmented curing compound by a hand sprayer in a single coat continuous film and uniform coverage of at least one gallon to each 200 square feet. Thoroughly agitate the curing compound in the drum prior to application and during application as necessary to prevent settlement of pigment. Re-coat immediately any cracks, chips or other defects appearing in the coating.

G. Backfilling and Compacting: After the concrete has set sufficiently, fill the spaces in back of the curb to the required elevation with suitable material and compact to 90 percent relative density.

H. Machine Laid Curb: Concrete curbs may be installed by machines without forming, provided that the finished product is straight, free from warp or bends, and does not deviate from the design line and grade or cross section.

I. Driveways: When construction is through areas previously "built up", construct drop curbs for driveway aprons at all existing driveways and as shown on the plans. When construction is in "new" areas, construct drop curbs as shown in the plans.

J. Testing: Sample and cure the concrete in accordance with ASTM C31, except take not less than five (5) 6-inch by 12-inch cylinders for each 50 cubic yards poured or each day's pour less than 50 cubic yards. A slump test may be taken in conformity with ASTM C143, and the cylinders shall be tested in accordance with ASTM C39.

The finished curbs, valley gutters, and curb and gutters, and Miami curbs shall be within 0.02 feet of the lines and grades shown on the plans. The finished concrete shall be smooth to within 1/4-inch in ten feet, without cracks (other tan contraction joints) and without puddled or tapped water deeper than 1/4-inch

Remove and replace all work that does not meet above requirements.

END OF SECTION

SECTION 02574

PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Work included under this Section consists of cutting, removing, protecting and replacing existing pavements, driveways, sidewalks, curb and combination curb and gutter of the various types encountered.

B. Protection of Existing Improvements: 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.

C. Related Work Described Elsewhere:

1. Excavating, Backfilling and Compaction: Section 02220.

1.02 DEFINITIONS

A. Surface Cap: A ½-inch thick crust of sprayed asphalt over the backfilled open cut area with sand spread over the sprayed surface.

B. Surface Patch: A temporary asphalt surface with a minimum 1-inch of thickness as specified in Paragraph 3.01.A.1.d.

C. Complete Replacement / Overlay: A complete resurfacing of the entire width of the street with asphaltic concrete 2-inches thick, including restoration of the full base and subgrade requirements as specified in the pavement section of the drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials, including stabilized subgrade, base, bituminous prime and tack coat, and asphaltic concrete for the above work shall meet the requirements of the ROW permits granted by the governing agency. In the absence of permit requirements, materials shall comply with the following:

1. Stabilized subgrade shall conform to Section 160 of the Florida Department of Transportation (FDOT) Standard Specification of Road and Bridge Construction (latest edition).

2. Base material shall conform to Section 230 of the FDOT Standard Specification of Road and Bridge Construction (latest edition).

3. Bituminous prime and tack coat materials shall conform to Section 300 of the FDOT Standard Specification of Road and Bridge Construction (latest edition).

4. Asphalt concrete shall conform to Section 334 of the FDOT Standard Specification of Road and Bridge Construction (latest edition) or requirements of authority having jurisdiction.

5. Portland cement concrete shall conform to Section 350 of the FDOT Standard Specification of Road and Bridge Construction (latest edition).

PART 3 - EXECUTION

3.01 PERFORMANCE

A. Removals:

1. Pavement Removal:

a. Where existing pavement is to be removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, to the full depth of the pavement section extending through the base and subgrade, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimized.

b. Temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration.

c. In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the dimensions specified in the drawings. Following the above operation, the CONTRACTOR shall proceed immediately with final pavement, base, and subgrade restoration in accordance with these requirements.

2. Sidewalk, Drive & 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. The removal line shall be extended to the next joint, each way. After sawing, the material shall be removed. Temporary paths of travel shall be provided to maintain pedestrian traffic. Particular attention should be given to providing accessible routes to the disabled.

B. Restorations:

1. General: Street or roadway pavement cut and removed in connection with trench excavation shall be replaced or restored to the full depth through the base and subgrade in equal or better condition than the original and as shown on the Drawings. Street or roadway pavement restoration shall begin immediately upon completion of backfill and compaction or curing of flowable backfill. The Drawings indicate minimum requirements.

2. Asphalt Pavement Restoration: Restoration of existing pavement shall be in accordance with the drawings replacing full depth of asphalt, base, and subgrade and with the provisions of Section 334 of the FDOT Standard Specifications for Road and Bridge Construction (latest edition) or requirements of authority having jurisdiction.

3. Asphalt Driveway Restoration: Driveway pavement with base cut and removed in connection with trench excavation shall be replaced or restored as specified above for street or roadway pavement, except the new base course shall equal the existing base course in thickness.

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. Class B concrete shall be used in all cases.

   b. Replaced portions of these items shall conform to the lines, grades, and cross sections of the removed portions. Concrete sidewalks and walkways subject to vehicular traffic shall be of 6-inch thickness; concrete sidewalks and walkways not subject to vehicular traffic shall be of 4-inch thickness; concrete driveways and driveway ribbons shall be 6-inch thickness. Replaced concrete curb and/or gutter shall extend the next control joint, each way.

5. Concrete Pavement Restoration: Rigid pavement shall be replaced in kind with Class B concrete, using high early strength cement. The base course for rigid pavement shall be replaced in kind and compacted to a thickness to match the existing base.

6. Asphaltic Concrete Surface course Overlay:

   a. The work under this section includes asphaltic concrete surface course overlay paving as and where directed by the ENGINEER. Where this paving is directed it shall take the place of asphaltic concrete pavement restoration as specified herein above. This surface course overlay shall extend over the reconstructed base course and the existing pavement to the limits directed by the ENGINEER, which generally shall be the full width of the roadway.

   b. After the base course construction in the trench area has been completed and primed, the asphalt pavement surface shall meet standards of authority having jurisdiction.

END OF SECTION

SECTION 02730

PIPE CULVERTS AND STORM SEWERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work specified in this Technical Provision consists of furnishing drainage pipe and mitered end sections, conforming to these specifications and the particular types, sizes and dimensions as shown on the detailed project plans. This work shall include the installation of the pipe and mitered end sections at the locations called for, and furnishing and construction of such joints and connections to existing pipes, catch basins, inlets, manholes, walls, and such, as may be required to complete the work as indicated in the detailed project plans. The Contractor shall, at no additional cost to the city, replace any bedding material that is not acceptable to the City. Bedding material shall be incidental to this bid item. All pipe culvert and storm sewer pipe shall be placed true to the lines and grades given and within a plus tolerance of 0.00' and a minus tolerance of 0.04'.

1. If the storm sewer pipe will be installed in the rainy season, the City recommends, but does not require, the use of well pointing to keep the storm sewer trenches workable.

2. Construction of pipe culverts and storm sewers shall conform to the requirements of Section 430 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, dated 2010, and Florida Department of Transportation Roadway and Traffic Design Standards, Indexes No. 205, 270, 272, 273, and 280 dated January 2010, except as amended herein.

3. Proposed storm sewer pipe to be connected to existing structures shall have openings cut into the existing structure without permanently damaging the structure. The opening shall be grouted watertight after installation of the pipe, and the structure shall be restored as approved by the Engineer. The cost of connections to existing structures shall be included in the price bid for the pipe.

4. Wrap all reinforced concrete pipe joints (round and elliptical) with a geotextile fabric (Mirafi or approved equal). The fabric shall completely encircle the joint, overlap 2%' and extend 2%' beyond both sides of the joint. The unit cost for placement of pipe includes joint wrapping.

5. The Contractor shall comply with TS-104 N.P.D.E.S. Compliance including, but not limited to, staked silt fence placed at ends of the pipe culvert for erosion control

during the shoulder and sodding construction. Filter fabric shall be used instead of baled hay or straw, per FDOT Specifications, Section 985. Erosion control measures will be paid for as part of TS-104 N.P.D.E.S. Compliance.

1.02 DRAINAGE PIPE

A. HDPE DRAINAGE PIPE: The work specified in this Technical Provision consist of furnishing HDPE drainage pipe conforming to these specifications and the particular sizes and dimensions as shown on the detailed project plans. This work shall include the installation or the drainage pipe and at the locations called for, and furnishing and construction of such joints and connections to existing pipes, catch basins, inlets, manholes, walls, and such, as may be required to complete the work as indicated in the detailed project plans. The Contractor shall, at no additional cost to the City, replace any bedding material that is not acceptable to the City. Bedding material shall be incidental to this bid item. All pipe shall be placed true to the lines and grades given and within a plus tolerance of 0.00' and a minus tolerance of 0.04'.

1. The HDEP pipe shall be corrugated on the outside and smooth wall inside. Pipe shall be ADS N-12 ST (ASTM 2648) or approved equal.

B. CONCRETE DRAINAGE PIPE: The work specified in this Technical Provision consist of furnishing Concrete drainage pipe conforming to these specifications and the particular sizes and dimensions as shown on the detailed project plans. This work shall include the installation or the drainage pipe and at the locations called for, and furnishing and construction of such joints and connections to existing pipes, catch basins, inlets, manholes, walls, and such, as may be required to complete the work as indicated in the detailed project plans. The Contractor shall, at no additional cost to the City, replace any bedding material that is not acceptable to the City. Bedding material shall be incidental to this bid item. All pipe shall be placed true to the lines and grades given and within a plus tolerance of 0.00' and a minus tolerance of 0.04'.

1. The Concrete pipe shall be reinforced concrete pipe (Class III) in accordance with FDOT Specification Section 499-Precast Concrete Drainage Products.

1.03 METHOD OF MEASUREMENT:

A. The quantities to be paid for under this Technical Provision shall be the length in linear feet of pipe measured in place, completed and accepted. The measurement shall include the portion of pipe extending into the walls (farthest point) of the inlets, junction boxes, and manholes.

1.04 BASIS OF PAYMENT:

A. The quantities, determined as provided above shall be paid for at the Contract unit price per linear foot of pipe, of the kinds and sizes shown on the bid form. Price and payment shall be full compensation for all work and materials required. Such prices and payments shall be full compensation for all work and materials including excavation (in whatever material is encountered), dewatering, removal of unsuitable material, backfilling, and compacting around the culvert, furnishing and laying the pipe, and disposal of surplus materials. Payment for connection of proposed pipes to existing structures and replacement of pavement and base course removed for pipe trenching shall be included in these items.

END OF SECTION

SECTION 02822

SOLID SODDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to prepare lawn bed and install sodding as specified.

B. Areas to receive sodded grass lawns shall be as follows:

1. All areas within right-of-way and all other areas disturbed by the CONTRACTOR's operation.

1.02 SUBMITTALS

A. Provide technical data as provided in Section 01340 for shop drawings on all materials or installation procedures required under this Section.

B. Submit representative topsoil samples for analysis by a private laboratory to determine nutrient deficiencies and outline a proper fertilization program.

C. Submit as provided in Section 01720 certifications required for all sodding supplied.

PART 2 - PRODUCTS

2.01 LOAM

A. Loam (topsoil) shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks, peat, weeds and sod and obtained from naturally well drained areas. It shall not be excessively acidic or alkaline nor contain toxic material harmful to plant growth. Topsoil stockpiled under other Sections of this Division may be used, but the CONTRACTOR shall furnish additional loam at his own expense, if required.

2.02 SOIL CONDITIONERS

A. Fertilizer:

1. Fertilizer shall be a complete fertilizer, the elements of which are derived from organic sources. Fertilizer shall be a standard product complying with State and Federal fertilizer laws.

2. Percentages of nitrogen, phosphorus and potash shall be based on laboratory tests on soils outlined in Paragraph 1.02.A and approved by the ENGINEER. For the purpose of bidding, assume 6% nitrogen, 6% phosphorus and 6% potash by weight. At least 50% of the total nitrogen shall contain no less than 3% water-insoluble nitrogen.

3. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guaranteed statement of analysis, or a manufacturer's certificate of compliance covering analysis shall be furnished to the ENGINEER. Store fertilizer in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.

B. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 20 available phosphoric acid.

C. Lime shall be ground limestone.

2.03 SOD

A. Sod shall be Argentine Bahia, Floratam or of like kind where existing sod is removed or disturbed and replaced by CONTRACTOR's operation. Contractor shall attempt to match existing grass. Sod shall have firm texture, a compacted growth and good root development, as approved.

B. Sod shall be certified to meet 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. Before being cut and lifted the sod shall have been mowed 3 times with the final mowing not more than a week before cutting into uniform dimensions.

PART 3 - EXECUTION

3.01 LAWN BED PREPARATION

A. Areas to be sodded shall be cleared of all rough grass, weeds, and debris, and ground brought to an even grade as approved.

B. The soil shall then be thoroughly tilled to a minimum 8 inch depth.

C. Loam shall be placed to a minimum depth of 4 inches and shall be lightly compacted. No loam shall be spread in water.

D. Lime shall be applied at a rate necessary to achieve a pH of 6 to 7.

E. Superphosphate at a rate for bidding purposes of 5 pounds per 1,000 square foot and complete fertilizer at a rate for bidding purposes of 16 pounds per 1,000 square foot shall be evenly distributed over entire area and cross-disced into a depth of 4-6 inches.

F. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over l-inch in diameter or dimension. The surface shall conform to finish grade, less the thickness of sod, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.02 SOD HANDLING AND INSTALLATION

A. During delivery, prior to planting, and during the planting of the lawn areas, the sod panels shall at all times be protected from excessive drying and unnecessary exposure of the roots to the sun. All sod shall be stacked during construction and planting so as not to be damaged by sweating or excessive heat and moisture.

B. After completion of soil conditioning as specified above, sod panels shall be laid tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope and with the joints offset relative to upper and lower panels. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.

C. Bring the sod edge in a neat, clean manner to the edge of all paving and shrub areas. Top dressing with approved, clean weed free sand may be required at no additional cost to the OWNER if deemed necessary by the ENGINEER.

3.03 MAINTENANCE

A. The CONTRACTOR shall produce a dense, well established lawn. The CONTRACTOR shall be responsible for the repair and resodding of all eroded or bare spots until project acceptance. Repair sodding shall be accomplished as in the original work except that fertilizing may be omitted. Sufficient watering shall be done by the CONTRACTOR to maintain adequate moisture for optimum development of the lawn areas. Sodded areas shall receive no less than 1.5 inches of water per week.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

A. Lawn areas planted under this Contract and lawn areas outside the designated areas damaged by CONTRACTOR's operations shall be repaired at once by proper sod bed preparation, fertilizing and resodding, in accordance with these Specifications.

3.05 TIMING

A. Restoration activities shall begin as soon as possible following trench backfill and compaction but no later than three (3) days after completion of backfill and compaction.

END OF SECTION

SECTION 02830

CHAIN-LINK FENCES AND GATES
(PVC Coated Steel Chain-link Fence Fabric)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included in this Section consists of furnishing and installing (Class 1) PVC Coated Steel Chain-link Fence Fabric, nominally 6 feet high, complete with gates. Where connecting to existing fencing, installed fencing shall match existing material and height.

1.02 QUALITY ASSURANCE

A. Erection Qualifications: The fencing erector must be a firm experienced the erection of fencing and accessories of the types specified. The erector must be approved by the manufacturer of the fencing.

B. Design Criteria: Comply with the standards of the Chain-link Fence Manufacturer's Institute for PVC-Coated Steel Chain-link Fence Fabric, Federal Specification RR-F-191/1A, unless otherwise shown or specified.

C. Sole Quality Control: Provide each type of fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.

D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASTM A-53, Specifications for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses.

2. ASTM A-90, Test Method for Weight of coating on Zinc-Coated (galvanized) Iron or Steel Articles.

3. ASTM A-392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

4. ASTM A-569, Specification for Steel, Carbon (0.15 Maximum Percent), Hot-rolled sheet and strip, commercial quality.

5. Chain-link Fence Manufacturers Institute, Galvanized Steel Chain-Link Fence Fabric.

6. Federal Specifications, RR-F-191/1A, Fencing and Wire and Post, and Metal (Chain-Link Fence Fabric).

7. ASTM F-668-Polyvinyl Chloride (PVC) Coated Steel Chain-link Fence Materials.

8. F-1664 - Standard Specification for Polyvinyl Chloride (PVC) - coated steel tension wire used with chain-link fence.

1.03 SUBMITTALS

A. Shop Drawings: Submit shop drawings in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.

1. Shop Drawings for chain-link fence system including plan layout and details illustrating fence height, location and sizes of posts, rails, braces, gates, footings, hardware list and erection procedures.

2. Descriptive literature of materials to be provided to determine compliance with the specifications.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials shall be in manufacturer's original packaging with all tags and labels intact and legible.

B. Handle and store materials in such a manner as to avoid damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fabric: The fabric shall be black PVC-coated steel chain-link 72 inches high, No. 9 gauge wire woven in a 2 inch mesh. Bottom selvage shall be barbed, top selvage shall be knuckled. The fabric shall conform to the requirements of ASTM Designation A-392. The PVC-coating shall be a minimum of 0.015 inches per square foot complying with ASTM F-668 and F-1043. The weight of coating shall be determined as defined in ASTM Designation A-90.

PVC-coated wire from which the fabric is woven shall withstand exposure for 1000 hours without failure at a black panel temperature of 145°F (63°C) when tested in accordance with ASTM D 1499. Type D, E, or F apparatus descirbed in ASTM G 23 or Type BH apparatus described in ASTM G 26 shall be used for the test.

The product shall be construed to have failed the test if:

1. The wire fails to withstand the mandrel bend test.

2. Shrinkage of the PVC coating is greater than 1/16 inch per ft. (5.2 mm/m) of wire.
3. There is a significant change in color or gloss of the PVC surface as determined by visual inspection.

Standard Polymer Colors (ASTM F934)
Hunter System

	Black
L	22.30
A	-0.09
B	-0.85
Delta/E	6.0

Test Method ASTM D 2244
Practice ASTM D 1729

B. Posts and Other Appurtenances: All posts and other appurtenances used in the construction of this fence shall be hot dipped galvanized with a minimum of 1.8 ounces per square foot of surface. Pipe sections shall conform to the requirements of ASTM Designation A-53. After installation, all posts and other appurtenances shall be painted black (to match PVC coated fabric), painting shall be completed prior to installation of fabric. After fabric is installed, installer shall touch-up all painted areas to provide a smoother surface.

C. Sizes of Posts, Rails are identified in Table 02830-A.

D. Barbed wire shall be as indicated on the Drawings.

E. Gate:

1. Fabricate gate perimeter frames of tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Provide upright and diagonal bracing rails as required for gates.
Fabricate as follows:

a. Horizontal top and bottom frame members:

2.375 in. OD Schedule 40 pipe weighing 3.65 lbs. per lin. ft., or
2 in. square tubing weighing 4.32 lbs. per lin. ft. (Painted black)

b. For gates over 6 ft. high, or leaf width exceeding 8 ft., interior upright bracing: (Painted black)

1.90 in. OD Schedule 40 pipe weighing 2.72 lbs. per lin. ft., or

1.50 in. square tubing weighing 2.60 lbs. per lin. ft. (Painted black)

c. Interior diagonal bracing:

1.66 in. OD Schedule 40 pipe weighing 2.27 lbs. per lin. ft., or
1.50 in. square tubing weighing 1.90 lbs. per lin. ft. (Painted black)

2. Assemble gate frames by welding or with special malleable or pressed steel fittings and rivets for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame on all sides at not more than 15 inches on center. Attach hardware with rivets or by other means which will provide security against removal or breakage.

3. Install diagonal cross-bracing consisting of 3/8-inch diameter adjustable length truss rods on gates where necessary to ensure frame rigidity without sag or twist.

4. Gate Hardware: Furnish the following hardware and accessories for each gate.

a. Double Swing Gates: Provide manufacturer's standard, heavy duty framing and supports, bracing and accessories as required.

F. Posts, Braces, Rails and Gate Frames - Option: Steel pipe manufactured from steel conforming to ASTM A-569, cold-rolled and coated with a minimum of 0.9 ounces of zinc per square foot, a minimum of 15 micrograms of zinc chromate per square inch and a minimum of 3 mils cross link polyurethane acrylic exterior coating may be furnished in lieu of round posts of Paragraphs 2.01B. and 2.01C. Steel pipe shall be of the same external dimension as round posts for the respective uses with minimum wall thickness as designated in Table 02830-B.

G. Top Rail: The top rail shall be provided with couplings approximately every 20 feet. Couplings are to be the outside sleeve type, at least 6 inches long.

H. Concrete: Concrete shall have a minimum compressive strength of 3,000 psi at 28 days.

I. Hardware: Miscellaneous hardware shall be of steel, malleable iron or ductile iron of standard design and conform to the requirements of the Chain-Link Fence Manufacturer's Institute. All parts shall be painted or PVC coated black.

PART 3 - EXECUTION

3.01 ARRANGEMENT

A. Posts (Painted Black): Post shall be uniformly spaced, not to exceed 10 feet on centers. Intermediate posts shall have waterproof tops, which have integrally cast openings

through which the top rails shall pass. Terminal posts shall consist of end, corner and pull posts.

B. Braces (Painted Black): Braces shall be provided at each gate, corner, pull and end post.

C. Top Rails (Painted Black): The top rails shall pass through the line post tops and form a continuous brace from end to end of each stretch of fence. The top rail shall be securely fastened to the terminal posts by heavy pressed steel brace bands and malleable end connections.

D. Bottom Tension Wire (PVC Coated Black): The bottom tension wire shall be No. 7 gauge aluminum coated spring coil and crimped wire. Minimum weight of aluminum coating shall be 0.40 ounces per square foot of wire surface. The tension wire shall be stretched taut between terminal posts and securely fastened to each intermediate post 6 inches above the finish grade line. Tension wire shall be attached to the fence fabric with aluminum hog rings every 24 inches.

E. Stretcher Bars (Painted Black): Stretcher bars shall be no less than 3/16-inch by 3/4-inch in cross section and shall have a minimum length 2 inches shorter than the fabric height. Stretcher bars shall be used for attaching the fabric to all terminal posts by threading through the fabric and being attached to the posts with 11 gauge tension bands, or other positive mechanical means, spaced at 12 inch centers. One (1) stretcher bar shall be provided for each gate and end post and two (2) of each corner and pull post.

F. Ties and Clips (PVC Coated Black): Fabric shall be fastened to all intermediate posts with 9 gauge tie wires, spacing not to exceed 12 inches apart. Fabric shall be tied to top rail with 9 gauge tie wires, spacing not to exceed 14 inches on centers.

3.02 INSTALLATION

A. Post Setting: Line posts shall be set in holes 12 inches in diameter, 38 inches deep with 36-inch post embedment. Terminal posts shall be set in holes 15 inches diameter, 38 inches deep with 36-inch post embedment. After the post has been set and plumbed, the hole shall be filled with concrete. The exposed surface of the concrete shall be crowned to shed water.

B. Terminal and Gate Posts: Terminal and gate posts shall be set as specified above and shall be braced to the nearest post with a galvanized horizontal brace used as a compression member an galvanized 3/8-inch steel truss rod and truss tighten used as a tension member.

C. Fabric: Fabric shall not be stretched until concrete footings have cured a minimum of three days. Chain-link fabric shall be placed on the side designated by the Engineer and shall be stretched taut approximately 2 inches above finish grade and securely fastened to all posts. Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

TABLE 02830-A

DIMENSIONS OF POSTS, RAILS AND GATE FRAMES

Designation	Nominal Diameter (Inches)	Outside Diameter (Inches)	Thickness (Inches)	Pounds Per Foot Plain Ends
End, corner and pull posts	2.50	2.875	0.203	5.79
Gate posts (one (1) leaf width over 18 feet)	8.00	8.625	0.322	28.55
Gate posts (one (1) leaf width 13 feet to 18 feet)	6.00	6.625	0.280	18.97
Gate posts (one (1) leaf width 6 feet to 13 feet)	3.50	4.000	0.226	9.11
Gate posts (one (1) leaf width 6 feet or less)	2.50	2.875	0.203	5.79
Intermediate posts	2.00	2.375	0.154	3.65
Braces	1.25	1.660	0.140	2.27
Top Rails	1.25	1.660	0.140	2.27

TABLE 02830-B

STEEL PIPE MINIMAL
WALL THICKNESS

Outside Dimension (Inches)	Wall Thickness (Inches)
1.66	0.111
1.90	0.120
2.375	0.130
2.875	0.160

END OF SECTION

Palm Bay Utilities

DIVISION 3

CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Concrete toppings.
6. Building frame members.
7. Building walls.

B. Related Sections:

1. Section 02200: Earthwork for drainage fill under slabs-on-grade.

1.03 DEFINITIONS

A. Cementitious Materials: 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.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

2. Water/cement ratio (total gallons of water per cubic yard).

3. Brand, type, and quantity of cement.

4. Type and quantity of aggregates.

5. Type and quantity of admixtures.

6. Type, composition, and quantity of fly ash, slag (GGBFS), or silica fume.

7. Unit weight (wet density).

8. Composition strength based on 28-day compression test.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. 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 supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Engineer.

F. Samples: For waterstops vapor retarder.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Joint-filler strips.
13. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Submit laboratory test reports for concrete mix design, aggregates (particularly deleterious materials in coarse aggregate) and fly ash, slag (GGBFS) and silica fume (if used) 4 weeks before scheduled pouring.

1. For mass concrete, submit laboratory test report on the heat of hydration for the trial mix design if requested by Engineer. Trial mix design shall consist of concrete block 4-foot by 4-foot by 4-foot.

F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

G. Field quality-control reports.

1. Submit written reports to Engineer documenting testing and inspection results.

2. Submit mill test reports on reinforcement.

3. Submit materials certificates in lieu of laboratory test reports on other materials. Manufacturer and Contractor shall sign material certificates certifying that each material item complies with, or exceeds, specified requirements. Submit certification from admixture manufacturers that chloride content complies with specification requirements.

H. Minutes of preinstallation conference.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade in the location indicated or, if not indicated, as directed by Engineer.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.

b. Independent testing agency responsible for concrete design mixtures.

c. Ready-mix concrete manufacturer.

d. Concrete subcontractor.

e. Special concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.08 PROJECT CONDITIONS

A. Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

c. Structural 1, B-B or better; mill oiled and edge sealed.

d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.

2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

C. Deformed-Steel Wire: ASTM A 496/A 496M.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar

supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I, except use Type III where applications require high-early-strength or Type II where required by Engineer for corrosive environments.

2. Use one brand of cement throughout Project, unless otherwise acceptable to Engineer.

B. Fly Ash: ASTM C 618, Type C or Type F (corrosive environments) with loss on ignition not more than 6 percent.

C. Ground Granulated Blast-Furnace Slag: ASTM C 989.

D. Silica Fume: ASTM C 1240, amorphous silica.

E. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

F. Water: ASTM C 94/C 94M.

G. Potable Water Structures: For surfaces in contact with potable water, use only materials approved by Department of Public Health of the state that has jurisdiction.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chloride ions.

2. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. Water Reducing, Nonchloride Accelerator Admixture: ASTM C 494, Type E.

6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

2.06 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches (25 to 57 mm) long.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Monofilament Micro-Fibers:

1) Axim Italcementi Group, Inc.; Fibrasol II P.
2) Euclid Chemical Company (The), an RPM company; Fiberstrand 150.
3) FORTA Corporation; FORTA Econo-Mono.
4) Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
5) Metalcrete Industries; Polystrand 1000.
6) Nycon, Inc.; ProConM.
7) Propex Concrete Systems Corp.; Fibermesh 150.
8) Sika Corporation; Sika Fiber PPM.

2.07 WATERSTOPS

A. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

1. JP Specialties, Inc.
2. Sika Corporation.
3. Vinylex Waterstop & Accessories.
4. Westec Barrier Technologies.
5. Profile: As indicated.
6. Dimensions: as indicated on the structural drawings.

B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. BoMetals, Inc.
2. Paul Murphy Plastics Company.
3. Sika Corporation.
4. Vinylex Waterstop & Accessories.
5. Profile: as indicated on the structural drawings.
6. Dimensions: as indicated on the structural drawings.

C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

1. Carlisle Coatings & Waterstop.
2. CETCO.
3. Concrete Sealants Inc.
4. Henry Company, Sealants Division.
5. JP Specialties, Inc.
6. Sika Corporation.

D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

1. Adeka Ultra Seal/OCM, Inc.
2. Sika Corporation.
3. Vinylex Waterstop & Accessories.

E. Chemical resistant waterstops

1. Where specifically noted on Contract Drawings, chemical resistant waterstops shall be used instead of PVC waterstops.

2. Chemical resistant waterstops for construction joints shall be ribbed with a center bulb. They shall be 6 inches wide with a minimum thickness at any point of 3/16 inches.

3. Chemical resistant waterstops for expansion joints shall be ribbed tear web. They shall be 9 inches wide with a tear web designed to accommodate 1 inch of free movement minimum.

4. Chemical resistant retrofit waterstop shall be a minimum of 2½" wide along the ribbed side and a minimum 5" wide along the side attached to the existing concrete surface. Retrofit waterstop shall include a centerbulb and shall have a minimum thickness of 3/16". Retrofit waterstop manufacturer shall provide a complete system including waterstop, stainless steel anchoring hardware and epoxy for installation.

5. Chemical resistant waterstops shall be manufactured from a fully crosslinked thermoplastic vulcanizate rubber.

6. Waterstops shall be TPE-R by BoMetals, Inc., Earth Shield TPV/TPE-R by JP Specialties, Inc., Westec TPE-R by Westec Barrier Technologies, or TPE-R by DuraJoint Concrete Accessories.

2.08 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Fortifiber Building System.
2. Raven Industries, Inc.
3. Stego Industries, LLC.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

2.09 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. BASF Construction Chemical.
2. ChemMasters, Inc.
3. Dayton Superior.
4. Euclid Chemical Company.
5. Kaufman Products, Inc.
6. L&M Construction Chemical.
7. Lambert Corporation.
8. Metalcrete Industries.
9. Nox-Crete Products Group.
10. Sika Corporation.
11. SpecChem.
12. Symons by Dayton Superior.
13. TK Products Unitex by Dayton Superior.
14. Vexcon Chemicals Inc.
15. W.R. Meadows, Inc.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

C. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: 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.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixes for each concrete class and strength by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use independent testing facilities acceptable to Engineer for preparing and reporting proposed mix designs. Testing facility shall not be identical to that used for field quality control testing.

B. Fly ash shall be used to partially supplant cement content in Class A and Class S concrete, unless noted otherwise, and is optional in other classes. Replacement quantity of cement content by weight shall be not less than 15 percent for Class A and Class S concrete or more than 25 percent for all classes except Class F.

C. For concrete Class A and Class S, concrete mix design with fly ash and silica fume shall be maximum 30 percent of cement content by weight, and shall constitute no more than 20 and 10 percent, respectively, of the total weight of cementitious materials.

D. For concrete, Class S, use Portland cement Type II with fly ash, Type F.

E. Ground granulated blast furnace slag (GGBFS) shall only be permitted for mass concrete placement and as approved by Engineer. Replacement quantity of cement content weight shall not be less than 35 percent or more than 50 percent.

F. Coarse aggregate shall be 1-1/2” top size, except for Class G concrete which shall be 3/8” top size.

G. Design mixes to provide normal weight concrete for following classes and properties:

1. Locations for concrete classes are as follows:

a. Class A Structural concrete (slabs, walls, columns, beams, equipment bases, and slab toppings 2 inches or greater in thickness). Note: High range water-reducing admixture shall be used for all concrete walls

b. Class G Grout fill for use in sweeping in final surfaces in sanitary structures and slab toppings less than 2 inches in thickness.

c. Class P Exterior pavements (unless otherwise indicated on Drawings).

d. Class B Sidewalks and manhole bases (unless otherwise indicated on Drawings).

e. Class C Fill within manholes, mud mats, fill under structures, encasement for piping below or adjacent to structures and encasement for floor drains, sewer inlets and similar items.

f. Class F Flowable fill for filling spaces as permitted and directed by Engineer.

2. Properties for concrete classes are as follows:

Concrete Class		**A**	**G**	**P**	**B**	**C**	**F**
28-Day* Compressive Strength (f'c), psi		4,000	4,000	3,500	3,000	2,000	50-100
Cement Content per cubic yard of concrete, sacks minimum **		6	6	5.5	5	4	0.4-3.0
Water/Cement Ratio by weight, max.		0.44	0.44	0.44	0.58	0.75	0.40-0.75
Air Content, percent by volume		2±1	2±1	2+±1.5	2±1.5	NA	NA
Slump at point of placement, inches.	WR***	2-4	2-4	2-4	3-5	3-6	NA
	MRWR	4-6	4-6	4-6	NA	NA	NA
	HRWR****	6-8	6-8	6-8	NA	NA	NA
Monofilament Polypropylene, Type F1		NA	NA	NA	NA	NA	NA

* 7-day compressive strength for high-early-strength concrete. 56-day compressive strength for mass concrete with ground granulated blast furnace slag.

** For concrete with fly ash, values are total of cement plus fly ash (except Class F concrete).

*** Slump prior to the addition of mid-range or high-range water reducers.

**** High range water-reducing admixture shall be used for all concrete walls.

3. Adjustment of Concrete Mixes: Mix designs may be adjusted when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, when approved by Engineer, at no additional cost to Owner. Submit laboratory test data for revised mix design and strength results to Engineer before using in work.

4. Admixtures:

   a. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in concrete for placement and workability.

   b. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F (10 degrees C).

   c. Add air-entraining admixture at manufacturer's prescribed rate to result in placed concrete having total air content specified.

   d. Use nonstructural synthetic reinforcement, monofilament polypropylene Type F1 in Class A concrete for exposed exterior surfaces without earth covering, and as specified by Engineer for other concrete mix design. Bottom slabs of open concrete tanks do not require synthetic reinforcement. The synthetic reinforcing fibers shall be added to the concrete mix at the rate of 1.5 pounds per cubic yard and in accordance with manufacturer's recommendations.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

B. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

A. 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 structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or 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.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. 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.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where 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.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. 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 items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

3.03 REMOVING AND REUSING FORMS

A. Vertical Forms not supporting concrete weight may be removed when concrete has sufficiently set to resist damage from removal operation.

B. Other forms shall be left in place until concrete has attained strength to support its own weight and construction live loads, unless removed in sections, and each structural section immediately reshored.

C. Time Periods: Forms remain in place as shown in table below. If form removal occurs before time shown in the table, apply curing procedures previously specified.

Minimum Time Forms are to Remain in Place:

	Average Air Temperature* During Period	
Part of Structure	40 - 50 degrees F	50 degrees F
Walls, columns and sides of beam (hours)	72	24
Bottom forms for slabs, beams arches not reshored (days)	12	7
Bottom forms for slabs, beams and arches if reshored (days)	7	4

* Air temperature near form.

D. 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 new form-release agent.

E. 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 unless approved by Architect.

3.04 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.05 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Field bending of reinforcement:

1. Field bending of plain reinforcement shall be performed using an approved and appropriately sized portable hydraulic device that makes ACI-approved radius bends. No other field bending method shall be permitted.

2. No field bending shall be permitted for epoxy coated reinforcement.

3.06 JOINTS

A. Locate and install construction joints as shown or, if not shown, locate so as not to impair strength and appearance of structures, at intervals not to exceed 50 feet. For construction joints in water-containing structures or tanks or in water-restraining structures, use watertight joints.

B. Continue reinforcement across construction joints, unless otherwise noted. Mechanical inserts with threaded studs are not accepted as substitutes for through-dowels.

C. Locate construction joints in floor system at or near middle of span in slabs, beams, or girders unless beam intersects girders at this point. Then, where not shown on Drawings, joints in girders shall be offset distances twice the width of beams, and provisions made for shear by web reinforcement across joints.

D. Provide watertight joints to prevent water seepage. Take special care in finishing surfaces to which succeeding concrete is bonded. Provide waterstops in joints if shown. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops according to manufacturer's printed instructions.

E. Provide isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces of column pedestals, foundation walls, and grade beams.

F. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction (control) joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 3/16 inch by 1/4 slab depth or inserts 1/4-inch wide by 1/4 of slab depth unless otherwise noted.

G. If joint pattern is not shown, provide joints at 15 feet at most in either direction, with locations to conform to bay spacing wherever practical (at column centerlines, half-bays, third-bays).

H. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

I. Cut contraction joints in unexposed floor slabs by saw cuts as soon as practical after slab finishing when it can be safely done without dislodging aggregate.

J. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 INSTALLATION OF EMBEDDED ITEMS

A. Set and build into Work anchorage devices and other embedded items required for other work that are attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of attachment items.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain set elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support screed strips by use of strike-off templates or accepted compacting screeds.

C. Conduits and pipes of aluminum shall not be embedded in structural concrete unless they are effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

D. PVC Waterstops:

1. Field butt splices shall be heat fused using a Teflon-coated thermostatically controlled waterstop splicing iron at approximately 380 degrees F following manufacturer's recommendations. Lapping of waterstop or use of adhesives shall not be allowed.

2. Center the waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12 inches on center along length of waterstop and wire tie to adjacent reinforcing steel. Do not drive nails or otherwise puncture additional holes in the waterstop when forming.

E. Bentonite and Hydrophylic Waterstops:

1. Adhere waterstop to substrate using manufacturer's recommended adhesive.

2. Tightly butt ends of waterstop together to form a continuous waterstop. Do not lap waterstop.

3. Verify that minimum concrete per manufacturer's recommendations will occur along waterstop's entire length. Do not install waterstop in keyways.

4. Follow manufacturer's recommended installation procedures.

3.08 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch to return forms to acceptable surface condition.

B. Coat contact surfaces of forms with form-coating compounds before placing reinforcement.

C. Thin form-coating compounds only with acceptable thinning agents, quantity, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete is placed. Apply in compliance with manufacturer's instructions.

D. Coat steel forms with non-staining, rust-preventive form oil to protect against rusting. Rust-stained steel formwork is not acceptable.

3.09 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, reinforcing steel, waterstop installation, and other embedded or cast-in items.

1. Notify other crafts to permit installation of their work.

2. Cooperate with other trades in setting their work.

3. Moisten wood forms immediately before placing concrete where form coatings are not used.

4. Apply temporary protective covering to lower 2 feet of finished walls where adjacent floor slabs are poured to guard against spattering during slab placement.

B. Comply with ACI 304R and as specified in this Section.

C. Discharge Concrete at Site within 1-1/2 hours after cement is added to water or aggregates. When air temperature exceeds 85 degrees F, the discharge time shall be less than 45 minutes. The 45-minute requirement may be waived with the use of a water reducing, retarding admixture and approval of Engineer.

D. Provide trip ticket in duplicate for each ready-mixed concrete load delivered, stating truck number, Project name, Contractor and producer, batching time, total yards of concrete and material contained therein. Show ticket to Engineer upon request. Fill in concrete discharge time and turn over to Engineer trip ticket copies at end of each day.

E. Deposit concrete continuously or in layers so that no concrete is placed on concrete which has hardened sufficiently to cause seams or planes of weakness. If section cannot be placed continuously, provide construction joints as specified. Deposit concrete as nearly as practical to its final location to avoid segregation.

F. When depositing by chute, provide equipment of size and design to ensure continuously flowing concrete. Provide discharge end of chute with baffle plate to prevent segregation. Position chute so that concrete need not flow more than 5 feet horizontally.

G. Do not drop concrete from chute end distances greater than 3 times the deposited layer thickness, nor more than 5 feet. Where distance from chute end to surface of concrete exceeds these distances, use spout and maintain lower end as near to deposit surface as practical. When operations are intermittent, discharge chutes into hoppers.

H. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches to avoid inclined construction joints. Where placement involves several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Fill bottom of wall space with 2 to 4 inches of cement slurry immediately before depositing concrete in walls. Use cement slurry composed of 1 part Portland cement, 2 parts fine aggregate, and sufficient water (but not to exceed 0.45 parts) for 7-inch slump mixture.

2. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for concrete consolidation in accordance with ACI recommended practices.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible machine effectiveness. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into concrete layers that have begun to set. At each insertion, limit duration to time necessary to consolidate concrete and complete reinforcement embedment and other embedded items without causing mix segregation. Keep vibrators away from waterstops to prevent displacement.

I. Placing Concrete Slabs: Deposit and consolidate concrete slabs in continuous operations between construction joints until panel or section placement is complete.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces before beginning finishing operations.

3. Maintain reinforcing in proper position during concrete placement operations.

4. Maintain waterstop in proper position during concrete placement operations.

5. Concrete Placement against Expanding Bentonite Waterstop. Direct concrete flow away from bentonite water stops. If flow cannot be away from bentonite, direct flow parallel to waterstop.

6. Moisten soil when depositing concrete directly on granular soil.

J. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

K. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

L. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 95 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete 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 that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At 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.

3.11 FINISHING FLOORS AND SLABS

A. Trowel Finish: Apply trowel finish to monolithic slab surfaces exposed-to-view, and slab surfaces covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using power-driven trowels. Begin last troweling when surface produces ringing sound when trowel moves over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance.

2. Check and level surface plane to tolerances of floor flatness (FF) of 20 and floor levelness (FL) of 17 in accordance with ASTM E 1155. In main process building floor provide (FF) of 45 and (FL) of 35

3. Grind smooth surface defects that would telegraph through applied floor covering system.

B. Nonslip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, ramps, and elsewhere as noted.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required finish with Engineer before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while 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. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 4 inches ((100 mm)) high unless otherwise indicated; and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.

3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.

6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. Maintain curing as follows:

1. All concrete unless otherwise noted: 7 days.

2. High-early-strength concrete: 3 days.

3. Mass concrete with ground granulated blast furnace slag: 14 days.

C. Curing Methods: Cure concrete for water-retaining structures by moist curing. Cure concrete for other structures by curing compound, moist curing, moisture-retaining cover curing, or combinations thereof.

D. Provide Moist Curing by following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Continuous water-fog spray.

3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to cover concrete surfaces and edges, with 4 inches lap over adjacent absorptive covers.

E. Provide Moisture-Retaining Cover Curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practical width with sides and ends lapped 3 inches and sealed by waterproof tape or adhesive.

2. Immediately repair holes or tears during curing period using cover material and waterproof tape.

F. Provide Curing Compound as follows:

1. Apply specified curing compound to concrete slabs as soon as last finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain coating continuity and repair damage during curing period.

2. Transparent curing compound shall be used for structural concrete (Class A concrete). White curing compound shall be used for exterior pavements (Class P concrete) and sidewalks (Class B concrete).

3. Do not use membrane curing compounds on surfaces that are covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Engineer.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including beam undersides, supported slabs and other similar surfaces by moist curing with forms in place for full curing period. If form removal occurs before curing period is up, continue curing by methods specified above as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by application of appropriate curing method.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mi dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: 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.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to 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.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. 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, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. 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.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. 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 manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. 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 same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 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 bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: The Contractor will engage a third party testing and inspecting agency to perform field tests and inspections and prepare test reports.

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.

7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Provide qualified personnel and employ testing laboratory, approved by Engineer, to do tests and to submit test reports.

D. Sampling Fresh Concrete: ASTM C 172, except modified for slump and air-content tests to comply with ASTM C 94.

1. Slump: ASTM C 143, one each time compression test specimens are made; additional tests when concrete consistency seems to have changed.

2. Air Content: ASTM C 231, pressure method, one each time compression test specimens made.

3. Concrete Temperature: Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time compression test specimens are made.

4. Compression Test Specimen: ASTM C 31, four standard cylinders for each compressive strength test set, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens.

5. Compressive Strength Tests: ASTM C 39, one set for each day's pour exceeding 5 cubic yards plus additional set for each 100 cubic yards over and above first 50 cubic yards of each concrete class placed in 1 day; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and 1 specimen retained in reserve for later testing if required.

E. Test Results: Report test results in writing to Engineer and Owner within 24 hours after tests. Compressive strength test reports shall contain Project identification name and number, concrete placement date, concrete testing service name, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and break type for both 7-day tests and 28-day tests.

F. Acceptance: Concrete strength shall be considered satisfactory if averages of 3 consecutive strength test results equal or exceed specified 28-day compressive strength (f'c), and no individual strength test result falls below specified compressive strength by more than 500 psi.

G. Failure to Meet Requirements:

1. Should 7-day compressive strengths shown by test specimens fall below 65 percent of required 28-day strength (f'c), Engineer will have the right to require changes in proportions for remaining Work. Furthermore, Engineer will have the right to require additional curing, as specified in this Section, on those portions or structures represented by failed test specimens.

2. Should 28-day compressive strengths (f'c) test results fail to meet required strength, core-boring tests conforming to ASTM Standard C 42 shall be made at Contractor's expense within 60 days of that concrete placement.

H. At locations where concrete quality is deemed questionable by Engineer, core-boring tests shall also be made at Contractor's expense.

I. Concrete is acceptable if average strength of 3 cores is at least 85 percent and no single core is less than 75 percent of required minimum allowable 28-day compressive strengths (f'c). If core-boring test results fail to meet strength requirements, Engineer will have right to require strengthening or replacing those portions of structures which failed to develop specified strength.

J. Provide additional curing when ordered by Engineer because of failure to meet requirements. It shall be done at Contractor's expense, and no claim for extra compensation for additional curing will be allowed. Additional curing shall extend period of protection. Additional curing is limited to 60 days.

K. Additional Tests: Testing service shall make additional in-place concrete tests when test results suggest specified concrete strengths and other characteristics have not been attained. Testing service may conduct tests to determine adequacy by cored cylinders complying with ASTM C 42, or by other approved methods. Contractor shall pay for additional tests when unacceptable concrete is verified.

3.17 Backfill Against Walls

A. 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.

B. Do not backfill the walls of structures that will be laterally restrained or supported by suspended slabs or slabs on grade until the slab is poured and the concrete has reached the specified compressive strength.

END OF SECTION

SECTION 03410

PRECAST CONCRETE VAULTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This section includes materials, design, and installation of precast concrete vaults (ROPW Air Gape Structure and Chemical Containment Pull Box) with factory applied waterproofing.

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall be in accordance with the current editions of the following standards:

1. Standard Building Code.
2. Local Codes and Regulations
3. ACI Building Code Requirements for Reinforced Concrete
4. American Society for Testing and Materials (ASTM)
5. American Concrete Institute (ACI)

B. The forms, dimensions, concrete, and construction methods shall be acceptable to the City and Engineer in advance of construction.

1.03 SUBMITTALS

A. The following information shall be submitted to the Engineer for approval in accordance with Section 01340: Shop Drawings, Working Drawings and Samples. Fabrication shall not begin until submission has been approved.

1. Design: Complete calculations including shear, moment, buoyancy, and camber calculations shall be submitted. Refer to process and structural sheet for precast design loads and requirements. All computation sheets shall bear the seal of a Professional Engineer registered in the State of Florida. Design water table shall be assumed to be at finished grade.

2. Shop Drawings: Submit manufacturer's catalog data on precast concrete items. Show dimensions of vault and location of openings including thicknesses of walls, floor and top slab. Show reinforcing wire and steel. Show materials of construction by ASTM reference and grade.

3. Manufacturer's data sheets shall be submitted on the following:

a. Joint mastic and gaskets.
b. Grout material.
c. Hatches.
d. Concrete waterproofing additive.
e. Joint Encapsulation material.

1.04 DELIVERY, STORAGE AND HANDLING

Transportation and erection shall be done by qualified personnel using proper equipment. Lifting and supporting shall be done only at points indicated on the shop drawings.

1.05 MANUFACTURERS

Precast structures, joining materials, and other appurtenances shall be manufactured by Forterra, Mack Precast, Oldcastle, Taylor Precast, Volusia Precast, or approved equal.

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

A. Precast Concrete Structures:

1. Rectangular precast concrete structures shall comply with ASTM C-913-79 and ASTM C-890-78 except as otherwise specified. All rectangular precast concrete structures including bottom slabs, walls, and top slabs, shall be designed to support an AASHTO H-20 loading plus all other soil and hydrostatic loads. Signed and sealed design calculations demonstrating compliance with these requirements shall be submitted in accordance with Paragraph 1.03.

2. The structures meet the following additional requirements.

a. Minimum wall thickness shall be 6-inches.

b. Cement shall be Type II Portland Cement conforming to ASTM Designation C150.

c. Sections shall have tongue and groove joints. Joints shall be filled with preformed flexible plastic joint sealer. The sealer shall be "Ram-Nek" as manufactured by the K.T. Snyder Co. or equal.

d. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.

e. The tops of bases shall be suitably shaped to mate with the precast wall section.

f. Lift rings or non-penetrating lift holes shall be provided for handling precast sections. Non-penetrating lift holes shall be filled with non-shrinking grout after installation of the structure.

g. Where force main piping penetrates a valve vault wall, a Type 316 stainless steel wall sleeve, with intermediate wall collar, shall be provided. The annular space between the carrier pipe and sleeve shall be sealed with a compression type wall seal with Type 316 stainless steel hardware.

3. Design and construct vaults to be watertight when subjected to groundwater over the entire height of the vault.

4. Provide openings in precast vaults for piping and access. No field coring of openings is allowed.

2. 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. Base and first section of precast structures shall be an integral cast.

3. Aggregates. All aggregates, fine and coarse, other than lightweight aggregate shall conform to ASTM C 33. Lightweight aggregates, fine and coarse, shall conform to ASTM C 330. Aggregates shall be free of deleterious substances causing reactivity with oxidized hydrogen sulfide.

   Both types of aggregate shall be graded in a manner so as to produce a homogenous concrete mix. All materials are to be accurately weighed at a central batching facility for mixing.

5. Cement shall be Portland cement Type II and shall contain a crystalline waterproofing concrete admix for all new concrete. Crystalline waterproofing concrete admix shall be added to the concrete during the batching operation. Admixture concentration shall be added based upon manufacturer's design percent concentration of admixture to the required weight of cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admixture was added to the concrete. Colorant shall be added and provided at the admixture manufacturing facility, not at the concrete batch plant. It is recommended that the admixture be added first to the rock and sand and blended thoroughly before adding cement and water or per the manufacturer's recommendations. Concrete structures without crystalline waterproofing admixture or admixture without colorant for field verification shall be rejected. Contractor shall provide certification from the pre-caster that the admixture was added in accordance with the manufacturer's recommendations. Concrete admixture shall be Xypex Admix C-1000Red (with red dye) 3-3.5%, or KIM K-301R (with red dye) 2%..

6. Minimum compressive strength of concrete used for precast concrete structures shall be 4,000 psi at 28 days.

7. Placing. 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 without segregation or loss of ingredients, until the approved unit is completed. Maximum elapsed time from batching to placement shall be 2 hours. Concrete shall be placed in layers not over 2 feet deep. Each layer shall be compacted by mechanical internal or external vibrating equipment. Duration of the vibration cycle shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation.

8. 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 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.

9. Reinforcing steel shall be sufficiently tied to withstand any displacement during the pouring operation. All bars shall be Grade 60.

10. Lifting holes through the structures are not permitted. Equally spaced lifting lugs, rings or non-penetrating lift inserts shall be provided.

11. The tops of bases shall be suitably shaped to mate with the adjoining precast section.

B. Hatches

1. The aluminum access frames shall be manufactured from 1/4-inch thick, one-piece extruded aluminum frame. The frame shall be a self-draining channel with a 1 1/2-inch draining coupling located in the channel frame. The door panels shall close flush and shall be 1/4-inch thick aluminum diamond (checker) plate. The installed access doors shall be designed to withstand a minimum live load of 300 pounds per square foot. Access doors shall be designed with a safety factor of 3.0. Removable aluminum cross-beams shall be provided by the hatch supplier as required to accomplish the stated loading. The doors shall have heavy duty stainless steel butt hinges with tamper-proof fasteners. All hardware shall be made of Type 316L stainless steel. Each door shall have

spring operators, such that the maximum lifting effort is less than 25 pounds. The hatch supplier shall provide the number of spring operators as required to accomplish the maximum lifting requirement. Each door shall open to 90° and lock automatically with a stainless steel, positive locking arm and a stainless steel release handle. Safe hatch type design shall be used. Each door shall have a recessed stainless steel lifting handle. The hatch shall be provided with a Type 316 stainless steel pad lock staple.

2. All access doors shall be designed to be watertight. Doors shall close flush with the frame and rest on a built-in neoprene cushion/gasket.

C. Coatings:

1. Exterior surfaces of precast structures shall be coated as specified in Section 09900.

2. Interior surfaces of flowmeter vaults shall be coated as specified in Section 09900.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Earthwork: The Contractor shall prepare an excavation large enough to accommodate the structure and permit sealing of openings, waterproofing, and backfilling operations. Earthwork shall conform to the applicable sections of Division 2.

B. Installation of Precast Concrete Structures: Precast concrete structures shall be constructed in a workmanlike manner at the locations indicated on the Drawings. Precast structures shall be set on a foundation of crushed stone. Crushed stone material shall be a well-graded crushed stone or crushed gravel meeting the requirements of ASTM C33, Gradation No. 67 (3/4 inch to No. 4 sieve). 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 precast structures.

C. Sealing and Grouting: Fill all interior and exterior joints between precast sections with a joint sealant.

D. Installing Precast Sections:

Set each precast concrete unit plumb on a bed of sealant to make a watertight joint at least 1/2-inch thick with the concrete base or with the preceding unit. Point the inside joint and wipe off the excess sealant.

G. Backfill: After the structure and all appurtenances are in place and approved, backfill shall be placed to the original ground line or to the limits designated on the Drawings. Backfill material shall consist of sand or loose earth, free from stones, clods, or other deleterious material. It shall be placed in horizontal layers not exceeding 12 inches in depth, and shall be moistened and thoroughly compacted to a minimum relative density conforming to the requirements of Division 2.

END OF SECTION

SECTION 03800

LEAKAGE TESTING OF HYDRAULIC STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Hydrostatically test concrete hydraulic structures which are intended to contain liquid to determine that they are watertight and free of detectable leaks as described herein.

PART 2 - PRODUCTS

2.01 GENERAL

A. Water: Potable.

B. Piping: As required to fill and empty structures.

C. Equipment: As required to fill and empty structures.

PART 3 - EXECUTION

3.01 INSPECTION AND TESTING

A. Prior to testing, clean exposed surfaces by thorough hosing and remove all loosened matter and wash water from the structures.

B. Conduct testing before backfill is placed against walls and after all concrete has attained the specified compressive strength.

C. Fill hydraulic structures to be subjected to leakage tests with water to the normal liquid level line. Do not fill more than 36 inches of water depth per day, unless otherwise approved by the Engineer. Repair any running leaks which appear during filling before continuing. After the structure has been kept full for 48 hours, it will be assumed, for the purposes of the tests, that the absorption of moisture by the concrete in the structure is complete. Then, close all valves and gates to the structure and measure the change in water surface each day for a five-day period.

D. During the test period, examine all exposed portions of the structure, and mark all visible leaks or damp spots. Repair such leaks or damp spots later. If the drop in water surface in a 24 hour period exceeds 1/10 of 1 percent of the normal volume of liquid contained in the structure, the leakage will be considered excessive.

E. If the leakage is excessive, drain the structure, repair leaks and damp spots, refill the structure and again test for leakage. Continue this process until the drop in water surface in a 24 hour period, with the structure full, is less than 1/10 of 1 percent of the volume.

F. Evaporation and precipitation rates shall be independently measured as part of the leakage test. A floating, restrained, partially filled, calibrated, open container for evaporation and precipitation measurement should be positioned in open structures and the water level in the container recorded at 24-hour intervals. Determination of evaporation by a shallow pan-type measuring device is not acceptable due to possible heating of the bottom of the shallow pan resulting in accelerated evaporation.

G. Make repairs and additional tests at no additional cost to the Owner. If any leaks, in excess of the specified amount, are not remedied by the Contractor within four (4) weeks of notification by the Engineer, regardless of whether the cause of these leaks is or is not determined, the Engineer shall have the authority to have these leaks repaired by others. The cost of repairs, by others, shall be deducted from monies due or to become due to the General Contractor.

H. Apply specified coatings only after acceptance of leakage testing by the Engineer.

3.02 REPAIR METHODS

A. Repair concrete not passing the leakage test in conformance with the applicable provisions of Division 3 and to the satisfaction of the Engineer.

END OF SECTION

Palm Bay Utilities

DIVISION 5

METALS

SECTION 05510

MISCELLANEOUS METALS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Concrete joint accessories are included in Section 03300.

B. Metal doors and frames are included in Division 8.

C. Painting is included in Division 9.

D. Slide gates, operators and appurtenances, including wall thimbles, are included in Division 2.

E Pipe hangers and sleeves are included in Division 15.

F. Equipment anchor bolts are included in the respective Sections of Divisions 11, 13 and 15.

1.03 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01340, shop drawings and product data showing materials of construction and details of installation for:

1. Shop drawings, showing sizes of members, method of assembly, anchorage and connection to other members.

B. Samples

1. Submit samples as requested by the Engineer during the course of construction.

C. Design Data

1. Submit calculations or test data demonstrating that the railings will resist the loads specified in the 2017 Florida Building Code at the post spacing provided.

2. Submit manufacturer's load and deflection tables for grating.

D. Test Reports

1. Certified copy of mill test reports on each aluminum proposed for use showing the physical properties and chemical analysis.

E. Certificates

1. Submit certification that the railing system is in compliance with OSHA requirements and the 2017 Florida Building Code.

2. Certify that welders have been qualified under AWS, within the previous 12 months, to perform the welds required under this Section.

1.04 REFERENCE STANDARDS

A. Aluminum Association (AA)

1. AA M31C22A41

a. M31: Mechanical Finish, Fine Satin

b. C22: Finish, Medium Matte

c. A41: Clear Anodic Coating, Class I

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A48 - Standard Specification for Gray Iron Castings.

3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

4. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.

5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

7. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.

9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.

10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

11. ASTM A366 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

14. ASTM A536 - Standard Specification for Ductile Iron Castings.

15. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

16. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

17. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

18. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

C. American Iron and Steel Institute (AISI).

1. Specification for Structural Steel Buildings.

D. American Welding Society (AWS)

1. AWS D1.1 - Structural Welding Code Steel.

2. AWS D1.2 - Structural Welding Code Aluminum.

E. Federal Specifications

1. FS-FF-B-575C - Bolts, Hexagonal and Square

F. Occupational Safety and Health Administration (OSHA)

G. 2017 Florida Building Code. (FBC)

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

1.05 QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Repair items which have become damage or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.07 PROJECT/SITE REQUIREMENTS

A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 - PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 MATERIALS

A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:

1. Structural Steel ASTM A36 ‘W’ shapes A 992

2. Structural Steel Tubing	ASTM A500, Grade B
3. Welded and Seamless Steel Pipe	ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work
4. Steel Sheets	ASTM A366
5. Gray Iron Castings	ASTM A48, Class 35
6. Ductile Iron Castings	ASTM A536, Grade 65-45-12
7. Aluminum Extruded Pipe	ASTM B429, Alloy 6063 T6
8. Aluminum Extruded Shapes	ASTM B221, Alloy 6061 T6
9. Aluminum Sheet and Plate	ASTM B209, Alloy 6061 T6
10. Stainless Steel Plates, Sheets, and Structural Shapes	
a. Exterior, Submerged or Industrial Use	ASTM F593, Type 316 (Type 316L for welded)
b. Interior and Architectural Use	ASTM F593, Type 304
11. Stainless Steel Bolts, Nuts, and Washers	ASTM F593 and ASTM F594, Type 316
12. Carbon Steel Bolts and Studs	ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)
13. High Strength Steel Bolts, Nuts and washers	ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted)
a. Elevated Temperature Exposure	Type I
b. General Application	Type I or Type II
14. Galvanizing	ASTM A123, Zn w/0.5 percent minimum Ni
15. Galvanizing, hardware	ASTM A153, Zn w/0.5 percent minimum Ni

2.03 ANCHORS, BOLTS AND FASTENING DEVICES

A. Anchor bolt material shall be ASTM F593 (316) unless otherwise noted.

B. Unless otherwise noted, expansion anchors shall be ASTM F593 (316) wedge type anchors complete with nuts and washers. Type 316 stainless steel, wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwik-bolt III; ITW Ramset; Redhead trubolt, or equal.

C. Compound masonry expansion anchors shall be lead expansion sleeve type anchors complete with nuts and washers. Anchors shall be precision die-cast zinc alloy with a minimum of two lead alloy expansion sleeves. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Star Expansion Industries, Star Slugin or equal.

D. Adhesive capsule anchors shall be a two-part stud and capsule chemical resin anchoring system. Capsules shall contain premeasured amounts of polyester or vinyl ester resin, aggregate and a hardener contained in a separate vial within the capsule. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Adhesive capsule anchors shall be Hilti, HVA Adhesive Anchor; Molly, Parabond; Rawlplug, Rawl Chem-Stud or equal.

E. Adhesive anchors, for fastening to hollow concrete block or brick, shall be a three-part stud, screen and chemical dispenser anchoring system. Adhesive cartridges shall contain premeasured amounts of resin and hardener which are mixed and deposited in a screen tube by a dispenser. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Anchors shall be Hilti HY 70 System or approved equal.

F. Automatic end welded headed anchor studs shall be flux ended studs made from cold drawn steel, ASTM A108 Grades C-1010 through C-1020. Headed anchor studs shall be Nelson, H4L Headed Concrete Anchors or equal.

G. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.

H. Toggle bolts shall be Hilti, Toggler Bolt or equal.

2.04 MISCELLANEOUS ALUMINUM

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be

smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous aluminum items shall include: beams, angles, closure angles, hatches, floor plates, stop plates, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.

D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.

E. Aluminum diamond plate and floor plate shall have a minimum thickness of 3/8-in. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 304 stainless steel. Plates shall have a mill finish.

F. Miscellaneous aluminum items shall have a cleaned and degreased mill finish.

2.05 MISCELLANEOUS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous steel items shall include: beams, angles, lintels, metal stairs, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane rails, monorail hoist beams, holddown straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel called for on the Drawings and not otherwise specified.

D. Structural steel angle and channel door frames shall be shop coated with primer. Frames shall be fabricated with not less than three anchors on each jamb.

E. Steel pipe pieces for sleeves, lifting attachments and other functions shall be Schedule 40 pipe unless otherwise shown on the Drawings. Wall and floor sleeves, of steel pipe, shall have welded circumferential steel waterstops at mid-length.

F. Lintels, relief angles or other steel supporting masonry or embedded in masonry shall be shop coated with primer.

G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust and foreign matter and shall be given one shop coat of primer compatible with the finish coat after fabrication but before shipment. Paint shall be omitted within 3-in of proposed field welds. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces.

H. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2 oz/sq ft of surface.

2.06 MISCELLANEOUS STAINLESS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous stainless steel items shall include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.

B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.

C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.

D. Specialty products shall be installed in accordance with the manufacturer's recommendations.

E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.

F. Install adhesive capsule anchors using manufacture's recommended drive units and adapters and in compliance with the manufacturer's recommendations.

G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.

H. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

I. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

J. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

K. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

END OF SECTION

SECTION 05521

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Aluminum pipe and tube handrails and railing systems.

2. Ladders and safety devices.

3. Safety Railing System.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.

1.02 DEFINITIONS

A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: AA Specifications for Aluminum Structures: Fabricate all pipe railing and handrails conforming to ASTM B429, alloy 6063-T6 Posts and handrail brackets shall not be spaced over 5 feet apart unless specifically called for otherwise.

2. Railing shall be shop assembled in sections as long as practical but shall not be greater than 24-ft in length. A field splice shall be used when an assembled section is to be attached to another section. Field splices shall be used in all railing panels that cross over structure expansion joints.

1.04 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

1. Drawings showing fabrication and installation of handrails and railings, including plans, elevations, sections, details of components, and attachments to other units of Work.

2. Where installed products are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by a qualified Professional Engineer, licensed in the state of Florida, responsible for their preparation.

3. Product Data for each type of product specified.

4. Samples for verification purposes of each type of exposed finish required, prepared on components indicated below that are of the same thickness and metal indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

    a. 6-inch-long sections of each distinctly different linear railing member including handrails, top rails, posts, balusters, and ladder rungs.

    b. Fittings and brackets.

    c. Welded connections.

B. Product Test Reports:

1. Based on tests performed by qualified independent testing laboratory evidencing compliance of railing components and systems with requirements based on comprehensive testing of current products.

C. Quality Assurance Submittals:

1. Qualification data for firms and persons specified in Quality Assurance Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Engineers and Owners, plus other information specified.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.

B. Engineering Responsibility: Engineer handrails and railing systems by qualified Professional Engineer legally authorized to practice in jurisdiction where Project is located.

1.06 STORAGE

A. Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

1.07 PROJECT CONDITIONS

A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying Work, warranty dimensions and proceed with fabrication of products without field measurements. Coordinate other construction to ensure that actual dimensions correspond to warranted dimensions.

1.08 SEQUENCING AND SCHEDULING

A. Sequence and coordinate installation of wall handrails as follows:

1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.

2. Mount handrails only on gypsum board assemblies reinforced to receive anchors and where the location of concealed anchor plates has been clearly marked for benefit of Installer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

1. Aluminum Pipe and Tube Railing Systems:

a. Blum, Julius Blum and Co., Inc.
b. Braun, J.G. Braun Co.
c. CraneVeyor Corp.
d. Moultrie Manufacturing Co.
e. Newman Bros., Inc.
f. Sterling Factories, Inc.
g. Superior Aluminum Products, Inc.
h. Wagner, R&B Wagner, Inc.

2. Nonshrink, Nonmetallic Grouts:

a. "Bonsal Construction Grout," W.R. Bonsal Co.
b. "Kemset," Chem-Masters Corp.
c. "Diamond-Crete Grout," Concrete Service Materials Co.

d. "Sure-Grip High-Performance Grout," Dayton Superior Corp.
e. "Crystex," L&M Construction Chemicals, Inc.
f. "Vibropruf No. 11," Lambert Corp.
g. "Masterflow 713," Master Builders.
h. "Sealtight 588 Grout," W.R. Meadows, Inc.
i. "Sonogrout," Sonneborn Building Products Division, ChemRex, Inc.
j. "Stoncrete NM1," Stonhard, Inc.
k. "Five Star Grout," U.S. Grout Corp.

3. Erosion-Resistant Anchoring Cement:

a. "Super Por-Rok," Minwax Construction Products Division.

2.02 METALS

A. Provide metal forms and types that comply with requirements of referenced standards and that are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required:

1.	Extruded Bar and Tube:	ASTM B 221, Alloy 6063T5/T52.
2.	Extruded Structural Pipe and Tube:	ASTM B 429, 6063-T5/T52.
3.	Drawn Seamless Tube:	ASTM B 210, 6063-T832.
4.	Plate and Sheet:	ASTM B 209, 6061-T6.
5.	Die and Hand Forgings:	ASTM B 247, 6061-T6.
6.	Castings:	ASTM B 26, A356-T6.

C. Brackets, Flanges, and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

2.03 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Pre-mixed, factory packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this Section.

B. Interior Anchoring Cement: Factory pre-packaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

C. Erosion Resistant Anchoring Cement: Factory pre-packaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Site to create pourable anchoring, patching, and grouting compound.

D. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

2.04 LADDER

A. Fabricate ladders for locations shown, with dimensions, spacings, materials, details, and anchorages as indicated on Drawings. Comply with requirements of ANSI A14.3.

1. Provide nonslip surfaces on top of each FRP rung by factory applying a permanently bonded epoxy nonslip surface.

2. Provide nonslip surfaces on top of each metal rung by coating with abrasive material metallically bonded to the rung by a proprietary process.

a. Mebac, IKG Borden.

2.05 SAFETY RAILING SYSTEM

A. Safety Railing System: Manufacturer's standard complete system including rails, clamps, fasteners, safety barrier at railing opening, all accessories required for a complete installation, and complying with 29 CFR 1910.23 requirements.

1. Height: 42 inches above finished roof deck.

2. Pipe or Tube: 1-1/4-inch ID galvanized pipe or 1-5/8-inch OD galvanized tube.

3. Flat Bar: 2-inch- high by 3/8-inch- thick galvanized steel.

4. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.

5. Pipe Ends and Tops: Covered or plugged with weather-resistant material.

6. 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.

7. Fabricate joints that will be exposed to weather in a watertight manner.

8. Close exposed ends of handrail and railing members with prefabricated end fittings.

9. Fasteners: Manufacturer's standard.

B. Manufacturer: “Bil-Guard” Hatch Railing System by The Bilco Company, or Engineer approved equal.

2.06 SAFETY CAGES

A. Fabricate safety cages for locations shown with dimensions, spacings, materials, details, and anchorages as indicated on Drawings.

2.07 LADDER SAFETY DEVICES

A. Ladder climbing safety devices shall be provided for ladder lengths of 20 feet or greater. Certification that the equipment meets the requirements of Federal specifications, in lieu of testing as provided in the Federal specification, shall be submitted. Material of carrier rail and ladder rung clamps shall match ladder material. Ladder safety climbing device shall be SAF-T-CLIMB as manufactured by North Safety Products or approved equal. Provide 2 ladder safety harnesses to OWNER for use with device.

B. Provide wall mounted confined space commercial grade rescuer anchor point kit at access ladder locations as detailed and indicated on drawings.

2.08 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners for Anchoring Railings to other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.

C. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnection of handrail and railing components and for their attachment to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.

2. For aluminum railings provide fasteners fabricated from Type 304 stainless steel.

D. Cast-In-Place and Post-Installed Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, load imposed within a safety factor of 4 as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.

1. Cast-in-place anchors.
2. Chemical anchors.
3. Expansion anchors.

2.09 FABRICATION

A. Fabricate ladders for the locations shown, with dimensions, spacings, details, and anchorages as indicated on Drawings. Comply with requirements of ANSI A14.3.

1. Provide nonslip surface on top of each rung either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufactured rung which is filled with aluminum oxide grout.

B. Pre-assemble railing systems in shop to 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. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Welded Connections for steel and stainless steel: Fabricate railing systems and handrails for connection of members by welding. For connections made during fabrication, 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 tee and cross intersections, notch ends of intersecting members to fit contour of pipe to which end is joined and weld all around.

5. 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.

D. Welded Connections for Aluminum Pipe: Fabricate pipe handrails and railing systems for connection of members by concealed internal welds, which eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

E. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

F. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

G. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

H. For handrails and railing systems that are exposed to exterior or to moisture from condensation or other sources, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing members.

I. Fabricate joints that will be exposed to weather in a manner to exclude water.

J. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

K. Toe Boards: Provide toe boards at railings around openings and at the edge of open-sided floors and platforms unless otherwise indicated. Fabricate to dimensions and details indicated for connection to, and centered between, each railing post.

L. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

2.10 FINISHES

A. Comply with NAAMM Metal Finishes Manual for recommendations relative to application and designations of finishes.

B. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are not acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples and they are assembled or installed to minimize contrast.

D. Aluminum Finishes:

1. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

2. Mechanical Finish: AA-M12 (Mechanical Finish: as fabricated, nonspecular).

3. Class I Clear Anodized Finish: AA-M12C22A41 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class I Architectural, clear film thicker than 0.7 mil) complying with AAMA 607.1.

E. Galvanized Finish:

1. Hot-dip galvanize items indicated to be galvanized to comply with applicable standard listed below:

a. ASTM A 153 for galvanizing iron and steel hardware.

b. ASTM A 123 for galvanizing iron and steel products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips.

2. For exterior steel railings and handrails formed from steel pipe with galvanized finish, galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.

3. For interior steel railings and handrails formed from steel pipe with galvanized finish, galvanize fittings, brackets, fasteners, sleeves, and other ferrous components.

4. For interior steel railings formed from steel pipe with black finish, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

5. Factory-Primed Finish: Apply air-dried primer immediately following cleaning and pre-treatment, to provide a minimum dry film thickness of 2.0 mils per applied coat, to surfaces that will be exposed after assembly and installation and to concealed, nongalvanized surfaces.

F. Steel Finishes:

1. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

a. Exteriors (SSPC Zone 1B): SSPC-SP6, "Commercial Blast Cleaning."

b. Interiors (SSPC Zone 1A): SSPC-SP7, "Brush-Off Blast Cleaning."

2. Apply shop primer to uncoated surfaces of handrails and railing components, except those with galvanized finish or to be embedded in concrete or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1, Paint Application Specification No. 1, for shop painting.

3. Shop Primer: Manufacturer's or fabricator's standard, fast curing, lead-free universal primer, selected for resistance to normal atmospheric corrosion, compatibility with substrate and field-applied finish paint system indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
a. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete as masonry construction. Coordinate delivery of such items to Site.

3.02 INSTALLATION

A. Fit exposed connections accurately together to form tight, hairline joints.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of handrails and railings. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.

3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

D. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.

E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and railings to in-place construction.

3.03 ANCHORING POSTS

A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.

B. Anchor posts to concrete with circular or rectangular flanges, floor or wall type, as required by conditions, connected to posts and secured to concrete with expansion anchors.

3.04 RAILING CONNECTIONS

A. Expansion Joints: Install expansion joints at locations indicated but not further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of post.

3.05 ANCHORING RAIL ENDS

A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with post-installed anchors and bolts.

B. Anchor rail ends to metal surfaces with oval or round flanges.

1. Connect flanges to rail ends using nonwelded connections.

2. Bolt flanges to metal surfaces.

C. Install removable railing sections where indicated in slip-fit sockets of same material surface mounted to concrete. Accurately locate sockets to match post spacing.

D. 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 steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

2. For stainless steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3. For aluminum pipe railings, attach posts as indicated using manufacturer's standard fittings designed and engineered for this purpose.

3.06 ADJUSTING AND CLEANING

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

B. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 of these specifications.

C. For galvanized surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

3.07 PROTECTION

A. Restore finishes damaged during installation and construction period so that 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.

B. Clean the following metals by washing thoroughly with clean water and soap, following by rinsing with clean water.

1. Aluminum.

2. Stainless steel.

END OF SECTION

SECTION 05530

GRATING, COVER PLATES, AND ACCESS HATCHES

PART 1 - GENERAL

A. Description

This section describes materials, fabrication, and installation of steel and aluminum grating, cover and floor plates, and access hatches.

B. Related Work Specified Elsewhere

1. Submittals: Section 01340.

2. Concrete: 03300.

3. Painting and Coating: 09961.

C. Design Criteria

Grating, Floor Plates, and Miscellaneous Cover Plates: Design live load of 100 psf, maximum deflection of 1/240 of span or ¼" Maximum.

Hatches: Design live load of 300 psf.

D. Submittals

1. Submit shop drawings in accordance with the General Conditions and Section 01340.Submit drawings of grating, cover plates, and access hatches. Show dimensions and reference materials of construction by ASTM designation and grade. Show design criteria.

2. Submit placing or erection drawings that indicate locations of fabricated items. Reproductions of contract documents will not be accepted for this purpose.

PART 2 - MATERIALS

A. Design of Grating, Floor Plates, and Miscellaneous Cover Plates

1. Grating, floor plates, and miscellaneous cover plates shall be as detailed in the drawings or, if not detailed, shall be designed per subsection on "Design Criteria" in Part 1. No single piece of grating, floor plate, or miscellaneous cover plate shall weigh more than 80 pounds. Length of individual pieces shall not exceed one and one-half times the width, unless limited by the installation.

2. Field measure grating and cover plates for proper cutouts and size.

3. Grating shall be completely banded. For pipe and conduits (including electrical conduit) larger than 1 inch in diameter penetrating grating, cut and band grating before galvanizing.

B. Stainless Steel Plate and Members

Except where otherwise specified, stainless steel plate and members shall be Type 316 or 316L, ASTM A240 or A666.

C. Aluminum Sheet

Aluminum sheet shall conform to ASTM B209, Alloy 3003, H 14 temper.

D. Aluminum Access Hatches

1. Access hatches shall be Bilco Type JAL of the size and configuration shown in the drawings. Aluminum doors shall be anodized. Latch and lifting mechanism assemblies, hold-open arms and guides, and all brackets, hinges, pins, and fasteners shall be 316 stainless steel.

2. Locking and Latching Devices:

a. Lugs welded to the exterior door surface to receive a padlock.

b. Hinged hasp on exterior door surface.

c. Recessed hasp covered by a hinged lid flush with the exterior surface.

d. Provide fall protection grating system. Grating panel(s) shall be fiberglass molded in one piece with load bearing bars in both directions to allow for use without continuous side support. Panels shall be designed to support a 300 PSF (1464 Kg/m2) live load and be high visibility safety yellow in color. Torsion rod lift assistance shall be provided for ease of operation and a hold open arm shall also be included to automatically lock the panel in the fully open 90 degree position. A release handle shall be provided to allow the grating panel to be closed and there shall be a provision for locking the panel to prevent unauthorized access. Hold-open arm shall be stainless steel with a stainless steel release handle. All other hardware, including mounting brackets, hinges, torsion rod, padlock loop, and fasteners, shall be type 316 stainless steel.

E. Grating

Grating shall be aluminum (Alloy 6061 or 6063, Temper T6, as indicated in the drawings. Main bars shall be of the thickness and of the depth indicated in the drawings.

F. Checkered Cover Plates

Checkered cover plates shall be aluminum. Minimum thickness shall be as shown in the drawings. Provide U-bolt lifting handles located at opposite ends on each removable section. Handles shall be recessed to reduce tripping hazards. Steel plates, including angle edgings, support angles, and lifting handles, shall be stainless steel. Aluminum plates shall comply with ASTM A786, Pattern 4, with material conforming to ASTM B209, Alloy 6061-T6.

G. Frames and Supports for Grating and Checkered Plates

Fabricated frames and supports for grating and checkered cover plates shall be aluminum or as indicated in the drawings. Corners of embedded angle frames shall be mitered and welded with the welds ground smooth.

H. Welding Electrodes

1. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

2. Welding electrode for aluminum shall be ER4043 filler metal.

3. Welding electrodes for stainless steel shall conform to AWS A5.4. 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

PART 3 - EXECUTION

A. Storage of Materials

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.

B. Installation and Erection

1. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

2. 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.

3. 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 aluminum or as indicated in the drawings.

C. Fastening

Fasten grating panels to supporting members as indicated in the drawings. Saddle clips shall be the same material as the grating.

D. Galvanizing

Zinc coating for plates, bolts, anchor bolts, and threaded parts shall be in accordance with ASTM A 153.

E. Welding

1. Perform welding on steel by the SMAW process. Welding shall conform to AWS D1.1-2006, except as modified in AISC Section J2.

2. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to AWS D1.2-2003.

3. Perform welding on stainless steel by the gas tungsten arc (TIG) process. Welds shall be full penetration and smooth. Provide inert gas on the inside of pipe during welding to reduce oxidation.

4. Provide a minimum of two passes for metal in excess of 5/16-inch thickness.

5. 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, nonuniform 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 manner that will not gouge, groove, or reduce the base metal thickness.

F. Repair of Galvanized Surfaces

Repair or replace metal with damaged galvanized surfaces at no additional cost to the Owner. Repair galvanized surfaces per Section 09961, System No. 55.

G. Corrosion Protection of Aluminum Surfaces

1. Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry per Section 09961 before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

2. Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

END OF SECTION

Palm Bay Utilities

DIVISION 6

WOOD AND PLASTICS

SECTION 06610

FRP FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:

1. FRP structural shapes.

2. FRP gratings, decking, and frames.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, apply to Work of this Section.

1.02 DEFINITIONS

A. Definitions in ASTM E 985 for railing related terms apply to this Section.

B. Pultrusion: Process of pulling fiberglass rovings (strands), mats, and other forms of reinforcements such as woven fiberglass through baths of thermosetting liquid resin, and then through a heated forming die (made of steel) to form a completed composite fiberglass structural shape.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

Structural Performance: Design, engineer, fabricate, and install the following FRP fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each FRP fabrication.

A. Design Criteria:

1. Refer to Design Criteria on Sheet S-001 for Load Requirements.

2. All FRP connections shall be 316 Stainless Steel

3. All primary and secondary supports shall be FRP, stainless steel or Aluminum as indicated on plans, designed and furnished by the FRP manufacturer.

4. All perimeter edge support angles shall be FRP.

1.04 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01340 – Shop Drawings, Working Drawings, and Samples covering the items included under this Section. Shop Drawing submittals shall include:

1. Shop Drawings detailing fabrication and erection of each FRP fabrication indicated. Include plans, elevations, sections, and details of FRP fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

2. Product Data for products used in miscellaneous FRP fabrications including paint products and grout.

3. Where installed FRP fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified Delegate Engineer, licensed in the State of Florida, responsible for their preparation.

4. Samples representative of materials and finished products as may be requested by Engineer.

B. Quality Control Submittals: Qualification data for firms and persons specified in "Quality Assurance" Paragraph to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects, Engineers and Owners, and other information specified.

1.05 QUALITY ASSURANCE:

A. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in Work.

1. Arrange for installation of FRP fabrications specified in this Section by same firm that fabricated them.

B. Engineer Qualifications: Professional Engineer licensed to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project shall sign and seal the shop drawings.

1.06 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which FRP fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

1. FRP Pultruded Grating, and Frame Materials:

a. Fibergrate Composite Structures.

b. Strongwell.

c. American Grating.

d. Or alternative manufacturer approved by architect, design engineer, and owner.

2.02 FRP SURFACES

A. For FRP fabrications exposed to view upon completion of Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for FRP sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. FRP resin shall be a corrosion resistant, fire resistant, pultruded-type premium grade isophthalic polyester.

2.03 MATERIALS

A. FRP structural shapes shall be manufactured using a pultruded process utilizing either flame-retardant isophthalic polyester containing an ultraviolet (UV) inhibitor. A synthetic surface veil shall be the outermost layer of reinforcement covering the entire exterior surface. The FRP shapes shall achieve a flame spread of 25 or less in accordance with ASTM test method E 84. The exterior of the pultruded shapes shall have a 1 mil (0.025 mm) minimum polyurethane protective coating for added UV protection. Dimensional tolerances shall be in accordance with ASTM specification D 3917. FRP shapes shall comply with the following material properties:

Table 1 - Fiberglass Pultruded Material Properties

Material Properties	**ASTM Test Method**	**Psi (MPa)**
Pultruded Fiberglass Structural Shapes		
Ultimate tensile strength in longitudinal direction	D 638	30,000 (207), minimum
Ultimate compressive strength in longitudinal direction	D 695	30,000 (207), minimum
Ultimate felexural strength in longitudinal direction	D 790	30,000 (207), minimum
Ultimate shear strength in longitudinal direction	D 3846	5,500 (38), minimum
Ultimate tensile strength in transverse direction	D 638	7,000 (48), minimum
Ultimate compressive strength in transverse direction	D 695	15,000 (103), minimum
Ultimate flexural strength in transverse direction	D 790	10,000 (69), minimum
Ultimate shear strengthen transverse direction	D 3846	5,500 (38), minimum
Density (lb/in.^{3} (kg/mm^3))	D 792	0.065 (0.00180), minimum
Water absorption (24-h immersion)	D 570	0.60 max, percent by weight
Pultruded Fiberglass Sheet		
Ultimate tensile strength in longitudinal direction	D 638	20,000 (138), minimum
Ultimate compressive strength in longitudinal direction	D 638	20,000 (138), minimum
Ultimate flexural strength in longitudinal direction	D 790	30,000 (207), minimum
Ultimate shear strength in longitudinal direction	D 3846	5,500 (38), minimum
Ultimate tensile strength in transverse direction	D 638	10,000 (69), minimum
Ultimate compressive strength in transverse direction	D 695	15,000 (103), minimum
Ultimate flexural strengthen transverse direction	D 790	13,000 (90), minimum
Ultimate shear strength in transverse direction	D 3846	5,500 (38), minimum
Density (lb./in.^{3}(kg/mm^3))	D 792	0.064 (0.00177), minimum
Water absorption (24-h) immersion)	D 570	0.50 max, percent by weight
Thermal		
Thermal Coefficient of Expansion	D 696	5 x 10^{-6} (inches with degree F)***
Thermal Conductivity		4 Btu per sq. ft./hour/ degree F/in.
Specific Heat		0.028 Btu/lb. degree F

Material Properties	**ASTM Test Method**	**Psi (MPa)**
Electrical		
Electric strength, short term in oil, 1/8 inch	D 149	200 vpm*
Electric strength, short term, in oil		35 kV per inch**
Dielectric constant, 60 Hertz	D 150	5.6
Dissipation factor, 60 Hertz	D 150*	0.03
Arc resistance	D 495	120 seconds***
Flame Retardant Properties		
Flame resistance	FTMS 402-2023	75/75 Ign. burn seconds
Intermittent flame test	HLT-15	100 rating
Flammability test	D 635	****
Surface burning characteristics	E 84	25 maximum
Flammability class	UL 94	V-0
Temperature index	UL 94	130

Notes to Table 1:

* Specimen tested perpendicular to laminate face.

** 1-inch long specimen tested parallel to laminate face using 2-inch diameter electrodes.

*** Indicates reported value measured in longitudinal direction.

**** Average time of burning = 0.5 second, average extent of burning = 15 minutes.

B. Fiberglass sheet or solid fiberglass bar shall be used to fabricate the internal connectors for the square tube. The internal connectors will be 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm) with length and angularity variable to meet the requirements of each connection. Angular connections shall be fabricated from fiberglass sheet bonded together using a bisphenol A/epichlorohydrin epoxy resin with an amine-curing agent to give a minimum thickness of 1-1/2 inches. The angular connections will be fabricated to the proper dimension from the fiberglass sheets that have been bonded together.

Fiberglass sheet used for angular connections shall meet the properties specified in Table 1. Fiberglass solid bar, 1-1/2 by 1-1/2-inch, shall be used for the straight connections, and shall meet the properties specified in Table 1.

C. Rivets shall be nickel copper or nonmetallic.

D. Bolts shall be a minimum 3/8 inch (9.5 mm) diameter, 316 stainless steel. FRP bolts or fasteners are not permitted.

E. Adhesive used to bond internal connectors to fiberglass pultruded square tube shall be a bisphenol A/epichlorohydrin epoxy resin with an amine-curing agent.

2.04 FABRICATION

A. FRP Stairs and Treads: All stair components, stringers, frames, supports, and hangers, shall be of standard FRP structural shapes where specified.

1. The treads for the open riser type FRP stairs and landings shall be safety type similar to floor gratings with non-slip nosings.

2. See Standard Details on Drawings for construction details.

2.05 FRP GRATINGS, DECKING, AND FRAMES

A. Glass-fiber grating frames shall be fabricated from pultruded structural angles. No metallic fasteners shall be used.

B. Glass fiber decking shall consist of a solid flat plate bonded to square mesh type or pultruded type grating manufactured of continuous glass fibers completely wetted with polyester resin.

C. Glass fiber gratings shall be standard square mesh type or pultruded bar type manufactured of continuous glass fibers completely wetted with polyester resin.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and provide anchorages, setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Site.

B. 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: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. All cut edges and holes shall be sealed with a compatible resin system containing an UV inhibitor.

E. All connections shall be made using a one-piece solid internal connector bonded to the interior of the square tube using an epoxy adhesive and riveted. The following types of connections are defined:

1. All bolted connections shall have a one-piece solid internal connector bonded to the interior of the square tube through which connector holes will be drilled. A minimum 1 inch (26 mm) length of the solid internal connector will be on each side of the drilled hole.

F. Additional solid internal connector pieces can be bonded with epoxy adhesive to the interior of the square tube as desired.

3.03 INSTALLATION OF FRP BAR GRATINGS AND DECKING

A. Install gratings and decking to comply with recommendations of NAAMM grating standard referenced under Part 2 that apply to grating types and/or bar sizes indicated, including installation clearances and standard anchoring details.

B. Secure removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach toe plates to gratings by bolting, at locations indicated.

D. Install removable railing sections where indicated in slip-fit sockets secured with expansion anchors into concrete. Accurately locate sockets to match post spacing.

E. Expansion Joints: Provide expansion joints at locations indicated or, if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of posts.

END OF SECTION

DIVISION 8

DOORS AND WINDOWS

SECTION 08350

ACCESS HATCH DOORS

PART I - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section includes providing all labor, materials and equipment necessary to install the safety access hatch doors on the Chemical Containment Pull boxes as indicated on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. Standards: The access doors shall meet the standards of the following:

1. Standard Building Code

2. OSHA Requirements

B. Manufacturers: Halliday Products, USF Fabrication, The Bilco Company, or approved equal.

1.03 SUBMITTALS

A. Shop Drawings: Shop drawings shall be submitted to the Engineer for approval. Shop drawings shall include manufacturer's data sheets showing all materials, connections and other required details to illustrate a complete operating access door. Refer to Section 01340 for the specific requirements of the submittal.

1.04 WARRANTY AND GUARANTEES

A. The manufacturer shall guarantee the access door against defects in material and workmanship for a period of ten (10) years. Refer to Section 01740 for additional requirements.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The access doors, in sizes as shown on the Drawings, shall be the standard design of the manufacturer.

2.02 MATERIALS

A. Each safe type hatch shall be designed according to the openings shown on the Drawings and designed to O.S.H.A. Standard 1910.23 – Fall Through Protection and Standard 1910.146 – Controlling Confined Space Entry. The aluminum access frames shall be manufactured from, one-piece extruded aluminum frame. The frame shall be a self-draining channel with a 1 1/2-inch draining coupling located in the channel frame. The door panels shall close flush and shall be ¼ inch thick aluminum diamond (checker) plate. The installed access doors shall be designed to AASHTO H-20 loading criteria. Access doors shall be designed with a safety factor of 3.0. Removable aluminum cross-beams shall be provided by the hatch supplier as required to accomplish the stated loading. The doors shall have heavy duty stainless steel butt hinges with tamper-proof fasteners. All hardware shall be made of Type 316L stainless steel. Each door shall have spring operators, such that the maximum lifting effort is less than 25 pounds. The hatch supplier shall provide the number of spring operators as required to accomplish the maximum lifting requirement. Each door shall open to 90° and lock automatically with a stainless steel, positive locking arm and a stainless steel release handle. Safe hatch type design shall be used. Each door shall have a recessed stainless steel lifting handle. The hatch shall be provided with a Type 316 stainless steel pad lock staple.

B. All access doors shall be designed to be watertight. Doors shall close flush with the frame and rest on a built-in neoprene cushion/gasket.

C. Hatch shall have a safety grate that is hinged and lockable. The aluminum grating panel shall be installed beneath access cover. The unit shall be lockable with an owner supplied padlock and shall include a spring assisted lifting handle that positions the handle near the slab level when the access cover is in the open position. The safety grate shall incorporate a 316 stainless steel hold open arm with aluminum latch and 316 stainless steel mounting hardware. Load rating of the safety grate shall be AASHTO H-20 or greater.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The access hatches and doors shall be installed as recommended by the manufacturer and adjusted for proper operation without binding.

B. Edges of the aluminum frame that will be in contact with concrete shall be coated in accordance with Section 09961 prior to casting into the concrete.

END OF SECTION

Palm Bay Utilities

DIVISION 9

FINISHES

SECTION 09905

PIPING, VALVE, AND EQUIPMENT IDENTIFICATION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of providing an identification system for piping systems and related equipment.

B. Related Work Described Elsewhere:

1. Shop Drawings, Working Drawings, and Samples: Section 01340.
2. High Performance Paints and Coating: Section 09961.
3. Equipment: Division 11.
4. Mechanical: Division 15.
5. Electrical: Division 16.

1.02 QUALITY ASSURANCE

A. Standards: ANSI Standard A13.1, Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. Submit manufacturer's descriptive literature, illustrations, specifications, and other pertinent data in accordance with Section 01340.

B. Schedules:

1. Provide a typewritten list of all tagged valves giving tag color, shape, letter code and number, the valve size, type, use, and general location.

2. Provide a complete list of materials to be furnished and surfaces on which they will be used.

C. Samples:

1. Provide a sample of each type valve tag supplied.
2. Provide a sample of each type of identification tape supplied.
3. Provide manufacturer's color charts for color selection by Engineer.

1.04 PRODUCTS DELIVERY, STORAGE, AND HANDING

A. Delivery of Materials: Except for locally mixed custom colors, deliver sealed containers with labels legible and intact.

B. Storage of Materials:

1. Store only acceptable project materials on project site.
2. Store in suitable location.
3. Restrict storage to paint materials and related equipment.
4. Comply with health and fire regulations.

1.05 JOB CONDITIONS

A. Environmental Requirements:

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

2. Do not apply finish in areas where dust is being generated.

B. Protection: Cover or otherwise protect finished work of other trades and surfaces not to be painted.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials for painting shall conform to requirements of Section 09961: High Performance Paints and Coating.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

C. Aboveground piping shall be identified by self-adhesive pipe markers equal to those manufactured by W. H. Brady Company or equal.

1. Markers shall be of wording and color as required herein and as shown on the drawings.

2. Lettering shall be:

a. 2 1/4-inches high for pipes 3 inches diameter and larger.
b. 1 1/8-inches high for pipes less than 3 inches diameter.

3. Flow arrows shall be:

a. 2 1/4-inches by 6 inches for pipes 3 inches diameter and larger.
b. 1 1/8-inches by 3 inches for pipes less than 3 inches diameter.

D. Buried piping shall be identified by identification tape installed over the centerline of the pipelines.

1. Identification Tape for Steel or Iron Pipe: Identification tape shall be manufactured of inert polyethylene film so as to be highly resistant to alkalies, acids, or other destructive agents found in soil, and shall have a minimum thickness of 4 mils. Tape width shall be 6 inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2 feet for entire length of tape. Tape shall be Terra Tape Standard 250, or approved equal.

2. Identification Tape for Plastic or Non-Magnetic Pipe: Identification tape shall be manufactured of reinforced polyethylene film with a minimum overall thickness of 4 mils and shall have a 0.35 mil thick magnetic metallic foil core. The tape shall be highly resistant to alkalies, acids, and other destructive agents found in soil. Tape width shall be 3 inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2 feet for entire length of tape. Tape shall be TerraTape Sentry Line 1350, or approved equal.

3. Tape background colors and imprints shall be as follows:

Imprint	Background Color
"Caution Sewer Line Buried Below"	Green
"Caution Electrical Line Buried Below:	Red
"Caution Water Line Buried Below"	Blue
"Caution Telephone Line Buried Below"	Orange
"Caution Gas Line Buried Below"	Yellow
"Caution Chemical Line Buried Below"	Yellow

4. Identification tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, TX; Allen Systems, Inc., Wheaton, IL; or approved equal.

E. Aboveground Valve Identifications: A coded and numbered tag attached with brass chain and/or brass "S" hooks shall be provided on all valves.

1. Tag Types: Tags for valves on pipe and tube lines conducting hot medium (steam, condensate, hot water, etc.) shall be brass or anodized aluminum. Tags for all other valves shall be Type 304 stainless steel. Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.

2. Coding: In addition to the color coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the valve service and number. All color and letter coding shall be approved by the Engineer. Valve service shall either be as listed in the drawings, or by equipment abbreviation if associated

with a particular piece of equipment. Valve numbering, if required, shall be as approved by the Engineer and/or Owner.

F. Buried valves shall have valve boxes protected by a concrete pad. The concrete pad for the valve box cover shall have a 3-inch diameter, bronze disc embedded in the surface as shown on the Drawings. The bronze disc shall have the following information neatly stamped on it:

1. Size of valve, inches.

2. Type of valve:

a. GV - Gate Valve.
b. BFV - Butterfly Valve.
c. PV - Plug Valve.

3. Valve Service - See drawings for abbreviations.

4. Number of turns to fully open.

6. Direction to open.

PART 3 - EXECUTION

3.01 COLOR CODING FOR PIPES AND EQUIPMENT

A. Piping color codes, and code labels for pipe identification shall conform to the drawings.

B. General Notes and Guidelines:

1. Pipelines, equipment, or other items which are not listed here shall be assigned a color by the Owner and shall be treated as an integral part of the Contract.

2. Color coding shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.

3. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange.

4. All safety equipment shall be painted in accordance with OSHA standards.

5. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted

with the pipe color up to, but not including, the flanges attached to pumps and mechanical equipment assigned another color.

6. All pipe hangers and pipe support floor standards shall be painted, unless specified otherwise due to material of construction.

C. All hangers and pipe support floor and accessories stands shall be painted to match their piping. The system shall be painted up to, but not including, the face of flanges or the flexible conduit connected to electrical equipment. Structural members used solely for pipe hangers or supports shall be painted to match their piping. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be coated in accordance with Section 09961.

D. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to, but not including, the face of flanges or connections on the equipment.

E. All insulated surfaces, unless otherwise specified, shall be given one coat of glue sizing, one prime coat and one finish coat.

F. System code lettering and arrows shall conform to the requirements of ANSI A 13.1 marked on piping as follows:

1. Legends shall be of the following color for the respective pipe color:

Key to Classification of Predominant Colors For Piping			Color of Letters, if not otherwise specified
(F)	Fire Protection:	Red	White
(D)	Dangerous:	Yellow	Black
		Orange	Black
		White	Black
		Brown	White
(S)	Safe:	Green	Black
		Black	White
		Light Gray	Black
		Dark Gray	White
		Aluminum	Black
(P)	Protective:	Blue	White

2. All piping containing or transporting corrosive or hazardous chemicals shall be identified with labels every 10 feet with at least two (2) labels in each room. Otherwise, markers shall be placed no more than 20 feet apart with at least one

(1) marker on every straight run and additional markers at turns and where pipe passes through walls.

3. An arrow indicating direction of flow shall be placed adjacent to each marker.

4. On pipes entering and leaving buildings, the destinations shall be included in ID.

3.02 FABRICATED EQUIPMENT

A. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished. See Section 09961 - High Performance Paints and Coating.

B. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.

C. Where specified in other sections of these specifications for mechanical equipment, the Contractor shall apply field coat or coats of paint in accordance with Section 09961. If shop finish coat is unsatisfactory due to poor adhesion or other problems with primer or finish coats, coatings shall be removed and replaced by sandblasting, priming and finishing in accordance with Section 09961 and this Section.

D. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned. Equipment contaminated by grit in critical areas, such as bearings, gears, seals, etc., shall be replaced at no cost to the Owner.

3.03 INSTALLATION OF IDENTIFICATION TAPE

A. Identification tape shall be installed for all buried piping in accordance with the manufacturer's installation instructions and as specified herein.

B. Identification tape for piping shall be installed at two (2) locations:

1. One (1) foot below finished grade along centerline of pipe, and;

2. Directly on top of the pipe.

3.04 BURIED VALVES

A. In paved or concrete areas, tops of valve box covers shall be set flush with pavement or concrete top. In concrete areas, valve boxes shall be embedded. Following paving operations, a 24 inch square shall be neatly cut in the pavement around the box and the paving removed. The top of the box shall then be adjusted to the proper elevation and a 24 inch square by 6 inch thick concrete pad poured around the box cover. Concrete

pads in traffic areas shall be reinforced with No. 4 reinforcement bars as shown on the Drawings. Concrete for the pad shall be 3,000 psi compressive strength.

B. In unpaved areas, tops of valve box covers shall be set 0.20-foot above finished grade. After the top of the box is set to the proper elevation, a 24 inch square by 6 inch thick concrete pad shall be poured around the box cover. Concrete for the pad shall be 3,000 psi compressive strength.

C. The bronze, valve identification disc shall be embedded in the concrete pad.

END OF SECTION

SECTION 09961

HIGH PERFORMANCE PAINTS AND COATINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Water Works Association (AWWA):

a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot-Applied.

b. C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

c. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

d. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.

2. Environmental Protection Agency (EPA).

3. International Concrete Repair Institute (ICRI) Guideline No. 310.2 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

4. NACE International (NACE): SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

5. ANSI / NSF International (NSF): 61, Drinking Water System Components- Health Effects.

6. National Association of Pipe Fabricators (NAPF)

a. 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe.

7. Occupational Safety and Health Act (OSHA).

8 The Society for Protective Coatings (SSPC):

a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.

b. PA 3, Guide to Safety in Paint Applications.

c. SP 1, Solvent Cleaning.

d. SP 2, Hand Tool Cleaning.

e. SP 3, Power Tool Cleaning.

f. SP 5, White Metal Blast Cleaning.

g. SP 6, Commercial Blast Cleaning.

h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.

i. SP 10, Near-White Blast Cleaning.

j. SP 11, Power Tool Cleaning to Bare Metal.

k. SP 12, Surface Preparation and Cleaning of Metals Waterjetting Prior to Recoating.

l. SP 13, Surface Preparation of Concrete.

m. SP 16, Brush-off Blast cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

n. Guide 15, Field Methods for Retrieval and Analysis of Soluble Sa1ts on Steel and Other Nonporous Substrates.

o. TU 11, Inspection of Fluorescent Coating Systems.

9. National Fire Protection Association (NFPA).

10. American Society for Testing and Materials (ASTM International).

1.02 SUMMARY

A. Section Includes: Field painting as shown and/or herein required. See specific items not requiring field painting under Work Not Included.

B. Provide all labor, materials, equipment and services for furnishing and installing the finishes as indicated on drawings and schedules, and as herein specified.

C. In general, exposed surfaces of factory and/or shop-primed work that are delivered to Site without a final finish shall be painted. The shop priming and intermediate shop coatings shall not be considered as included in the number of field coats specified under Part 2, Field Painting Systems Article, Finish Paints paragraph in this Section.

D. Ferrous metal surfaces, excluding stainless steel surfaces that will be exposed in the completed Work, shall be sandblasted either at the point of fabrication or under this Section

prior to placement of primers. Field fabrication, including welds and cuts, shall be sandblasted, primed, and painted as herein specified.

E. Ferrous metal items that will be in contact with precast concrete slabs, masonry, etc., shall be finish painted.

F. Galvanized steel items that are not included under "Work Not Included," shall be prepared, primed, and finish painted as herein specified.

G. Bruises, mars, and/or scratches in the shop painting due to handling, shall be immediately touched up in the field by Contractor prior to any storage or installation.

H. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.

I. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

J. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect-Engineer will select these from standard colors or finishes available. All new color finishes shall match the existing scheme/colors.

K. Painting of piping includes pipe hangers, valves, and piping accessories, and also includes surfaces that will be in contact with piping supports. ALL PIPING SHALL BE COMPLETELY PAINTED.

L. Existing surfaces shall be painted where shown and/or called for. Preparation for repainting and priming shall be as herein specified.

M. Altered existing Work or damaged surfaces that are a result of the revisions shall be painted under this item of Work. The finishes shall match the existing adjacent coatings.

N. Miscellaneous equipment shipped to Site with factory-applied coatings as follows, shall be painted under this Work as specified:

1. No Factory Finish: Surface preparation, priming, and finish painting.

2. Prime Coat: Surface preparation, touch-up, and finish painting.

3. Intermediate Coat: Surface preparation, touch-up, and finish painting.

4. Pre-finished Equipment: Touch-up as required. Equipment manufacturer shall furnish necessary touch-up paint.

5. Factory finish coats, not matching the approved finish colors, that are provided in lieu of the shop prime specified shall be properly prepared and receive a final field coat to match the adjacent related Work.

O. Painting as called for on Drawings is for guidance only and does not limit the requirements for painting.

P. Work Not Included: Unless specifically called for on Drawings or specified in this Section, the following are not included:

1. Nonferrous metals and stainless steel, except copper and brass.

2. Exterior aluminum siding.

3. Nonexposed surfaces of treated lumber.

4. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, pipe spaces, and duct shafts.

5. Conduits below the main floor, except in rooms that are painted.

6. Exterior gratings with a hot-dipped galvanized finish.

7. Manufacturer's name and identification plates, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

8. Overhead sectional doors - shall have a factory finish on both interior and exterior exposed surfaces.

9. All interior and exterior sealant and caulking unless adjacent to latex-coated surfaces and approved by Engineer.

10. Interior concrete surfaces of tanks and basins, immersed and exposed not to be painted.

11. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motors, and fan shafts will not require finish painting.

12. All new surfaces, equipment, piping etc. shall be painted. Existing surfaces, equipment, piping etc. disturbed during construction shall also be painted.

1.03 DEFINITIONS

A. Terms used in this section:

1. ASTM D 16, unless otherwise specified.
2. Coverage: total-minimum dry film thickness in mils or square feet per gallon.

3. FRP: Fiberglass Reinforced Plastic.
4. HCl: Hydrochloric Acid.
5. MDFT: Minimum Dry Film Thickness, mils.
6. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
7. Mil: Thousandth of an inch.
8. PDS: Product Data Sheet.
9. PSDS: Paint System Data Sheet.
10. PVC: Polyvinyl Chloride.
11. SFPG: Square Feet per Gallon.
12. SFPGPC: Square Feet per Gallon per Coat.
13. SP: Surface Preparation.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Submit in accordance with Division 1 Submittal Procedures.

a. Data Sheets:

1) For each product, furnish a Product Data Sheet (PDS), the manufacturer's technical data sheets, and paint colors available (where applicable). The PDS form is appended to the end of this section.

2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.

3) Technical and performance information that demonstrates compliance with Specification.

4) Furnish copies of paint system submittals to the coating applicator.

5) Indiscriminate submittal of only manufacturer's literature is not acceptable.

b. Detailed chemical and gradation analysis for each proposed abrasive material.

2. Samples:

a. Proposed Abrasive Materials: Minimum 5-pound sample for each type.

b. Reference Panel:

1) Surface Preparation:

a) Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel for each grade of sandblast specified herein, prepared to specified requirements.

b) Provide panel representative of the steel used; prevent deterioration of surface quality.

c) Panel to be reference source for inspection upon approval by Engineer.

2) Paint:

a) Unless otherwise specified, before painting work is started, prepare minimum 8-inch by 10-inch sample with type of paint and application specified on similar substrate to which paint is to be applied.

b) Furnish additional samples as required until colors, finishes, and textures are approved.

c) Approved samples to be the quality standard for final finishes.

B. Informational Submittals:

1. Typewritten schedule of Painting Operations. This schedule shall include for each surface to be painted, the brand name, generic type, solids by volume, application method, the coverage and number of coats in order to achieve the specified dry film thickness, and color charts.

2. Coating manufacturer's Certificate of Compliance, in accordance with Division 1, Manufacturers' Field Services.

3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.

4. Manufacturer's written verification that submitted material is suitable for the intended use.

5. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer's written confirmation that materials are compatible.

6. Manufacturer's written instructions and special details for applying each type of paint.

C. Warranty:

1. Submit manufacturer’s standard warranty in accordance with requirements of Division 1, warranties covering the items included under this Section.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years' experience in application of specified products.

B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.

2. Perform surface preparation and painting in accordance with recommendations of the following:

a. Paint manufacturer's instructions.

b. SSPC PA 3, Guide to Safety in Paint Applications.

c. Federal, state, and local agencies having jurisdiction.

C. Mockup:

1. Before proceeding with Work under this section, finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details.

2. After Engineer approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

D. Pre-application Meeting:

1. Convene a pre-application meeting two [2] weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Engineer, applicator, and manufacturer’s representative. Review the following:

a. Environmental requirements.
b. Protection of surfaces not scheduled to be coated.
c. Surface preparation.
d. Application.
e. Repair.
f. Field quality control.
g. Cleaning.
h. Protection of coating systems.
i. One-year inspection.
j. Coordination with other work.

E. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

F. Coordination of Work: Review other sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coatings systems for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.

2. Protect shop painted surfaces during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.

B. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material.
2. Fed. Spec. number, if applicable.
3. Manufacturer's stock number, batch number, and date of manufacturer.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Color name and number.

C. Storage:

1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.

2. Primed surfaces shall not be exposed to weather for more than 2 months before being topcoated, or less time if recommended by coating manufacturer.

3. Handling: Protect materials during handling and application to prevent damage or contamination.

4. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.

2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than

5 degrees F above dew point of ambient air.

3. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

4. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

5. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted or restricted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

6. Paint only when the surface temperature is at least 5 degrees F above the dew point, unless otherwise permitted by paint manufacturer’s printed instructions.

B. Status of Existing Coatings:

1. Perform tests as required to verify condition of existing coatings and substrate conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.

B. Minimum of 5 years' verifiable experience in manufacture of specified product.

C. Each of the following manufacturers is capable of supplying most of the products specified herein:

1. TNEMEC Company, Inc.

2. The Sherwin-Williams Company.

3. PPG Industries.

4. Carboline.

2.02 ABRASIVE MATERIALS

A. Abrasives for blasting shall be sharp, washed, salt free, angular, and free from feldspar or other constituents that tend to breakdown and remain on the surface.

B. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.03 PAINT MATERIALS

A. General:

1. Manufacturer's highest quality products suitable for intended service. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.

3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

4. Color Pigments: Pure, non fading, applicable types to suit substrates and service indicated.

a. Lead content in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non volatile (dry film) of paint by weight.

B. Products:

Product	Definition
Acrylic Latex	Single-component, 100% acrylic finish as required
Block Filler	Primer-sealer designed for rough masonry surfaces, acrylic emulsion, cementitious acrylic, or epoxy
Coal-Tar Epoxy	Amine, polyamide, or phenolic epoxy type, suitable for immersion service
Epoxy Filler/Surfacer	100% solids epoxy trowel grade filler and surface, nonshrinking, suitable for application to concrete and masonry
Epoxy Nonskid (Aggregated)	100% solids two-component catalyzed epoxy aggregated; aggregate may be packaged separately
Epoxy Primer- Ferrous Metal	High-build, two component catalyzed epoxy primer.
Epoxy Primer- Other	Epoxy primer, high-build, as recommended by coating manufacturer for specific galvanized metal, copper, or nonferrous metal alloy to be coated
Fusion Bonded Coating	100% solids, thermosetting, fusion bonded, dry powder epoxy, suitable for the intended service
Fusion Bonded, TFE Lube or Grease Lube	Tetrafluoroethylene, liquid coating, or open gear grease as supplied by McMaster-Carr Supply Corporation, Elmhurst, IL; RL 736 manufactured by Amrep, Inc., Marietta, GA, or approved equal.
High Build Epoxy	High-build, two component catalyzed epoxy, capability of 3 to 5 MDFT per coat
Product	Definition
Latex Primer Sealer	Waterborne vinyl acrylic primer/sealer for interior gypsum board and plaster. Capable of providing uniform seal and suitable for use with specified finish coats.
Gloss Polyurethane -	Two-component, aliphatic acrylic based polyurethane; high gloss finish
Multipolymeric Matrix Coating	Heat resistant single component inert multipolymeric matrix coating for high heat applications under insulation.
Water Base Epoxy	Two-component, polyamide epoxy emulsion, finish as required.

2.04 MIXING

A. Multiple-Component Coatings:

1. Prepare using each component as packaged by paint manufacturer.

2. No partial batches will be permitted.

3. Do not use multiple-component coatings that have been mixed beyond their pot life.

4. Furnish small quantity kits for touchup painting and for painting other small areas.

5. Mix only components specified and furnished by paint manufacturer.

6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

1. Colors: Formulate paints with colorants for reasons of color or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

2.05 SHOP FINISHES

A. Shop Blast Cleaning: Reference Paragraph, Shop Coating Requirements.

B. Surface Preparation: Provide Engineer minimum 7 days' advance notice to start of shop surface preparation work and coating application work.

C. Shop Coating Requirements:

1. When required by equipment Specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.

2. Where manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Pipe:

1. Steel and Ductile Iron Pipe:

a. Prepare steel surfaces in accordance with SSPC SP-6, Commercial Blast Cleaning with a surface profile of 2 to 3 MILS.

1) Prepare ductile or cast iron surfaces in accordance with NAPF 500-03-04 Abrasive Blast Cleaning with the exception that ALL rust and mold coating be removed. Only tightly adherent annealing oxide may remain. Bituminous coated pipe shall NOT be allowed if field painting is required.

2) Bituminous coated pipe shall NOT be allowed if field painting is required.

3) Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

b. The surface preparation and application of the primer shall be performed by pipe manufacturer.

c. Prior to blast cleaning, grind smooth surface imperfections, including, but not limited to delaminating metal or oxide layers.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide Engineer minimum 7 days' advance notice to start of field surface preparation work and coating application work.

B. Perform the Work only in presence of Engineer or their representative, unless Engineer grants prior approval to perform the Work in Engineer's absence.

C. Schedule inspection of cleaned surfaces and all coats prior to succeeding coat in advance with Engineer.

D. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect-Architect-Engineer. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations. At completion of work of other trades, touch up and restore all damaged or defaced painted surfaces.

3.02 EXAMINATION

A. Factory Finished Items:

1. Scheduling Inspection with Engineer before repairing damaged factory finished items delivered to Site.

2. Repair abraded or otherwise damaged areas on factory-finished items as recommended by coating manufacturer. Carefully blend repaired areas into original finish. If required to match colors, provide full finish coat in field.

B. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of

paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

C. Starting of painting work will be construed as acceptance of surfaces and conditions within any particular area.

D. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.03 PROTECTION OF ITEMS NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering.

E. Protect surfaces adjacent to or downwind of Work area from overspray.

3.04 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition, or as required by this specification, the more stringent requirements shall apply.

1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect-Architect-Engineer in writing of any anticipated problems in using the specified coating systems with substrates primed by others.

2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning per SSPC SP-1. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

4. Abrasives for blasting shall be sharp, washed, salt free, angular, and free from feldspar or other constituents that tend to breakdown and remain on the surface.

5. Concrete floors shall be dry as indicated by testing in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

B. Field Abrasive Blasting:

1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.

2. Refer to coating systems for degree of abrasive blasting required.

3. Where the specified degree of surface preparation differs from manufacturer's recommendations, the more stringent shall apply.

C. Metal Surface Preparation:

1. Where indicated, meet requirements of SSPC Specifications summarized below:

a. SP 1, Solvent Cleaning: Removal of visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.

b. SP 2, Hand Tool Cleaning: Removal of loose rust, loose mill

scale, loose paint, and other loose detrimental foreign matter, using nonpower hand tools.

c. SP 3, Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using power-assisted hand tools.

d. SP 5, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.

e. SP 6, Commercial Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.

f. SP 7, Brush-Off Blast Cleaning: Removal of visible rust, oil, grease, soil, dust, loose mill scale, loose rust, and loose coatings. Tightly adherent mill scale, rust, and coating may remain on surface.

g. SP 10, Near-White Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides: corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.

h. SP 11, Power Tool Cleaning to Bare Metal: Removal of visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter using power-assisted hand tools capable of producing suitable surface profile. Slight residues of rust and paint may be left in lower portion of pits if original surface is pitted.

i. SP 12, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating: Surface preparation using high- pressure and ultrahigh-pressure water jetting to achieve specified surface cleanliness condition. Surface cleanliness conditions are defined in SSPC SP 12 and are designated WJ-1 through WJ-4 for visual surface preparation definitions and SC-1 through SC-3 for nonvisual surface preparation definitions.

2. The words "solvent cleaning", "hand tool cleaning", "wire brushing", and "blast cleaning", or similar words of equal intent in these Specifications or in paint manufacturer's specification refer to the applicable SSPC Specification.

3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers' recommendations for wet blast additives and first coat application shall apply.

4. Hand tool clean areas that cannot be cleaned by power tool cleaning.

5. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.

6. Welds and Adjacent Areas:

a. Prepare such that there is:

1) No undercutting or reverse ridges on weld bead.

2) No weld spatter on or adjacent to weld or any area to be painted.

3) No sharp peaks or ridges along weld bead.

b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

7. Pre-blast Cleaning Requirements:

a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.

b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.

c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.

8. Blast Cleaning Requirements:

a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.

b. Select type and size of abrasive to produce surface profile that meets coating manufacturer's recommendations for particular primer to be used.

c. Use only dry blast cleaning methods.

d. Do not reuse abrasive, except for designed recyclable systems.

e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.

9. Post-Blast Cleaning and Other Cleaning Requirements:

a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.

b. Paint surfaces the same day they are blasted. Reblast surfaces that have started to rust before they are painted.

D. Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation:

1. Prepare galvanized steel and nonferrous metal surfaces in accordance with SSPC-SP16 and the coating manufacturer’s instructions.

2. Test galvanized surfaces for chromate treatments and remove as required by SSPC-SP 16, or other Engineer approved method.

3. Ensure surfaces are dry.

E. Concrete Surface Preparation:

1. Do not begin until 30 days after concrete has been placed.

2. Meet requirements of SSPC SP 13 and ICRI 310.2.

3. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods. Remove residual abrasives, dust, and loose particles by vacuuming or blowing with high pressure air.

4. Abrasive blast clean to remove loose concrete and laitance, and provide an ICRI CSP profile as required by paint manufacturer.

5. Secure coating manufacturer's recommendations for additional preparation, if required, for excessive bug holes exposed after blasting.

6. Unless otherwise required for proper adhesion, ensure surfaces are dry

   Prior to painting. Concrete floors shall be dry as indicated by testing in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method, and, if necessary, ASTM F1869, Measuring Moisture Vapor Emission Rate of Concrete. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

7. If surfaces are found to be sufficiently alkaline to cause blistering and burning off of finish paint, correct this condition before application of paint.

F. Plastic and FRP Surface Preparation:

1. Hand sand plastic surfaces to be coated with medium grit sandpaper to provide tooth for coating system.

2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

G. Masonry Surface Preparation:

1. Complete and cure masonry construction for 14 days or more before starting surface preparation work.

2. Remove oil, grease, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent washing, or other suitable cleaning methods.

3. Clean masonry surfaces of mortar and grout spillage and other surface deposits using one of the following:

    a. Nonmetallic fiber brushes and commercial muriatic acid followed by rinsing with clean water.

    b. Brush-off blasting.

    c. Water blasting.

4. Do not damage masonry mortar joints or adjacent surfaces.

5. Leave surfaces clean and, unless otherwise required for proper adhesion, dry prior to painting.

6. Masonry Surfaces to be Painted: Uniform texture and free of surface imperfections that would impair intended finished appearance.

7. Masonry Surfaces to be Clear Coated: Free of discolorations and uniform in texture after cleaning.

H. Wood Surface Preparation:

1. Replace damaged wood surfaces or repair in a manner acceptable to Engineer prior to start of surface preparation.

2. Solvent clean (mineral spirits) knots and other resinous areas and coat with shellac or other knot sealer, prior to painting. Remove pitch by scraping and wipe clean with mineral spirits or turpentine prior to applying knot sealer.

3. Round sharp edges by light sanding prior to priming.

4. Filler:

    a. Synthetic-based wood putty approved by paint manufacturer for paint system.

    b. For natural finishes, color of wood putty shall match color of finished wood.

    c. Fill holes, cracks, and other surface irregularities flush with surrounding surface and sand smooth.

    d. Apply putty before or after prime coat, depending on compatibility and putty manufacturer's recommendations.

e. Use cellulose type putty for stained wood surfaces.

5. Ensure surfaces are clean and dry prior to painting.

6. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.

I. Gypsum Board Surface Preparation: Typically, new gypsum board surfaces need no special preparation before painting.

1. Surface Finish: Dry, free of dust, dirt, powdery residue, grease, oil, or any other contaminants.

J. Galvanized Surfaces: SSPC SP 16.

K. Existing Painted Surfaces to be Repainted Surface Preparation:

1. Detergent wash and freshwater rinse.

2. Clean loose, abraded, or damaged coatings to substrate by band or power tool, SP 2 or SP 3.

3. Feather surrounding intact coating.

4. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.

5. Apply one full finish coat of specified primer to entire surface.

6. If an aged, plural-component material is to be topcoated, contact coating manufacturer for additional surface preparation requirements.

7. For ductile iron pipe with asphaltic varnish finish not specified to be abrasive blasted, apply coat of tar stop prior to application of cosmetic finish coat.

8. Application of Cosmetic Coat:

a. It is assumed that existing coatings have oxidized sufficiently to prevent lifting or peeling when overcoated with paints specified.

b. Check compatibility by application to a small area prior to starting painting.

9. Perform blasting as required to restore damaged surfaces. Materials, equipment, procedures shall meet requirements of SSPC.

L. Shop Primed Surfaces: Prepare shop-applied prime coats wherever damaged or bare as required by other sections of these Specifications. Clean and touch-up with same type shop primer.

3.05 SURFACE CLEANING

A. Brush-off Blast Cleaning:

1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC SP 7.

2. Abrasive: Either wet or dry blasting sand, grit, or nutshell.

3. Select various surface preparation parameters, such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.

4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.

5. Engineer will review acceptable trial blast cleaned area and use area as a representative sample of surface preparation.

6. Repair or replace surface damaged by blast cleaning.

C. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.

2. Meet requirements of SSPC SP 1.

3.06 APPLICATION

A. General:

1. The intention of these Specifications is for existing and new interior masonry, interior and exterior wood, and metal and submerged metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise. Do not paint exterior concrete surfaces, unless specifically indicated.

2. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.

3. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating until completion of curing cycle.

4. Apply coatings in accordance with these Specifications and paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.

5. Sand wood lightly between coats to achieve required finish.

6. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

7. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.

8. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.

9. Water-Resistant Gypsum Board: Use only solvent type paints and coatings.

10. On pipelines, terminate coatings along pipe runs to 1 inch inside pipe penetrations.

11. Keep paint materials sealed when not in use.

12. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

13. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

14. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

15. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

16. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.

    a. Piping, pipe hangers, supplementary steel and supports (except galvanized surfaces.

    b. Heat exchangers.

c. Tanks.

d. Ductwork, insulation.

e. Motor, mechanical equipment, and supports.

f. Accessory items.

g. Conduits and fittings (except galvanized surfaces).

h. Switchgear.

i. Hanger and support (except galvanized surfaces).

17. Provide finish coats which are compatible with prime paints used.

18. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

19. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable. Holiday test coated steel in immersion areas in accordance with NACE International RP 0188-90.

20. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

21. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

B. Galvanized Metal, Copper, and Nonferrous Metal Alloys:

1. Concealed galvanized, copper, and nonferrous metal alloy surfaces (behind building panels or walls) do not require painting, unless specifically indicated herein.

2. Prepare surface and apply primer in accordance with System No. 5 specification.

3. Apply intermediate and finish coats of the coating system appropriate for the exposure.

C. Porous Surfaces, Such As Concrete and Masonry:

1. Filler/Surfacer: Use coating manufacturer's recommended product to fill air holes, bug holes, and other surface voids or defects.

2. Prime Coat: May be thinned to provide maximum penetration and adhesion.

   a. Type and Amount of Thinning: Determined by paint manufacturer and dependent on surface density and type of coating.

3. Surface Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of coating.

D. Film Thickness and Coverage:

1. Number of Coats:

   a. Minimum required without regard to coating thickness.

   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.

2. Application Thickness:

   a. Do not exceed coating manufacturer's recommendations.

   b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.

3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:

   a. Perform with properly calibrated instruments.

   b. Recoat and repair as necessary for compliance with Specification.

   c. Coats are subject to inspection by Engineer and coating manufacturer's representative.

4. Visually inspect concrete, masonry, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.

5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.

6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.

3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question.

B. The Finish Schedule on Architectural Drawings addresses walls, floors and ceilings for various buildings Additional requirements are included in the following schedule which addresses structural steel, prefabricated steel trusses, process equipment, pumps, piping and other items.

C. NSF International approval required for coatings used in contact with the water treatment plant process water.

D. System No. 1 Steel Submerged in Process or Wastewater:

Surface Prep	Paint Material	Min. Coats, Cover
SP 10, Near White Blast Cleaning	High Build Chemical Resistant Epoxy (Flake-Filled preferred). Coal Tar Epoxy is NOT acceptable.	OPTIONAL Shop Primer 2 coats, 8.0 – 12.0 MDFTPC

1. Use on the following items or areas:

Metal surfaces new and existing below a plane 1 foot above the maximum liquid surface; metal surfaces above the maximum liquid surface that are a part of the immersed equipment; surfaces of metallic items, such as wall pipes, pipes, pipe sleeves, access manholes, gate guides and thimbles, and structural steel that are embedded in concrete.

E. System No. 2 Exposed Metal-: Exterior

Surface Prep	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning with a surface profile of 2 to 3 MILS.	Epoxy Primer- Ferrous Metal	1 coat, 3 to 5 MDFT
	High Build Epoxy	1 coat, 3 to 5 MDFT
	Gloss Polyurethane	1 coat, 2 to 4 MDFT

1. Use on the following items or areas:

Exposed metal surfaces, new and existing located outside of structures and exposed to weather, and the following specific surfaces:

1) Exposed metal surfaces, piping and equipment.
2) Exposed process piping above grade and within structures or vaults.

3) Structural steel and structural aluminum surfaces.

F. System No. 3 Exposed Metal-: Interior

Surface Prep	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning with a surface profile of 2 to 3 MILS	Epoxy Primer- Ferrous Metal	1 coat, 3 to 5 MDFT
	High Build Epoxy	1 coat, 3 to 5 MDFT
	High Build Epoxy	1 coat, 3 to 5 MDFT

1. Use on the following items or areas:

Exposed metal surfaces, new and existing located inside of structures and the following specific surfaces:

1) Exposed metal surfaces, piping and equipment.
2) Exposed process piping above grade and within structures or vaults.
3) Structural steel including roof joist and roof deck.

G. System No. 4 Buried Steel (Soil Side)

Surface Prep	Paint Material	Min. Coats, Cover
SP 10, Near White Blast Cleaning	Coal Tar Epoxy	1 or 2 coats, 14.0 – 20.0 MDFT Total

H. System No. 5 Galvanized Metal, Copper, and Nonferrous Metal Alloy Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
SSPC-SP 16	Epoxy Primer-Other	As recommended by coating manufacturer, Ext. Topcoat: Gloss Polyurethane 1 coat, 2 to 4 MDFT Int. Topcoat: High Build Epoxy 1 coat, 3 to 5 MDFT

1. Use on the following items or areas:

a. Galvanized surfaces requiring painting.
b. After application of System No. 4, apply finish coats as required for exposure.

I. System No. 6 Carbon Steel or Stainless Steel – Atmospheric or Insulated Service:: Ambient or Hot Steel up to 500 degrees F (260 degrees C)

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Multipolymeric-Matrix Coating	2 coats, 5 MDFTPC

1. Use on the following items or areas:

   a. High heat applications for carbon steel or stainless steel.
   b. Application surface temperatures from ambient to 1,000 degrees F (537 degrees C).
   c. Operating surface temperatures cryogenic to 1200 degrees F (649 degrees F).
   d. Self priming, single component.

J. System No. 7 Skid-Resistant- Concrete:

Surface Prep	Paint Material	Min. Coats, Cover
SSPC-SP 13 to achieve ICRI CSP as required by manufacturer	Epoxy Nonskid (Aggregated)	1 coat, 160 SFPG 10 MDFT plus aggregate

1. Use on the following items or areas:

   a. Use on floors per finish schedule except floors within chemical storage and feed areas.

K. System No. 8 Buried Concrete (Soil Side)

Surface Prep	Paint Material	Min. Coats, Cover
SSPC-SP 13 to achieve ICRI CSP as required by manufacturer	Coal Tar Epoxy	1 or 2 coats, 16.0 – 24.0 MDFT Total

L. System No. 9 Skid-Resistant- Concrete for above grade slabs or where slab moisture content is unknown:

Surface Prep	Paint Material	Min. Coats, Cover
SSPC-SP 13 to achieve ICRI CSP as required by manufacturer	Waterbased Breathable Self-leveling Epoxy with Nonskid Aggregated added	2 coats, total 10 MDFT plus aggregate to Owner desired texture

M. System No. 10 Chemical Resistant Concrete Floor: - NOT USED, See System No. 11

Surface Prep	Paint Material	Min. Coats, Cover
SSPC-SP 13 to achieve ICRI CSP as required by manufacturer	100% Solids Flake-Filled Epoxy Novolac	Manufacturer Recommended Primer – 4.0 to 6.0 mils DFT 2 coats – 15.0 – 20.0 mils DFT

N. System No. 11 Chemical-Resistant, Heavy-Duty- Concrete and Masonry:

Surface Prep.	Paint Material	Min. Coats, Cover
SSPC-SP 13 to achieve ICRI CSP as required by manufacturer	Epoxy Filler/Surfacer.	1 coat, as required to fill voids and bugholes to provide a continuous substrate
	100% Solids Epoxy Novolac	2 or 3 coats, 10.0 – 14.0 mils DFT Total

Verify resistance to stored commodities and anticipated traffic load PRIOR to installation.

1. Use on the following items or areas:

    a. Walls and floors for chemical containment areas.

    b. Walls and floors for chemical storage and feed areas.

    c. Interior base slabs and walls for chemical piping pull boxes.

2. Add polyurethane top coat in exterior applications for one coat application, 2 to 4 mils DFT.

O. System No. 12 Exposed Concrete (Immersion - Potable):

Surface Prep.	Paint Material	Min. Coats, Cover
SSPC-SP 13/NACE 6 with a surface profile of ICRI CSP 2 or 3.	Filler: Fill bug holes, air pockets and other voids. Primer: Immersion Grade Two-Component ANSI / NSF 61 Certified Epoxy. DFT 3.0 to 5.0 mils. Roll or backroll.	1 coat, as required to fill voids. Intermediate Coat: Grade Two-Component ANSI / NSF 61 Certified Epoxy. DFT 6.0 to 8.0 mils. Finish Coat: Grade Two-Component ANSI / NSF 61 Certified Epoxy. DFT 6.0 to 8.0 mils. Total DFT: 15.0 to 21.0 mils.

1. Use on the following items or areas:

    a. Interior of GST and Clearwell.

2. Spray apply 100% solids ANSI / NSF 61 Certified Epoxy or Polyurethane for two coat application (higher film build possible). OAP technology strongly recommended

P. System No. 13 Exposed Concrete (Immersion – Process or Wastewater):

Surface Prep.	Paint Material	Min. Coats, Cover
SSPC-SP 13 to achieve ICRI CSP as required by manufacturer	Epoxy Filler/Surfacer.	1 coat, as required to fill voids and bugholes to provide a continuous substrate
	100% Solids Amine-Cured Epoxy	2 coats, 40.0 – 60.0 mils DFT Total

1. Finish color: as indicated on the drawings, or color schedule.

2. May be applied in one coat application given DFT total and holiday testing requirements are adhered to.

Q. System No. 14 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1)	Prime in accordance with manufacturer's recommendations	
	Coal-Tar Epoxy	1 coat, 10 MDFT

1. Use on aluminum surfaces embedded or in contact with concrete.

R. System No. 15 Interior Concrete and Masonry Walls, Non-immersion, excluding Floors:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Concrete and Masonry Surface Preparation	Manufacturer Recommended Surfacer or Block Filler	1 coat, as required to fill voids
	Two Component Water Based Catalyzed Epoxy	2 coats, total 5.0 – 8.0 MDFT

1. Use on the following items or areas:

   a. Concrete and concrete block walls, columns and supports.
   b. Concrete ceilings and beams.
   c. Non-corrosive room areas.

S. System No. 16 Interior Gypsum Wallboard:

Surface Prep	Paint Material	Min. Coats, Cover
In accordance with Paragraph Interior Gypsum Board Surface Preparation	Latex Primer Sealer Acrylic Latex	1 coat, 1.5 MDFT 2 coats, 1.5 MDFT

1. For interior gypsum wallboard (walls and ceilings).

T. System No. 17 Exposed FRP, PVC Plastic Piping, Valves, Fittings, and Conduit, Interior and Exterior

Surface Prep	Paint Material	Min. Coats, Cover
In accordance with Paragraph 3.02 Surface Preparation, including cleaning and washing with detergent to remove all dirt and foreign material, and light surface abrasion using medium grade sandpaper. Remove dust, dirt and debris with clean rags prior to coating.	Two component epoxy. Hi-Build Epoxy	1 coat, 3.0 MDFT 1 coat, 3.0 MDFT Total min. system coating thickness: 6.0 MDFT

1. For PVC or fiberglass piping or electrical systems requiring color coding, and for protection of exposed, exterior plastic components from the elements, and shall include the following:

   a. PVC and fiberglass piping, fittings, valves, and electrical conduits requiring color coding in accordance with Section 15050: Process and Utility Piping, Fittings, Valves, and Accessories.

   b. Exposed exterior plastic piping, valve, and fitting components subject to UV degradation and weathering by the elements.

U. System No. 18 Exposed Exterior Concrete and Masonry, Non-immersion.

Surface Prep	Paint Material	Min. Coats, Cover
SSPC-SP 13/NACE 6 with a surface profile of ICRI CSP 2 or 3. Clean and dry.	Filler/Surfacer: Fill bug holes, air pockets and other voids to provide a continuous substrate. Prime in accordance with manufacturer's recommendations. Primer: As required by manufacturer. Elastomeric Acrylic Hi-Build Waterproofing Coating	1 coat as required to fill voids. 1 coat, 6.0 – 9.0 MDFT Finish Coat: 2 coats, 6.0 – 9.0 MDFT per coat Total min. system coating thickness over surfacer and prier: 12.0 MDFT

1. For exposed exterior concrete (non-immersion) at above grade Ground Storage Tank and Blending Basin locations.

2. Finish Color: As selected by Owner from manufacturer's full range of standard colors.

3.08 COLORS

A. Provide as shown for equipment and appurtenances and designated herein and shown in Piping Schedule. All new color finishes shall match the existing scheme/colors.

B. Proprietary identification of colors is for identification only. Selected manufacturer may supply matches.

C. Equipment Colors:

1. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.

2. Paint equipment and piping one color as selected.

3. Paint nonsubmerged portions of equipment the same color as the piping it serves, except as itemized below:

a. Dangerous Parts of Equipment and Machinery: OSHA Orange.

b. Fire Protection Equipment and Apparatus: OSHA Red.

c. Radiation Hazards: OSHA Purple.

d. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.

D. Pipe Identification Painting:

1. Color code non-submerged metal piping, except electrical conduit. Paint fittings and valves the same color as pipe, except equipment isolation valves.

2. Piping Color Schedule: In accordance with Piping Schedule.

3. On exposed stainless steel piping, apply color 24 inches in length along pipe axis at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 9 feet on center.

4. Pipe Supports: Painted light gray, as approved by Owner.

5. Fiberglass reinforced plastic (FRP) pipe, polyvinylidene fluoride (PVDF), and polyvinyl chloride (PVC) pipe located inside of buildings and enclosed structures will not require painting, except as noted or scheduled.

3.09 FIELD QUALITY CONTROL

A. Testing Equipment:

1. Provide magnetic type dry film thickness gauge to test coating thickness specified in mils, as manufactured by Nordson Corp., Anaheim, CA, Mikrotest, or approved equal.

2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities, as manufactured by Tinker and Rasor, San Gabriel, CA, Model M-1, or approved equal.

3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit as recommended by coating manufacturer.

B. Testing:

1. Thickness and Continuity Testing by Contractor:

a. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.

b. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE RP0188.

c. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE RP0188.

d. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

C. Inspection: Leave staging and lighting in place until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

D. Unsatisfactory Application:

1. If item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.

2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.

3. Repair defects in accordance with written recommendations of coating manufacturer.

E. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.

2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.

3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

F. The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:

1. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

2. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

G. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.10 MANUFACTURER'S SERVICES

A. In accordance with Division 1, Manufacturers' Field Services, coating manufacturer's representative shall be present at Site as follows:

1. On first day of application of any coating system.

2. A minimum of two additional Site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.

3. As required to resolve field problems attributable to or associated with manufacturer's product.

4. To verify full cure of coating prior to coated surfaces being places into immersion service.

    a. Inspection Reports: Submit written reports to Engineer and Contractor describing inspections made and actions taken to correct nonconforming work. Report nonconforming work not corrected.

    b. Manufacturer’s Field Services: Manufacturer’s representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.11 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

D. As soon as painting Work is accepted by Contactor, it shall become its responsibility for protection, final cleaning, and tough-up. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color. Repair coating defects in accordance with manufacturer’s written instructions.

E. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.12 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Engineer, and manufacturer’s representative.

C. Repair deficiencies in coating systems as determined by Engineer in accordance with manufacturer’s instructions.

3.13 SUPPLEMENTS

A. The supplements listed below, and following "End of Section," are a part of this Specification:

1. Piping Color Schedule – To facilitate identification of piping in Water Treatment Plants and Pumping Stations follow the Ten states Identification System unless otherwise noted.

2. Paint System Data Sheet (PSDS)

3. Product Data Sheet (PDS)

3.14 STENCILING

A. The Contractor shall supply all materials and labor necessary for stenciling of legends on pipes. The legend shall show the name of the contents. Review by the Architect-Engineer of legends will be required. Names shall be "plainly visible". Arrows showing direction of flow shall also be stenciled on pipes. The legends shall be located not more than 10 feet apart and, in general, at each valve and piece of equipment. The size and location of the legend shall be in general accordance with ANSI A13.1-1981 "Scheme for the Identification of Piping Systems". All visible piping 6" in diameter and larger shall be color-coded and stenciled. "Stick-on" labels are not acceptable.

3.15 PLASTIC IDENTIFICATION MARKERS

A. All visible piping 3/4" and greater and less than 6" which is accessible for maintenance operations shall be color-coded and identified with semi-rigid plastic identification markers equal to SETMARK Pipe Markers as manufactured by Seton Name Plate Corporation, New Haven, Conn.; T & B/Westline, Los Angeles, California; or approved equal. Direction of flow arrows are to be included on each marker, unless otherwise specified.

B. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ANSI A 13.1 - 1981).

C. For pipes under 3/4" O.D. (too small for color bands and legends), brass identification tags 1-1/2" in diameter with depressed 1/4" high black-filled letters above 1/3" blackfilled numbers shall be fastened securely at specified locations.

D. All electrical conduits, which are accessible for maintenance operations, shall be identified with semi-rigid identification markers similar to those specified above.

E. Each marker background is to be color-coded with a clearly printed legend to identify the conductor. Size of markers and sizes of lettering to generally conform to the "Scheme for Identification of Piping Systems" (ANSI A 13.1 - 1981)

F. Locations for pipe and electrical markers to be as follows:

1. Adjacent to each valve and fitting (except on plumbing fixtures and equipment).

2. Each branch and riser take-off.

3. Each pipe passage through wall, floor and ceiling construction.

4. Each pipe passage to underground.

5. All horizontal pipe runs-marked every 25 feet.

TABLE 09961-B
PAINT SCHEDULE

Structure	Location	System No.
Metal Piping, Ferrous Valves, Pumps, and Exposed Lift Station Metal Piping and Appurtenances	Above Grade Interior	▪ Ferrous Metal: No. 3 ▪ Submerged: No. 1
	Above Grade Exterior	▪ Ferrous Metal: No. 2
	Below Grade	▪ NA
Plastic Piping, Fittings, Valves, exposed FRP Duct Work, Conduit	Exterior	▪ Plastic Piping: No. 17
	Interior	▪ Plastic Piping: No. 17
Bollards	Exterior	▪ Ferrous Metal: No. 2
Chemical Containment Areas	Interior and Exterior	▪ Flooring, walls, base slabs: No. 11
Precast Concrete Structures	Exterior	▪ System No. 8
Interior Concrete Columns, Supports, Ceilings and Beams	Interior and Exterior	▪ System No. 15
General Flooring (all other areas not receiving chemical resistant flooring)	Exterior	▪ Exposed: No. 9
Concrete	Submerged	▪ System No. 12

END OF SECTION