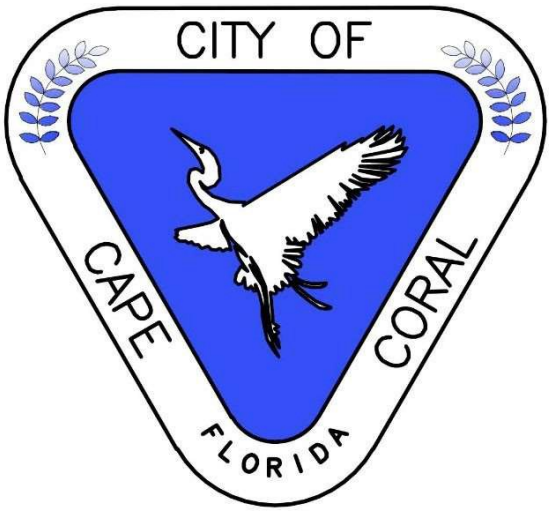

PUMP STATION
AND
PROPOSED 36" DIA. RAW WATER LINE
FROM
NORTHEAST RESERVOIR TO
GATOR SLOUGH

March 2025
Revised June 2025

Prepared For:

CITY OF CAPE CORAL
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CITY OF CAPE CORAL
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SECTION 01005

PROJECT REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work:

A. 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.

1.02 DRAWINGS, PROJECT MANUAL AND CITY DESIGN PROCEDURES and TECHNICAL SPECIFICATIONS

1. 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.

2. Supplementary Drawings:

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

B. 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 therefore to the Contractor shall be subject to the terms of the Agreement.

3. Contractor to Check Drawings and Data:

A. 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.

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

4. 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.

5. Intent:

A. 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.

B. 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.

6. Contractor to Review City Requirements and Data:

A. Contractor shall obtain and thoroughly review the following documents: City Design Procedures, City Technical Specifications, and City Standard Utility Drawings.

1) The Design Procedures consist of seven (7) parts: General Notes, General Piping Criteria's, Materials, Separation and Location Requirements, General System Design, Irrigation Water Systems, General parts of the Design Procedures contain General Requirements which govern the Work.

2) The Technical Specifications consist of Divisions 02 – 17. General parts of a Specification contain General Requirements which govern the Work.

3) The Utility Drawings consist of three (3) Details and Descriptions: (1) General Notes, Sitework, Road/(Driveway), and Drainage, (2) Pump Station, electrical building, and details, (3) 36" pipe, fittings, jack and bores, outlet structure, restoration. The standard drawings contain General Requirements which govern the Work.

1.03 MATERIALS AND EQUIPMENT

1. Manufacturer:

   A. 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.

   B. 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.

2. Delivery:

   A. 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.

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

3. Tools and Accessories:

   A. 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 or lockable manufacturer provided cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

   B. 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.

   C. 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.

4. Service of Manufacturer's Engineer:

   A. 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.

   B. 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

1. General:

A. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests, and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Five (5) copies of the reports shall be submitted, and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

B. 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.

C. 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.

D. 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.

2. Costs:

A. All costs for inspections required under the Building Permit shall be provided by the Contractor, unless otherwise expressly specified.

B. 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.

C. 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.

3. Certificate of Manufacture:

A. 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.

B. 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.

4. Shop Tests:

A. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. Shop tests where specified shall be witnessed by the Engineer.

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

C. The cost of shop tests, travel expenses of the Engineer, and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

5. Start-up Tests:

A. As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.

B. 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.

6. Demonstration Tests:

A. 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.

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

1.05 LINES AND GRADES

1. Grade:

   A. 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.

   B. The Engineer will establish, as needed, benchmarks, baseline controlling points, and/or reference marks for pipe laying lines and appurtenance locations. 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.

2. Surveys:

   A. The Contractor shall furnish and maintain, at his own expense, stakes and other such materials.

   B. 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.

   C. 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.

3. Safeguarding Marks:

   A. 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.

   B. The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent to but not related to the Work and shall bear the cost of re-establishing them if disturbed or destroyed.

1.06 ELECTRONIC INFORMATION MANAGEMENT

1. General:

   A. The City of Cape Coral may elect to use an electronic information management software as part of this contract. If used, the City will supply access to the software to the CONTRACTOR and it will be the CONTRACTOR’s responsibility to familiarize

themselves with the software and its use. If used, all documents associated with this project will be electronically stored, shared, and transmitted via the software including but not limited to:

1) Shop Drawings

2) Pay Applications

3) Punch Lists

4) Requests for Information

5) Requests for Proposals

6) All other contract documents

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 – GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDED

1. The Work of this Contract includes, but is not limited to, the following:
The Work is comprised of the construction of a 36" raw irrigation water transmission main, restoration, road/driveway reconstruction, site and drainage work, Pump Station and other Work displayed or described in the Contract Documents from the Southwest Aggregate Mine to Gator Slough along with all associated valves, fittings, air release valves, casings, and all necessary restoration and site work.

1.02 CONTRACT TIME

1. Contract Time from the notice to proceed to the date of substantial completion shall not exceed 515 calendar days and 545 calendar days for final completion.

1.03 CONTRACTS

1. Construct the portions of Work under a lump sum and unit price Contract as shown on the attached bid sheet.

1.04 WORK BY OTHERS (Not Used)

1.05 FUTURE WORK

1. This project is to be completed in 1 Phase only and is bounded by the limits shown on the Drawings.

1.06 WORK SEQUENCE

1. The Contractor is responsible for determining their work sequencing for the project.

2. Service to all existing facilities shall be maintained at all times including but not limited to:

A. The existing wastewater system

B. The existing potable water system

C. The existing reclaimed water system

D. All public and private roadways, driveways, mailboxes, etc.

E. The wastewater treatment plant

F. The water treatment plants

G. All potable water supply wells

H. All wastewater lift stations

1.07 CONTRACTOR'S USE OF PREMISES

1. Contractor shall limit his use of the premises for Work and for storage, to the areas shown on the Drawings or as directed by the EOR or Owner.

2. Coordinate use of premises under direction of Engineer.

3. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.

4. Move any stored Products, under Contractor's Control, which interfere with operations of the Owner or others.

1.08 OWNER OCCUPANCY

1. Owner will occupy premises during entire construction period for conduct of his normal operations. Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.09 REQUIRED INSURANCES

1. See General Conditions.

1.10 SAFETY AND OSHA COMPLIANCE

1. The Contractor shall comply in all respects with all Federal, State and Local safety and health regulations. Copies of the Federal regulations may be obtained from the U.S. Department of Labor, Occupation Safety and Health Administration (OSHA), Washington, DC 20210 or their regional offices.

2. The Contractor shall comply in all respects with the applicable Workman's Compensation Laws.

1.11 PRE-PURCHASED EQUIPMENT (Not Used)

1.12 CONTRACTOR PURCHASE RESPONSIBILIY

1. The Contractor, as a part of this Contract, shall include in his bid the furnishing and installation of all labor, materials, and work as necessary to complete the installation of the various irrigation main, valves, pumps road crossing casings, and all of items shown on the Drawings and described in these specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

1.01 GENERAL

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

2. The prices stated in the proposal include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as shown on the Drawings and specified herein. The basis of payment for an item at the unit price shown in the proposal shall be in accordance with the description of that item in this Section.

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

1.02 MEASUREMENT

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

1.03 SAVINGS PROPOSALS

1. The CONTRACTOR may make proposals to change the WORK, which result in savings in the cost to perform the WORK. When such proposals are made, they will be referred to the OWNER for evaluation. If it is determined by the OWNER that the proposal provides the same level of service and if the OWNER accepts the change, the CONTRACTOR shall provide an estimate of the savings resulting from the proposed change. The OWNER and the CONTRACTOR shall share equally in the savings after all costs for evaluation and review by the OWNER have been deducted. A change order documenting the changes will be issued by the OWNER to incorporate the changes including the savings through revised Unit Prices.

1.04 **NO SEPARATE MEASUREMENT AND PAYMENT FOR REMOVAL OF ROCK AND OTHER UNSUITABLE MATERIALS**

1. Payment for items requiring excavation will be made at the Bid Form unit price for the size and type installed, which payment shall be full compensation for all excavation, including removal and proper disposal of rock, inorganic and organic unsuitable fill materials. Include the cost of removal and proper disposal of these materials in the item for which they are most closely associated.

1.05 **NO SEPARATE MEASUREMENT AND PAYMENT FOR CONTRACTOR'S USE OF OWNER WATER**

1. Payment for items requiring use of owner water will be made at the Bid Form unit price for the size and type installed, which payment shall be full compensation for use of OWNER water for testing, flushing, dust control, and all other construction uses including actual cost of the water and meter rental billed by OWNER. Include the cost of use of OWNER water in the item for which they are most closely associated.

1.06 PAYMENT ITEMS

1. General Requirements - (Bid item #1.1, Bid Item #1.2, Bid Item #1.3)

   A. Measurement for various items covered under General Requirements will not be made for payment, and all items shall be included in the lump sum price.

   B. Payment for shall include:

      1.1 Bonds and Insurance: All Insurance requirements costs, the costs of all bonds, and all administrative costs associated with acquiring and maintaining the necessary coverage as described in the Contract Documents. The Contractor shall attach with the payment request invoices to substantiate that appropriate insurance and bonds have been obtained by the Contractor.

      1.2 Preconstruction Video: Video plus photographs of hidden features not readily apparent on the video recording after submittal to and approval by the City and the Engineer. Payment shall be prorated based on the percent (%) of preconstruction video completed and submitted to and approved by the City at the time a pay estimate is submitted for payment.

      1.3 Erosion and Sedimentation Controls: Controls shall include all equipment, labor and materials required to prepare, implement and maintain a Stormwater Pollution Prevention Control Plan including preparing and filing necessary regulatory forms and providing certifications at completion of project. Payment will be made on a prorated basis based on the percentage of work completed.

   C. This item will be paid upon each payment request made by the Contractor. General Requirements shall be limited to 10% of the total bid.

2. Maintenance of Traffic (Bid Item #2)

A. No measurement shall be made for this item.

B. Payment shall be made at the Bid Schedule lump sum price for Contractor to complete and conduct acceptable MOT practices as necessary to complete the work as shown on the drawings and detailed in the specifications.

3. Clear and Grub Site (Bid Item #3)

A. All clearing and grubbing shall be performed in accordance with the plans, except as modified herein. The limits of clearing and grubbing are depicted on the plans for the "Site". All trees and their stumps, roots, and vegetated/organic material shall be removed within the Project Site limits.

B. Stump Removal: When specified for removal, tree stumps and major roots projecting through or appearing on the surface of the ground shall be removed to a depth of twelve (12) inches below the existing soil surface. Removal shall be accomplished by means of chipping equipment designed for this purpose or by hand. Blasting or pushing the stops out with bulldozers, or equipment that disturbs the surrounding ground, will not be permitted unless in conjunction with clearing and grubbing operations. Holes or voids created by the removal of stumps must be filled, graded and compacted with acceptable fill material.

C. Ownership of Clearing and Grubbing Material: Unless otherwise specified, all material removed in performing clearing and grubbing shall become the property of the Contractor at the time the material is changed from the pre-construction condition. Materials shall be disposed of in a legal manner.

D. No measurement shall be made for this item

E. Payment for Clearing and Grubbing of the site shall be paid as Lump Sum and shall include the furnishing of all equipment, hauling of material, disposal of unused material, labor and incidentals necessary to complete the work.

4. Building (Bid Item #4)

A. The building shall be installed in accordance with the plans and specifications. This includes all materials, labor and equipment for installation of a functional building to be placed on a concrete slab that is included within Bid Item #8.

B. No measurement shall be made for this item

C. Payment for the Building shall be paid as Lump Sum and shall include the furnishing of all equipment, hauling of material, disposal of unused material, labor and incidentals necessary to complete the work.

5. Electrical (Bid Item #5)

A. The Electrical shall be installed in accordance with the plans and specifications. This includes all materials, labor and equipment for installation of all of the Electrical Systems onsite. This includes coordination with the power company to get a transformer installed, connections to everything that requires power. All of the internal building electrical equipment and connections for proper functionality as shown on the plans and specifications is included. In addition, all conduits from the building to the site are included.

B. No measurement shall be made for this item

C. Payment for the Electrical shall be paid as Lump Sum and shall include the furnishing of all equipment, hauling of material, disposal of unused material, labor and incidentals necessary to complete the work.

6. Concrete Structure (Bid Item #6)

A. The Concrete Structure shall be installed in accordance with the plans and specifications. This includes all materials, labor and equipment for installation of the Concrete Structure. This includes all concrete, rebar, intake gates, hatches and all items included within the Concrete Structure for the intake of water.

B. No measurement shall be made for this item

C. Payment for the Concrete Structure shall be paid as Lump Sum and shall include the furnishing of all equipment, hauling of material, disposal of unused material, labor and incidentals necessary to complete the work.

7. Concrete Flat Work (Bid Item #7)

A. The Concrete Flat Work shall be installed in accordance with the plans and specifications. This includes all materials, labor and equipment for installation of the Concrete Flow Work. This includes all concrete, rebar, for the concrete pads, areas under the above ground piping and remaining concrete work outside of the Concrete Structure.

B. No measurement shall be made for this item Payment for the Concrete Flat Work shall be paid as Lump Sum and shall include the furnishing of all equipment, hauling of material, disposal of unused material, labor and incidentals necessary to complete the work.

8. Aboveground Piping (Bid Item #8)

A. The Aboveground Piping shall be installed in accordance with the plans and specifications. This includes all materials, labor and equipment for installation of the piping connecting the below ground ductile iron pipe along the entry round to the pumps within the Concrete Structure. This includes piping, valving, supports, metering, and all materials and labor for installation.

B. No measurement shall be made for this item

C. Payment for the Aboveground Piping shall be paid as Lump Sum and shall include the furnishing of all equipment, hauling of material, disposal of unused material, labor and incidentals necessary to complete the work.

9. Submersible Pumps (Bid Item #9)

A. The Submersible Pumps shall be installed in accordance with the plans and specifications. This includes all materials, labor and equipment for installation of Submersible Pumps. This includes all mechanical connections, electrical connections, setting the pumps and performing the startup of the pumps.

B. No measurement shall be made for this item

C. Payment for the Submersible Pumps shall be paid as a per each and shall include the furnishing of all equipment and will be paid after installation of each pump acceptably installed and tested.

10. SP-12.5 Asphalt Concrete (2”) (Bid Item #10) -Reference FDOT Section 334 Superpave Asphalt Concrete (2023)

A. Measurement for Asphalt Concrete (2”) will be on a unit price basis per (TN). Asphalt Concrete pavement with the type of mixture specified in the Contract Documents. Superpave mixes identified as Type SP-12.5. Obtain Asphalt Concrete from a plant that is currently on the Florida Department of Transportation Production Facility Listing. 334-1.3

B. Gradation Classification: The Asphalt Concrete mix are classified as fine and are defined in FDOT Section 334-3.2.2. The equivalent AASHTO nominal maximum aggregate size Superpave mixes are as follows:

Type SP-12.5..... 12.5 mm

C. Thickness: The total thickness of the Type SP asphalt layers will be the plan thickness as shown in the Contract Documents. Before paving, propose a thickness for each individual layer meeting the requirements of this specification, which when combined with other layers (as applicable) will equal the plan thickness. For construction purposes, the plan thickness and individual layer thickness will be converted to spread rate based on the maximum specific gravity of the asphalt mix being used, as well as the minimum density level, as shown in the following equation: Spread rate (lbs/yd2) = t x Gmm x 43.3 Where: t = Thickness (in.) (plan thickness or individual layer thickness) Gmm = Maximum specific gravity from the verified mix design The weight of the mixture shall be determined as provided in 320-3.2. For target purposes only, spread rate calculations should be rounded to the nearest whole number. Note: Plan quantities are based on a Gmm of 2.540, corresponding to a spread rate of 110 lbs/yd2 -in. Pay quantities will be based on the actual maximum specific gravity of the mix being used.

D. Payment shall be made at the Bid Schedule unit price for each ton (TN) placed. Such price shall be full compensation for all equipment, materials and labor required to place asphalt concrete as shown on the plans and/or associated with site development in proximity to the pump station. The work shall include, but is not limited to: excavation, fine grading, preparation and compaction of subbase, placement and compaction of base material, compaction testing, prime coat, tack coat, asphaltic concrete in no case shall the thickness be less than 2", installation, curing and maintenance during the construction period; pavement marking and striping. Backfilling against the finished asphalt concrete pavement, fine grading and restoration of adjacent disturbed surfaces to tie the finished asphalt concrete pavement into the surrounding grades shall be considered incidental to this bid item.

11. Optional Base Course – Base Group 6 (Bid Item #11) - Reference - FDOT Section 285 (2023)

A. Description. Construct a base course composed of one of the optional materials shown on the typical cross-sections. 285-2

B. Materials. Meet the material requirements as specified in the Section covering the particular type of base to be constructed.

Graded Aggregate .....Section 204

Asphalt .....Section 234

Reclaimed Asphalt Pavement (RAP)*.....Section 283

Limerock .....Section 911

Shell Base.....Section 911

Shell-Rock.....Section 911

Cemented Coquina.....Section 911

Recycled Concrete Aggregate (RCA)** .....Section 911

C. Method of Measurement. The quantity to be paid for will be the plan quantity area in square yards, omitting any areas where under-thickness is in excess of the allowable tolerance as specified in 285-6. The pay area will be the surface area, determined as provided above, adjusted in accordance with the following formula:

D. Pay Area= Surface Area ($\frac{\text{Calculated Average Thickness per 285 -7}}{\text{Plan Thickness}}$)

The pay area shall not exceed 105% of the surface area. There will be no adjustment of the pay area on the basis of thickness for base courses constructed utilizing mixed-in-place operations. For Superpave asphalt base course, the quantity to be paid for will be the plan quantity area in square yards. The pay area

will be adjusted in accordance with 234-9. 285-9

E. Payment shall be full compensation for all work specified in this Section, including tack coat between base layers, prime coat, cover material for prime coat, bituminous material used in bituminous plant mix, and cement used in soil-cement. Where the Plans include a typical cross-section which requires the construction of an asphalt base only, price adjustments for bituminous material provided for in 9-2.1.2 will apply to that typical cross-section. For typical cross-sections which permit the use of asphalt or other materials for construction of an optional base, price adjustments for bituminous material provided for in 9-2.1.2 will not apply. Payment will be made per square yard

12. Type B Stabilization (LBR 70 - 12") (Bid Item #12) – Reference FDOT Section 160 (2023)

A. The work specified consists of the stabilizing of designated portions of the site to provide a firm and unyielding subgrade, having the required bearing value specified in the plans.

B. Method of Measurement. The quantity to be paid for under this Provision shall include all items and all work described in Section 160 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, dated 2010, and as shown on the construction plans. The quantity of Type 'B' stabilization to be paid for under this Provision shall be measured in square yards of satisfactorily completed and accepted stabilized subgrade constructed to limits, thickness, and specified LBR 40 as shown on the plans. Payment will be based upon plan quantity.

C. Payment shall be full compensation for the quantity of Type 'B' stabilization at the Contract unit price per square yard. The price and payment shall constitute full compensation for all work described herein and in Section 160 of the Florida Department of Transportation Standard Specifications, including the cost of furnishing and hauling any additional stabilizing material required, and all mixing, shaping, and compacting of the stabilized area.

13. and 14. Pipe Culverts (12"x18" and 36" RCP) (Bid Item #13 and Bid item #14)

A. The work specified consists of furnishing drainage pipe, 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, 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 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. 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. The Contractor shall comply with all 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 may be used instead of baled hay or straw.

2) Method of Measurement. The quantities to be paid for under this Provision shall be the length in linear feet of pipe culvert measured in place, completed and accepted. The measurement shall include the portion of pipe extending to the farthest point.

3) Payment shall be based on the quantities, shall be paid for at the Contract unit price per linear foot of pipe culvert, 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 described herein. Including excavation (in whatever material is encountered), dewatering, removal of unsuitable material, backfilling, and compacting around the culvert, furnishing and laying the pipe culverts, filter fabric wrap, and disposal of surplus materials.

15 and 16. Mitered End Sections (12”x18” and 36” MES) (Bid Item #15 and Bid Item #16)

A. The work specified consists of furnishing drainage pipe mitered end sections, conforming to these specifications and the particular sizes and dimensions as shown on the detailed project plans. This work shall include the installation of the mitered end sections at the locations called for, in conformity with the lines and grades given, and furnishing and construction of such joints as may be required to complete the work as indicated in the detailed project plans.

B. Payment shall be based on the quantities at the contract unit price each for mitered end section which price and payment shall be full compensation for all pipe, grates (when required), fasteners, reinforcing, connectors, anchors, concrete (Class I) sealants, jackets, coupling beads.

17. and 18. 6’ Chain Link Fence and Gate (Bid Item #17 and Bit item #18)

A. Method of Measurement. The quantities to be paid for under this Provision for the fence shall be the length in linear feet of fence installed and accepted by the City. The Gate and its entire system shall be paid per gate installed. All equipment, poles, rails, steel ties, fasteners, anchors, stiffeners, gate hinges, locking mechanisms, and removal of vegetation in proximity to the fence shall be considered incidental to this item.

B. Payment shall be made at the Bid Schedule unit price for the total linear feet of fence installed and for each gate installed that is accepted by the City.

19. Performance Turf Sod (Bahia)- PUMP SITE (Bid Item #19)

A. The work under this section shall be in accordance with the plans, except as modified herein. Watering and fertilizing will be considered incidental to this item. Any additional areas disturbed by the Contractor's negligence or

equipment shall be replaced at the Contractor's expense. Do not use sod which has been cut for more than seventy-two (72) hours. Sod placed on developed or maintained lots will be cut in to match existing sod, and will conform to the slope characteristic of the area prior to it being disturbed.

B. Argentine Bahia will be considered the "standard" sod species. When sodding in areas of maintained lawn disturbed by construction, the sod species shall be of the type existing. If the sod species is different than Argentine Bahia, payment will still be based on the unit price in the contract for Argentine Bahia. Sod shall be placed immediately behind the fill operation to maintain slope and prevent erosion. The Contractor will be responsible to repair any areas of erosion which occur in his work prior to acceptance by the City.

C. Maintenance - The Contractor shall, at his expense, maintain the sodded areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include the filling, leveling, watering, mowing, fertilizing and repairing any washed or eroded areas, as may be necessary. No special or separate allowance will be made for watering, mowing or fertilizing as required. The City, at any time, may require replanting of any areas in which the establishment of the sod does not appear to be developing satisfactorily, at no additional expense to the City.

D. Method of Measurement, shall be the area in square yards of Sodding, completed and accepted. No special or separate allowance will be made for watering, mowing or fertilizing. Such price for and payment for sodding shall be full compensation for all items and work described herein, including furnishing the appropriate species of sod, fertilizing, installing sod, and sufficient watering to maintain the sod in a healthy growing condition until acceptance by the City.

E. Payment shall be for all work incurred in complying with this section and shall be based on the unit prices per square yard. 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 described herein.

20. RIP-RAP RUBBLE (1.5” Dia x 13.5” Thick) (Bid Item #20.1 Pump Site and Bid item #20.2 Discharge Site)

A. All work under this section shall conform to the Provisions of the Contract Plans.

B. Method of measurement: The quantity of Rip-rap and Bedding Stone, as shown on the bid form, is approximate and is given only as a basis of calculation for award of the contract. The actual quantity may vary from the estimated amount. The quantity to be paid for under this Section shall be measured in tons, completed and accepted and shall include all items and all work described herein, and as specified in the Plans.

C. Payment shall be the quantity, as determined above, which shall include all work, materials, equipment, and labor costs specified under this Section shall be paid for at the contract unit price in tons.

21. Direct Bury 36” Ductile Iron Water Pipe (Bid Item #21)

A. Measurement for 36” Ductile Iron Water Pipe and Associated Appurtenances shall be based on the length of the pipe in linear feet actually located as measured along the centerline of the completed pipe, between the limits shown on the drawings.

B. Payment shall be made at the Bid Schedule unit price per linear foot for the 36” Ductile Iron Water Pipe, which price and payment shall be full compensation for installation in locations indicated on the construction drawings, all pipe fittings and restraints, clearing, grubbing, excavation (including rock, and other inorganic and organic unsuitable material), dewatering, pipe bedding, backfill and compaction, pressure testing, pipe locating tape, and markers, and all equipment and all other work necessary to complete the installation as specified.

22. 42” Ductile Iron Water Pipe – Direct Bury (Bid Item #22)

A. Measurement for 42” Ductile Iron Water Pipe and Associated Appurtenances shall be based on the length of the pipe in linear feet actually located as measured along the centerline of the completed pipe, between the limits shown on the drawings.

B. Payment shall be made at the Bid Schedule price per linear foot for the 42” Ductile Iron Water Pipe, which price and payment shall be full compensation for installation in locations indicated on the construction drawings, all pipe fittings and restraints, clearing, grubbing, excavation (including rock, and other inorganic and organic unsuitable material), dewatering, pipe bedding, backfill and compaction, pressure testing, pipe locating tape, striping, and markers, and all equipment and all other work necessary to complete the installation as specified.

23. 54” Steel Casing – Jack and Bore (Bid Item #23)

A. Measurement for 54” Steel Casing Jack and Bore and Associated Appurtenances shall be based on the length of the pipe in linear feet actually located as measured along the centerline of the completed pipe, between the limits shown on the drawings.

B. Payment shall be made at the Bid Schedule price per linear foot for the 54” Steel Casing Jack and Bore, which price and payment shall be full compensation for installation in locations indicated on the construction drawings, all pipe fittings and restraints, clearing, grubbing, excavation (including rock, and other inorganic and organic unsuitable material), dewatering, pipe bedding, backfill and compaction, pressure testing, pipe locating tape, striping, and markers, and all equipment and all other work necessary to complete the installation as specified.

24. MJ 153 Ductile Iron Compact Fitting (Bid Item #24)

A. Measurement for MJ 153 Ductile Iron Compact Fitting shall be based on the pounds of each Compact Fitting actually placed in the field and actually accepted.

B. Payment shall be made at the Bid Schedule unit price per each Compact Fitting for the size and type installed, which price and payment shall be full compensation for Compact Fitting installation in locations indicated on the Construction Drawings, furnishing, installing and testing the fittings, pipe locating tape, striping, and markers, complete with mechanical restraints, nut with extension if specified, tie rods, pipe bedding, backfill and compaction, and all equipment and all other work necessary to complete the installation as specified.

25. Discharge Assembly (Bid Item #25)

A. No measurement shall be made for this item

B. Payment for the Discharge Assembly shall be paid as Lump Sum and shall include the furnishing of all equipment, hauling of material, disposal of unused material, labor and incidentals necessary to complete the work.

C. Payment hall be made at the Bid Schedule unit price of the Discharge Assembly that is furnished, installed, and accepted including the all-other components necessary to furnish and install the Discharge Assembly as shown on the Drawings and specified herein.

26. Pipe Bedding Material (Bid Item #26)

A. Measurement for Pipe Bedding Material shall be based on confirmed tonnage of Pipe Bedding Material delivered and placed as shown on the approved construction plans.

B. Payment for Pipe Bedding Material shall be at the Bid Schedule Unit Price, including all work and materials necessary to furnish and install Pipe Bedding Material based on the project specifications, and all other incidentals necessary to complete the installation as specified.

27. 2” Automatic Air Release Valve – Complete Assembly, CCCU Detail (Bid Item #27)

A. Measurement for Air Release Valves and Associated Appurtenances shall be based on the quantity of each valve actually placed in the field and actually accepted.

B. Payment shall be made at the Bid Schedule unit price per each valve furnished, installed, and accepted including the precast concrete vault, curb stops, fittings, saddles, and all other components necessary to furnish and install the air release valves as shown on the Drawings and specified herein.

28. Marker Balls and Marker Tape (Bid Item #28)

A. Measurement for the Marker Balls and Marker Tape shall be based on each installed Marker Ball. Marker Tape shall be incidental to the unit price of direct bury pipe installation as shown on the drawings.

B. Payment for installation shall be made at the Bid Schedule unit price per each for Marker Ball installed, which price and payment shall be full compensation for installation in locations indicated on the construction drawings, along with preparation and submittal of as-built information, and all other incidentals necessary to complete the installation as specified.

29. Performance Turf Sod (Bahia)- US 41 Right-of-way (Bid Item #29)

A. The work under this section shall be in accordance with the plans, except as modified herein. Watering and fertilizing will be considered incidental to this item. Any additional areas disturbed by the Contractor's negligence or equipment shall be replaced at the Contractor's expense. Do not use sod which has been cut for more than seventy-two (72) hours. Sod placed on developed or maintained lots will be cut in to match existing sod, and will conform to the slope characteristic of the area prior to it being disturbed.

B. Argentine Bahia will be considered the "standard" sod species. When sodding in areas of maintained lawn disturbed by construction, the sod species shall be of the type existing. If the sod species is different than Argentine Bahia, payment will still be based on the unit price in the contract for Argentine Bahia. Sod shall be placed immediately behind the fill operation to maintain slope and prevent erosion. The Contractor will be responsible to repair any areas of erosion which occur in his work prior to acceptance by the City.

C. Maintenance - The Contractor shall, at his expense, maintain the sodded areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include the filling, leveling, watering, mowing, fertilizing and repairing any washed or eroded areas, as may be necessary. No special or separate allowance will be made for watering, mowing or fertilizing as required. The City, at any time, may require replanting of any areas in which the establishment of the sod does not appear to be developing satisfactorily, at no additional expense to the City.

D. Method of Measurement, shall be the area in square yards of Sodding, completed and accepted. No special or separate allowance will be made for watering, mowing or fertilizing. Such price for and payment for sodding shall be full compensation for all items and work described herein, including furnishing the appropriate species of sod, fertilizing, installing sod, and sufficient watering to maintain the sod in a healthy growing condition until acceptance by the City.

E. Payment shall be for all work incurred in complying with this section and shall be based on the unit prices per square yard. 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 described herein.

30. Surveying and As-Builts (Bid Item #30)

A. The Contractor shall provide field engineering, services, which includes, but is not limited to: establishing elevations, lines, and levels utilizing recognized engineering and surveying practices. The work shall include furnishing, placing and maintaining construction stakes necessary for the successful completion of the work.

B. All survey work shall be accomplished in accordance with Minimum Technical Standards for Land Surveyors Rule 5J-17 F.A.C. pursuant to Florida Statues 472.027 and special instructions.

C. It is emphasized that the Contractor shall be responsible for the engineering layout of the Work, and that the cost of performing such work shall be included in the bid prices for the various bid items or considered incidental to those items.

D. The Contractor shall verify locations of survey control and reference points prior to starting work, and promptly notify the City of any discrepancies discovered.

E. During the course of the rehabilitation, any property corners (i.e. iron rods, concrete monuments, PRMs and section corners) disturbed as a result of the Contractor's work shall, at the Contractor's expense, be reset by a Florida Professional Surveyor and Mapper licensed in the state of Florida. The Contractor shall make no changes without prior written notice to the City.

F. The CONTRACTOR shall obtain the services of a State of Florida licensed Professional Surveyor and Mapper (PSM) in good standing with the State to certify all project AS-BUILT DATA. The CONTRACTOR will submit to the PSM a copy of their project As-built Drawings for the PSM to use in developing the project AS-BUILT DATA. The AS-BUILT DATA shall be the result of field located survey work that is verified and accurately represented in electronic or digital format by the PSM using sound and accepted land surveying methods and procedures. The project AS-BUILT DATA shall result in a signed and sealed AS-BUILT Drawing by the PSM. The Contractor shall be responsible for transmitting the project AS-BUILT DATA and copies of the Record Drawings and the Contractor's Record Drawings to City of Cape Coral. The Contractor shall submit three (3) sets of Record Drawing's, signed and sealed by a Florida Professional Surveyor and Mapper licensed in the State of Florida, prior to Notice of Substantial Completion. In addition to the three (3) sets, an electronic copy of the Record Drawings must be provided to the Public Works Administrative Services Department. Acceptable media includes CD or DVD and must be provided in both DXF or DWG and PDF Format (Note: If Micro Station is used for the design, DGN, PDF and DXF Formats must be provided). As an alternate to providing the media an e-mail of both DXF and PDF (For Micro Station Users: also provide the DGN) formats will be acceptable however, the files must be less than 20 megs and can be e-mailed to jdaubenb@capecoral.gov. In the event the City does not approve the Record Drawings, the Contractor shall be

responsible to remedy any deviations.

G. At a minimum, the Record Drawings shall include the following information, recorded on City-provided construction drawings:

1) Discharge Structures – Locations, dimensions and elevations of all, including weirs, orifices, gates, pumps, and pipes.

2) System Grading – dimensions, elevations, contours, final grades or cross-sections to determine contributing drainage areas, flow directions and conveyance of runoff to the system discharge point(s).

3) Conveyance – dimensions, elevations, contours, final grades or cross-sections of systems utilized to divert offsite runoff around or through the new system (site).

4) Water levels – existing water elevation(s) and the date determined.

5) Benchmark(s) – location and description (minimum of one per major water control structure).

6) Roadway/Driveway – Information shall be recorded for beginning and end stations, and 50' stations. Elevations and distances shall be recorded for centerline for roadway, edge of pavement, edge of shoulder, top of swale, and flow line of swale as detailed on the plans.

7) Utilities – Record Drawings shall for ALL City of Cape Coral Utilities shall comply with the requirements set forth in City Specification's.

H. In compliance with the Southwest Florida Water Management District Permit(s) "Record Drawings and Information Checklist", the Contractor shall place a permanent benchmark within 50 feet of each control structure for each the pond sites identified in the plans.

I. The Contractor shall maintain a complete and accurate log of control and survey work as it progresses. A Record Drawing, based on field survey as-built data shall be prepared and signed and sealed by a Florida Professional Surveyor and Mapper, licensed in the state of Florida. The Record Drawing and a copy of the field notes signed and sealed by a Professional Land Surveyor shall be submitted with the Record Drawings. As a final deliverable the right of way will be monumented on the ground and the Record Drawings will reflect the monumentation either recovered or set by the Florida Professional Surveyor and Mapper responsible for the Drawings.

J. BASIS OF PAYMENT – ALL surveying required to layout the project and collect data for Record Drawings shall be incidental to the project or included in the bid price for the various bid items. The costs to produce Record Drawings shall include all labor, materials and equipment necessary to produce an approved product. NO

payment shall be made until the Record Drawing is completed and accepted by the City.

31. Mobilization/Demobilization (Bid Item #31.1 and Bid Item#31.2)

A. No measurement shall be made for this item.

B. Payment shall be made at the Bid Schedule lump sum price, which shall constitute full compensation for preparatory work and operations in mobilizing for the 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, for establishment of temporary facilities, cost of bonds, permits, required insurance and other preconstruction expenses necessary for the start of the work. **Contractor shall be limited to a maximum of five percent (5.0%) of the total price bid for mobilization.** The cost of mobilization shall be shown in the Schedule of Values. **Demobilization shall be shown in the Schedule Of Values as a maximum of twenty-five percent (25.0%) of the value for mobilization.**

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01041

PROJECT COORDINATION

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. The Contractor shall:

   A. Utilize City PMIS Software for distribution of all project information.

   B. Coordinate work of his own employees and subcontractors.

   C. Expedite his work to assure compliance with schedules.

   D. Comply with orders and instructions of Engineer.

   E. Provide 24 hour/7 days a week contact information for the project superintendent, who shall be no more than 30 minutes from the project site during the duration of the project (that is a 30-minute response time). Additionally, the project superintendent shall have the equipment/manpower available (with a 30-minute response time) to respond to all problems which may occur at the site from the start of work to approval of the work.

   F. Once work begins, the Contractor shall continually work on the project until it is complete and shall not de-mobilize from the site or stop work for excessive periods of time.

1.02 RELATED REQUIREMENTS

1. Section 01010: Summary of Work.

2. Section 01045: Cutting and patching.

3. Section 01152: Application for Payment.

4. Section 01200: Project Meetings.

5. Section 01310: Construction Schedules.

6. Section 01340: Shop Drawings, Product Data and Samples.

7. Section 01500: Construction Facilities and Temporary Controls.

8. Section 01700: Contract Closeout.

1.03 CONSTRUCTION ORGANIZATION AND START-UP

1. Engineer shall establish on-site lines of authority and communications:

   A. Schedule and conduct preconstruction meeting and progress meetings as specified in Section 01200.

   B. Establish procedures for:

      1) Submittals.

      2) Reports and records.

      3) Recommendations.

      4) Coordination of drawings.

      5) Schedules.

      6) Resolution of conflicts.

   C. Interpret Contract Documents:

      1) Transmit written interpretations to Contractor, and to other concerned parties.

   D. Assist in obtaining permits and approvals:

      1) Verify that contractor and subcontractors have obtained inspections for Work and for temporary facilities.

   E. Control the use of Site:

      1) Allocate space for Contractor's use for field offices, sheds, and work and storage areas.

   F. Review and Testing:

      1) Review work for general performance in accord with requirements of Contract Documents.

      2) Administer special testing and inspections of suspect Work.

      3) Reject Work which does not comply with requirements of Contract Documents.

1.04 CONTRACTOR'S DUTIES

1. Construction Schedules:

   A. Prepare a detailed schedule of basic operations prior to beginning work for the review and approval of the Engineer.

   B. Monitor schedules as work progresses:

      1) Identify potential variances between scheduled and probable completion dates for each phase.

      2) Recommend to Owner adjustments in schedule to meet required completion dates.

      3) Document changes in schedule; submit to Owner, Engineer and to involved subcontractors.

   C. Observe work of each subcontractor to monitor compliance with schedule.
      1) Verify that labor and equipment are adequate for the work and the schedule.

      2) Verify that product procurement schedules are adequate.

      3) Verify that product deliveries are adequate to maintain schedule.

      4) Report noncompliance to Engineer, with recommendation for changes.

2. Process Shop Drawings, Product Data and Samples:

   A. Prior to submittal to Engineer, review for compliance with Contract Documents:

      1) Field dimensions and clearance dimensions.

      2) Relation to available space.

      3) Effect of any changes on the work of any subcontractor.

3. Review Drawings prepared by subcontractors:

   A. Prior to submittal to Engineer, review for compliance with Contract Documents.

4. Prepare Coordination Drawings as required to resolve conflicts and to assure coordination of the work of, or affected by, mechanical and electrical trades, or by special equipment requirements.

   A. Submit to Engineer.

   B. Reproduce and distribute copies to concerned parties after Engineer review.

5. Maintain Reports and Records at Job Site, available to Engineer and Owner.

   A. Daily log of progress of work.

   B. Records:

      1) Contracts.

      2) Purchase orders.

      3) Materials and equipment records.

      4) Applicable handbooks, codes and standards.

6. Maintain file of record documents

1.05 CONTRACTOR'S CLOSE-OUT DUTIES

1. Mechanical and Electrical equipment start-up:

   A. Coordinate check-out of utilities, operational systems and equipment.

   B. Organize initial start-up and testing.

   C. Record dates of start of operation of systems and equipment.

   D. Submit to Owner written notice of beginning of warranty period for equipment put into service.

2. At completion of Work, conduct an inspection to assure that:

   A. Specified cleaning has been accomplished.

   B. Temporary facilities have been removed from site.

3. Substantial Completion:

   A. Conduct an inspection to develop a list of Work to be completed or corrected.

   B. Assist Engineer in inspection.

   C. Supervise correction and completion of work of subcontractors.

1.06 ENGINEER'S CLOSE-OUT DUTIES

1. Final Completion:

A. When Contractor determines that Work is finally complete, conduct an inspection to verify completion of Work.

2. Administration of Contract closeout:

A. Receive and review contractor's final submittals.

B. Transmit to Owner with recommendations for action.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01045

CUTTING AND PATCHING

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Contractor shall be responsible for all cutting, fitting and patching, including attendant excavation and backfill, required to complete the Work or to:

   A. Make its several parts fit together properly.

   B. Uncover portions of the Work to provide for installation of ill-time work.

   C. Remove and replace defective work.

   D. Remove and replace work not conforming to requirement of contract documents.

   E. Remove samples of installed work as specified for testing.

   F. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

1.02 RELATED REQUIREMENTS

1. Section 01010: Summary of Work.

2. Section 01630: Substitutions and Product Options.

3. Section 02200: Earthwork.

1.03 SUBMITTALS

1. Submit a written request to Engineer well in advance of executing and cutting or alteration which affects:

   A. Work of the Owner.

   B. Structural value or integrity of any element of the Project.

   C. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.

   D. Efficiency, operational life, maintenance or safety of operational elements.

   E. Visual qualities of sight-exposed elements.

2. Request shall include:

A. Identification of the Project.

B. Description of affected work.

C. The necessity for cutting, alteration or excavation.

D. Effect on work of Owner or on structural or weatherproof integrity of Project.

E. Description of proposed work:

1) Scope of cutting, patching alteration, or excavation.

2) Trades who will execute the work.

3) Products proposed to be used.

4) Extent of refinishing to be done.

F. Alternative to cutting and patching.

G. Cost proposal, when applicable.

3. Should conditions of Work or the schedule indicate a change of products from original installation, contractor shall submit request for substitution as specified in Section 01630 – Substitutions and Product Options.

4. Submit written notice to Engineer designating the date and the time the Work will be uncovered.

PART 2 – PRODUCTS

2.01 MATERIALS

1. Comply with specifications and standards for each specific product involved.

PART 3 – EXECUTION

3.01 INSPECTION

1. Inspect existing conditions of Project, including elements subject to damage or movement during cutting and patching.

2. After uncovering work, inspect conditions affecting installation of Products, or performance of work.

3. Report unsatisfactory or questionable conditions to Engineer in writing; do not proceed with work until Engineer has provided further instructions.

3.02 PREPARATION

1. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.

2. Provide devices and methods to protect other portions of Project from damage.

3. Provide protection from elements for that portion of the Project which may be exposed by cutting and patching work, and maintain excavations free from water.

3.03 PERFORMANCE

1. Execute cutting and demolition by methods which will provide proper surfaces to receive installation of repairs.

2. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

3. Execute fittings and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

4. Restore work which has been cut or removed; install new products to provide completed work in accord with requirement of Contract Documents.

5. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

6. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes;

   A. For continuous surfaces, refinish to nearest intersection.

   B. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01050

FIELD ENGINEERING AND SURVEYING

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Provide and pay for field engineering services required for Project.

   A. Survey work required in execution of Project.

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

2. Owner's Representative will identify existing control points indicated on the Drawings, as required.

1.02 RELATED REQUIREMENTS

1. General Conditions.

2. Section 01010: Summary of Work.

3. Section 01700: Contract Closeout.

1.03 QUALIFICATIONS OF SURVEYOR OR ENGINEER

1. Qualified engineer or land surveyor, registered in the State of Florida and acceptable to Owner.

1.04 SURVEY REFERENCE POINTS

1. Establish basic horizontal and vertical control points for the Project prior to starting work.

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

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

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

   C. Require Surveyor to replace project control points which may be lost or destroyed.

      1) Establish replacements based on original survey control.

1.05 PROJECT SURVEY REQUIREMENTS

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

   A. Site improvements

      1) Stakes for grading, fill and topsoil placement.

      2) Utility slopes and invert elevations.

   B. Batter boards for structures.

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

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

3. Locate and mark all known underground utilities prior to entrance of any equipment on the site. All such utilities shall be protected from heavy traffic. Establish and maintain barricades around all manholes, drains, and similar underground items. Immediately notify the Owner of any conflict between operations and any in ground item to remain.

1.06 RECORDS

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

2. At the end of the project, submit a certified site survey at 1-inch equals 30 feet scale on reproducible tracing sheets 24 inches by 36 inches. Survey shall include: all topographic features, slab and asphalt elevations at least every 100 feet, and top of all buried pipe and conduit at least every 50 feet, and at all changes in vertical or horizontal direction, locations of all valves, casings, air release valves, and all other components installed.

1.07 SUBMITTALS

1. Submit name and address of Registered Surveyor to Engineer.

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

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01065

PERMITS AND FEES

PART 1 - GENERAL

1. Permits by Contractor:

   A. The Contractor shall obtain **all** permits including licenses related to his work except as otherwise provided herein.

   B. The Contractor shall obtain a Right-Of-Way Usage Permit for all work performed within the public right of way. In addition, the Contractor must submit a maintenance of traffic (MOT) Plan when applying for the permit and prior to start of work.

   C. Contractor shall obtain an electrical permit for installation of electrical equipment.

   D. Contractor shall coordinate with the COUNTY ity Building Department to determine whether or not additional permits are required.

   E. Comply with all conditions specified in each of the permits and licenses.

   F. A copy of the permits obtained by the Owner will be furnished to the Contractor.

2. Permits by Owner:

   A. The following permits have been obtained or will be obtained by the Owner prior to construction:

      - **FDEP ENVIORMENTAL RESOURCE PERMIT, FDOT UTILITY PERMIT, SWFWMD WATER USE PERMIT, SFWMD WATER USE PERMIT**

END OF SECTION

SECTION 01066

NPDES REQUIREMENTS

PART 1 — GENERAL

1.01 THE REQUIREMENT

1. This Section describes the required documentation to be prepared and signed by the Contractor and City before conducting construction operations, in accordance with the terms and conditions of the National Pollutant Discharge Elimination System (NPDES) Permit, as stated in the Federal Register Vol. 64 No. 235, issued by the Environmental Protection Agency (EPA) on December 8, 1999 (FR68722), and at the State level, as required by the State of Florida's authority to administer the NPDES Stormwater Program.

2. The Contractor shall be responsible for implementation, maintenance, and inspection of storm water pollution prevention control measures including but not limited to, erosion and sediment controls, storm water management, waste collection and disposal, and other practices shown on the Construction Drawings as specified in Section 02269 – Temporary Erosion Control, or as required by the NPDES permit.

PART 2 — PRODUCTS (NOT USED)

PART 3 — EXECUTION

3.01 NOTICE OF INTENT

1. The Contractor (or its consultant) shall prepare plans in accordance with Section 02269 - Temporary Erosion Control.

2. The Contractor shall fill out, sign, and date the Contractor's Notice of Intent (NOI) DEP Form 62-621.300(4)(b). A copy of the NOI form may be obtained from the City. The signed copy of the Contractor's NOI shall be submitted to the City for review. Once reviewed, the City shall return the form to the Contractor. The Contractor shall submit the NOI form with all pertaining attachments and pay all the corresponding processing fees to FDEP, NPDES Stormwater Notices Center in Tallahassee, Florida, and return one signed copy with attachments to the City, and the Engineer, for record keeping. Submission of the NOI is required by the Contractor before starting construction at the site. The Contractor shall forward a copy of the FDEP NOI acknowledgment letter to the City, with a copy to the Engineer, upon receipt from FDEP.

3. The Contractor shall also submit to FDEP the corresponding Notice of Termination (NOT) DEP Form 61-621.300(6) when construction activities have ceased and stormwater discharges are no longer being performed due to construction. A copy of the NOT form may be obtained from the City. The Contractor shall provide one copy of the NOT to the City, with a copy to the Engineer, for record keeping. The Contractor shall forward a copy of the FDEP NOT acknowledgment letter to the City, with a copy to the Engineer, upon receipt from FDEP.

3.02 RETENTION OF RECORDS

1. The Contractor shall keep a copy of the Stormwater Pollution Prevention Plan at the field office or on the site from the beginning of construction to conclusion of the project.

2. Monthly and at project closeout, the Contractor shall submit to the City, with a copy to the Engineer, all maintenance and inspection forms and certifications. This information will be retained by the City. Maintenance and receipt of inspection forms by the City is a condition for approval of monthly progress payment requests.

3.03 REQUIRED NOTICES

1. Copies of NOIs submitted by the City and the Contractor shall be posted in a prominent, visible place at the construction site or at the Contractor's office.

2. Waste disposal procedures shall be posted at the construction site or at the Contractor's office, in a prominent, visible place.

3. Copies of signed certifications shall be kept at the construction site or at the Contractor's office.

END OF SECTION

SECTION 01067

PROTECTED SPECIES PERMITTING

PART 4 -- GENERAL

1.01 PROTECTED SPECIES

1. The Florida burrowing owl (*Athene cunicularia*) is listed as a Species of Special Concern (SSC) by the Florida Fish and Wildlife Conservation Commission (FWC) under Florida Administrative Code (F.A.C.), Rule 68A-27.005. Rule 68A-27.005 (2)(a), F.A.C. provides the burrowing owl with the following protective provisions: No person shall take (pursue, hunt, harm, harass, capture, molest, or kill), possess, transport or sell any SSC, including its nests or eggs, except as authorized by permit from the FWC Executive Director. Burrowing owls and their nests are also federally protected under the Migratory Bird Treaty Act (MBTA). Therefore, destruction of an active burrowing owl burrow would require a federal permit issued by the U.S. Fish and Wildlife Service (USFWS). The City of Cape Coral Planning Division works in conjunction with the FWC to manage the burrowing owl population; the City of Cape Coral does not approve or deny permits for the destruction of burrowing owl burrows. However, the City Building Official has the ability to implement a "stop work" order on inspections if copies of required state/federal permits are not provided to the City of Cape Coral.

   A. If a burrowing owl nest/burrow is present on or within 10-feet of a particular construction site, the Contractor shall notify Engineer in a timely manner to assess whether the burrow is active and if there is a way to construct the project while maintaining a minimum 10-feet radius protective buffer in all directions from the burrow/nest entrance. Within 2 business days of receiving notice by the Contractor, Engineer or the Project Biologist will assess the burrow status using an underground infrared camera. If a 10-feet radius protective buffer can be provided, construction may take place any time of year without need of a state or federal permit. Upon approval by Engineer, the Contractor shall clearly barricade off the 10-feet radius protective buffer using PVC and/or stakes with flagging and signs to indicate the presence of a State protected species. Silt fence cannot be used to construct the protective barricade, as it may prohibit the owl's ability to see potential predators. Construction of a minimum 10-feet protective buffer is required to help avoid accidental damage or destruction of a burrow/nest and associated violations.

   B. Throughout the duration of the project the Contractor shall immediately notify Engineer if any potential burrowing owl burrows/nests are observed within 10-feet of the limits of the project area or within any proposed staging areas that were not identified in the bid specifications or construction plans. It is the responsibility of the Contractor to ensure that all work activities are conducted in accordance with Rule 68A-27, F.A.C.

2. The gopher tortoise (*Gopherus polyphemus) is classified as a Threatened species under Rule 68A-27, F.A.C.; as such* it is illegal to take, attempt to take, possess, hunt, capture, transport, or sell gopher tortoises, or their eggs, except as authorized by the FWC. No work activities

are permitted within 25 feet of a gopher tortoise burrow. Permits from the FWC are required to relocate gopher tortoises. The City Building Official has the ability to implement a "stop work" order on inspections if copies of required state permits are not provided to the City of Cape Coral.

A. It is the Contractor's responsibility to inspect the project area and any proposed staging areas at a frequency needed to ensure that no work occurs within 25 feet of any tortoise burrow(s). If a potential gopher tortoise burrow is observed, the Contractor must immediately contact Engineer for guidance and not conduct any work within 25 feet of the burrow entrance. It is the responsibility of the Contractor to obtain a gopher tortoise relocation permit. It is the responsibility of the Contractor to ensure that all work activities are conducted in accordance with Rule 68A-27, F.A.C.

3. The bald eagle (*Haliaetus leucocephalus*) is protected under the Federal Bald and Golden Eagle Protection Act and the MBTA. The bald eagle is also afforded state protection under F.A.C., Rule 68A-16.002, which makes it illegal to disturb or take an eagle in Florida. In order to help avoid violations to state and federal law, FWC and USFWS released separate guidelines outlining methods to minimize disturbance to nesting bald eagles. The state Bald Eagle Management Plan and the federal National Bald Eagle Management Guidelines recommend avoiding various types of activities within 330-660 feet of an active or alternate eagle nest, unless a Bald Eagle Management Plan is prepared and a qualified eagle monitor is present during the proposed activity. According to USFWS, an active nest is a nest that is attended (built, maintained, or used) by a pair of bald eagles during a given breeding season, whether or not eggs are laid. An alternate eagle nest is a nest that serves as an alternative nesting site for a pair of bald eagles. Bald eagle nesting season occurs from October 1 through May 15 of each year. The City of Cape Coral Bald Eagle Protection Ordinance (Chapter 23, Article I) provides for an Eagle Nest Management Zone, which designates a protective buffer area with a radius of 1,100 feet around any active bald eagle nest trees within its jurisdiction. In addition, the City of Cape Coral may prohibit any development or construction from taking place within 350 feet of an active bald eagle nest.

A. It is the responsibility of the Contractor to immediately contact Engineer for guidance if a bald eagle nest is identified within 1,100-feet of the project area, including staging areas outside the City right-of-way. If a bald eagle nest is identified, the Contractor shall not conduct any work within 1,100 feet of the nest without prior approval from Engineer. It is the responsibility of the Contractor to ensure that all work activities located within 1,100 feet of a bald eagle nest are conducted in accordance with the City of Cape Coral Bald Eagle Protection Ordinance (Chapter 23, Article I) and the 2007 USFWS bald eagle monitoring guidelines. Any permits needed by the contractor must also be provided to City of Cape Coral. The City Building Official has the ability to implement a "stop work" order on inspections if copies of required state/federal permits are not provided to the City of Cape Coral.

1.02 The Contractor shall prepare and submit the following affidavit for the limits of the project area including any laydown areas, as part of Section 01505 – Mobilization:

1. City of Cape Coral Affidavits for identified locations of Burrowing Owl/Gopher Tortoise, and other endangered species.

1.03 The following table presents a reference list of State and Local organization and some of the permits they administer:

State Agency/Contact	Permit
Angela Williams Florida Fish and Wildlife Conservation Commission Species Conservation Planning Section 620 South Meridian Street, Mail Station 2A Tallahassee, Florida 32399-1600 Ph: (850) 921-5990, Fax (850) 488-1961	State Wildlife Permitting (Burrowing Owl)
Heather Rigney Florida Fish and Wildlife Conservation Commission P.O. Box 309 Terra Ceia, Florida 34250 Ph: (941) 721-2097	State Wildlife Permitting (Gopher Tortoise)
Michelle van Deventer Bald Eagle Plan Coordinator Florida Fish and Wildlife Conservation Commission Species Conservation and Planning Section Ph: (941) 894-6675, Cell (352) 260-8699 Michelle.Vandeventer@MyFWC.com	State Wildlife Permitting (Bald Eagle)
Ulgonda Kirkpatrick United States Fish and Wildlife Service Ph: (407) 412-5859 Ulgonda_Kirkpatrick@fws.gov	Federal Wildlife Permitting (Bald Eagle)
Victoria Foster United States Fish and Wildlife Service 1339 20th Street Vero Beach, FL 32960-3559 Ph: (772) 562-3909, Ext. 327 Fax 1: (772) 564-7392, Fax 2: (772) 562-4288	Federal Wildlife Permitting
Derek C.S. Burr, AICP Department of Community Development - Planning Division P.O. Box 150027 Cape Coral, Florida 33915 Ph: (239) 573-3169, Fax: (239) 574-0591	City of Cape Coral

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Abbreviation and acronyms used in Contract Documents to identify reference standards.

1.02 QUALITY ASSURANCE

1. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.

2. Publication Date: The publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

1.03 ABBREVIATIONS, NAMES, AND ADDRESSES OR ORGANIZATIONS

1. Obtain copies of referenced standards direct from publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
AABC	Associated Air Balance Council 1000 Vermont Avenue, N.W. Washington, DC 20005
AASHTO	American Association of State Highway & Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
ACI	American Concrete Institute Box 19150 Redford Station Detroit, MI 48219

ADC	Air Diffusion Council 435 North Michigan Avenue Chicago, IL 60611
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction 1221 Avenue of the Americas New York, NY 10020
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ARI	Air-Conditioning and Refrigeration Institute 1815 North Fort Myer Drive Arlington, VA 22209
ASHRAE	American Society of Heating, Refrigeration & Conditioning Engineers 345 East 47th Street New York, NY 10017
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASPA	American Sod Producers Association Association Building Ninth and Minnesota Hastings, NE 68901
ASTM	American Society of Testing & Materials 1916 Race Street Philadelphia, PA 19103

AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, CO 80235
AWI	Architectural Woodwork Institute 2310 South Walter Reed Drive Arlington, VA 22206
AWPA	American Wood-Preserver's Association 7735 Old Georgetown Road Bethesda, MD 20014
AWS	American Welding Society 2501 NW 7th Street Miami, FL 33125
CDA	Cooper Development Association 57th Floor, Chrysler Building 405 Lexington Avenue New York, NY 10017
CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 180 North LaSalle Street, Suite 2110 Chicago, IL 60601
MF	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
GA	Gypsum Association 1603 Orrington Avenue Evanston, IL 60201

MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue
MLSFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NEBB	National Environmental Balancing Bureau 8224 Old courthouse Road Vienna, VA 22180
NEMA	National Electrical Manufacturer's Association 2101 L Street, N.W. Washington, DC 20037
NFPA	National Fire Protection Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036
NTMA	National Terrazzo and Mosaic Association 3166 Des Plains Avenue Des Plains, IL 60018
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 20076
PCI	Prestressed Concrete Institute 20 North Wacker Drive Chicago, IL 60606
PS	Product Standard U.S. Department of Commerce Washington, DC 20203
RCSHSB	Red Cedar Shingle & Handsplit Shake Bureau 515 116th Avenue Bellevue, WA 98004

SDI	Steel Deck Institute Box 3812 St. Louis, MO 63122
SDI	Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107
SIGMA	Sealed Insulating Glass Manufacturers Association 111 East Wacker Drive Chicago, IL 60601
SJI	Steel Joist Institute 1703 Parham Road, Suite 204 Richmond, VA 23229
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 8224 Old Court House Road Vienna, VA 22180
TAS	Technical Aid Series Construction Specifications Institute 1150 Seventeenth Street, NW Washington, DC 20036
TCA	Tile Council of America, Inc. Box 326 Princeton, NJ 08540
UL	Underwriter's Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01152

APPLICATION FOR PAYMENT

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Submit Applications for Payment to Engineer in accordance with the schedule established by Conditions of the Contract and herein.

1.02 RELATED REQUIREMENTS

1. Agreement between Owner and Contractor.

2. Conditions of the Contract: Progress Payments, Retainage and Final Payment.

3. Section 01153: Change Order Procedures.

4. Section 01370: Schedule of Values.

5. Section 01700: Contract Closeout.

1.03 FORMAT AND DATA REQUIRED

1. Submit applications in the form required by Owner, in accordance with the example which will be provided by the Engineer, with itemized data typed on 8-1/2-inch x 11-inch white paper continuation sheets.

2. Provide itemized data on continuation sheet:

A. Format, schedules, line items and values: Those of the Schedule of Values accepted by Engineer.

1.04 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

1. Application Form:

A. Fill in required information, including that for Change Orders executed prior to date of submittal of application.

B. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.

C. Execute certification with signature of a responsible officer of Contract firm.

2. Continuation Sheets:

A. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.

B. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.

1) Round off values to nearest dollar, or as specified for Schedule of Values.

C. List each Change Order executed prior to date of submission at the end of the continuation sheets.

1) List by Change Order Number, and description, as for an original component item of work.

1.05 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

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

A. Project

B. Application number and date.

C. Detailed list of enclosures.

D. For stored products:

1) Item number and identification as shown on application.

2) Description of specific material.

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

1.06 PREPARATION OF APPLICATION FOR FINAL PAYMENT

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

2. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700-Contract Closeout.

1.07 SUBMITTAL PROCEDURE

1. Submit Applications for Payment to Engineer at the times stipulated.

2. Number: 3 copies of each Application.

3. When Engineer finds Application properly completed and correct, he will transmit certificate for payment to Owner, with copy to Contractor.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01153

CHANGE ORDER PROCEDURES

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Promptly implement change order procedures.

   A. Provide full written data required to evaluate changes.

   B. Maintain detailed records of work done on a time and material/force account basis.

   C. Provide full documentation to Engineer on request.

2. Designate in writing the member of Contractor's organization:

   A. Who is authorized to accept changes in the Work.

   B. Who is responsible for informing others in the Contractor's employ of the authorization of changes in the Work.

3. Owner will designate in writing the person who is authorized to execute change Orders.

1.02 RELATED REQUIREMENTS

1. Section 01152: Application for Payment.

2. Section 01310: Construction Schedules.

3. Section 01370: Schedule of Values.

4. Section 01630: Substitutions and Product Options.

5. Section 01700: Contract Closeout.

1.03 DEFINITIONS

1. Change Order: See General Conditions.

2. Construction Change Authorization: A written order to the Contractor, signed by Owner and Engineer, which amends the Contract Documents as described, and authorizes Contractor to proceed with a change which affects the Contract Sum or the Contract Time, for inclusion in a subsequent Change Order.

3. Field Order: A written order, instructions, or interpretations, signed by Engineer making minor changes in the Work not involving a change in Contract Sum or Contract Time.

1.04 PRELIMINARY PROCEDURES

1. Owner or Engineer may initiate changes by submitting a Proposal Request to Contractor. Request will include:

   A. Detailed description of the change, products, and location of the change in the Project.

   B. Supplementary or revised Drawings and Specifications.

   C. The projected time span for making the change, and a specific statement as to whether overtime work is, or is not, authorized.

   D. A specific period of time during which the requested price will be considered valid.

   E. Such request is for information only, and is not an instruction to execute the changes, nor to stop Work in progress.

2. Contractor may initiate changes by submitting a written notice to Engineer, containing:

   A. Description of the proposed changes.

   B. Statement of the reason for making the changes.

   C. Statement of the effect on the Contract Sum and the Contract Time.

   D. Statement of the effect on the work of separate contractors.

   E. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.05 CONSTRUCTION-CHANGE AUTHORIZATION

1. In lieu of Proposal Request, Engineer may issue a construction change authorization for Contractor to proceed with a change for subsequent inclusion in a Change Order.

2. Authorization will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change, and will designate the method of determining any change in the Contract Sum and any change in Contract Time.

3. Owner and Engineer will sign and date the Construction Change Authorization as authorization for the Contractor to proceed with the changes.

4. Contractor shall sign and date the Construction Change Authorization to indicate agreement with the terms therein.

1.06 DOCUMENTATION OF PROPOSALS AND CLAIMS

1. Support each quotation for lump-sum and/or unit price proposals, with sufficient substantiating data to allow Engineer to evaluate the quotation.

2. On request provide additional data to support time and cost computations:

   A. Labor required.

   B. Equipment required.

   C. Products required.

      1) Recommended sources of purchase and unit cost.

      2) Quantities required.

   D. Taxes, insurance and bonds.

   E. Credit for work deleted from Contract, similarly documented.

   F. Overhead and profit.

   G. Justification for any change in Contract Time.

3. Support each claim for additional costs, and for work done on a time-and-material / force account basis, with documentation as required for a lump-sum proposal, plus additional information:

   A. Name of Owner's authorized agent who ordered the work, and date of the order.

   B. Dates and times work was performed, and by whom.

   C. Time record, summary of hours worked, and hourly rates paid.

   D. Receipts and invoices for:

      1) Equipment used, listing dates and times of use.

      2) Products used, listing of quantities.

      3) Subcontractors.

4. Document requests for substitutions for Products as specified in Section 01630.

1.07 PREPARATION OF CHANGE ORDERS

1. Engineer will prepare each Change Order.

2. Owner's Form, per example provided by the Engineer.

3. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.

4. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contact Time.

1.08 LUMP-SUM/FIXED PRICE CHANGE ORDER

1. Content of Change Orders will be based on, either:

   A. Engineer's Proposal Request and Contractor's responsive Proposal as mutually agreed between Owner and Contractor.

   B. Contractor's Proposal for a change, as recommended by Engineer.

2. Owner and Engineer will sign and date the Change Order as authorization for the Contractor to proceed with the changes.

3. Contractor shall sign and date the Change Order to indicate agreement with the terms therein.

1.09 UNIT PRICE CHANGE ORDER

1. Content of Change Orders will be based on, either:

   A. Engineer's definition of the scope of the required changes.

   B. Contractor's Proposal for a change, as recommended by engineer.

   C. Survey of complete work.

2. The amounts of the unit prices to be:

   A. Those stated in the Agreement.

   B. Those mutually agreed upon between Owner and Contractor.

3. When quantities of each of the items affected by the Change Order can be determined prior to start of the work:

   A. Owner and Engineer will sign and date the Change Order as authorization for Contractor to proceed with the changes.

   B. Contractor shall sign and date the Change Order to indicate agreement with the terms herein.

4. When quantities of the items cannot be determined prior to start of the work:

A. Engineer or Owner will issue a construction change authorization directing Contractor to proceed with the change on the basis of unit prices, and will cite applicable unit prices.

B. At completion of the change, Engineer will determine the cost of such work based on the unit prices and quantities used.

1) Contractor shall submit documentation to establish the number of units of each item and any claims for a change in Contract Time.

C. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

D. Owner and Contractor will sign and date the Change Order to indicate their agreement with the terms therein.

1.10 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION CHANGE AUTHORIZATION

1. Engineer and Owner will issue a Construction Change Authorization directing Contractor to proceed with the changes.

2. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.

4. Engineer will determine the allowable cost of such work, as provided in General Conditions.

5. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

6. Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.

1.11 CORRELATION WITH CONTRACTOR'S SUBMITTALS

1. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work, and to record the adjusted Contract Sum.

2. Periodically revise the Construction Schedule to reflect each change in Contract Time.

A. Revise sub schedules to show changes for other items of work affected by the changes.

3. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work:

A. 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:

1) Prepare agenda for meetings.

2) Make physical arrangements for meetings.

3) Preside at meetings.

4) Take and distribute meeting minutes.

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

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

D. Copies of the minutes of each progress meeting shall be distributed, by the Contractor, to the attendants within five business days after the meeting.

2. Related Requirements Described Elsewhere:

A. Construction Progress Schedules: Section 01310.

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

C. Project Record Documents: Section 01720.

1.02 PRECONSTRUCTION MEETING

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

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

3. Attendance:

A. Owner's representative.

B. Engineer and his professional consultants.

C. Resident project representative.

D. Contractor and his superintendent.

E. Major subcontractors.

F. Representatives of major suppliers and manufacturers as appropriate.

G. Governmental representatives as appropriate.

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

4. The Engineer shall preside at the preconstruction meeting. The Contractor shall provide for keeping minutes and distribution of minutes to the Owner, Engineer and attendants. 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.

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

A. Distribution and discussion of:

1) List of major subcontractors and suppliers.

2) Projected schedules.

3) Schedule of Values.

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

C. Major equipment deliveries and priorities.

D. Project coordination: Designation and responsible personnel.

E. Procedures and processing of:

1) Field decisions.

2) Proposal requests.

3) Request for Information.

4) Submittals.

5) Change Orders.

6) Applications for Payment.

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

G. Adequacy of distribution of Contract Documents.

H. Procedures for maintaining Record Documents

I. Use of premises:

1) Office, work, and storage areas.

2) Owner's requirements.

3) Access and traffic control.

J. Construction facilities, controls, and construction aids.

K. Temporary utilities.

L. Safety and first aid procedures.

M. Check of required Bond and Insurance certifications.

N. Completion time for contract and liquidated damages.

O. Request for extension of Contract Time.

P. 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.

Q. Security procedures.

R. Procedures for making partial payments.

S. Guarantees on completed work.

T. Equipment to be used.

U. Project layout and staking of work.

V. Project inspection.

W. Labor requirements.

X. Laboratory testing of material requirements.

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

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

AA. Rights-of-way and easements.

AB. Housekeeping procedures.

AC. Liquidated damages.

AD. Posting of signs and installation of Project Sign.

AE. Pay request submittal dates.

AF. Equal opportunity requirements.

1.03 PROGRESS MEETINGS

1. The Engineer shall schedule regular periodic meetings. The progress meetings will be held a minimum of once per week and at other times as required by the progress of the Work. The first meeting shall be held within thirty (30) days after the preconstruction meeting or thirty (30) days or less after the date of Notice to Proceed, but within 1 week of the commencement of construction.

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

3. Location of the meetings: To be determined by Owner/Engineer.

4. Attendance:

A. Engineer and his professional Subconsultants as needed.

B. Resident Project Representative.

C. Contractor and his Superintendent.

E. Owner's representatives.

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

G. Others as appropriate to the agenda (suppliers, manufacturers, other subcontractors,

etc.).

5. The Contractor 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.

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

   A. Review approval of minutes of previous meeting.

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

   C. Field observations, problems, conflicts.

   D. Problems which impede construction schedule.

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

   F. Corrective measures and procedures to regain projected schedule.

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

   H. Progress schedule during succeeding work period.

   I. Coordination of schedules.

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

   K. Maintenance of quality standards.

   L. Pending changes and substitutions.

   M. Shop drawing problems.

   N. Review proposed changes for:

      1) Effect on Construction Schedule and on completion date.

      2). Effect on other contracts of the Project.

   O. Critical/long lead items.

   P. Other business.

7. 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:

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

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

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

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

8. 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 01300

CONTRACTOR SUBMITTALS

PART 1 -- GENERAL

1.01 GENERAL

1. Wherever submittals are required in these specifications or Drawings, all such submittals by the Contractor shall be submitted in accordance with Section 01340 – Shop Drawings, Working Drawings and Samples.

1.02 PRE-CONSTRUCTION CONFERENCE SUBMITTALS

1. Prior to the pre-construction conference referred to in Section 01200 – Project Meetings, the Contractor shall submit the following items to the City for review:

   A. A list of required permits and licenses the Contractor will obtain indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.

   B. An Overall Project Bar Chart in accordance with Section 01310 – Construction Progress Schedules.

   C. The Contractor's temporary field office layout (if provided) and temporary utilities plan (if required).

   D. Location of laydown areas with permission letter and/or agreement from the property owners (if required).

   E. A direct purchase materials plan, if requested, including a list of materials to be purchased and required delivery dates and lead times for ordering.

   F. NPDES Notice of Intent (NOI) documents (if required).

   G. Hurricane Preparedness Plan in accordance with Section 01540.

   H. Quality Control Plan in accordance with Section 01400.

   I. Safety Program and any required training program documentation (if required).

   J. Affidavit for surveys for Florida burrowing owl, Bald Eagle and Gopher Tortoise (if required).

1.03 CONTRACTOR SUBMITTALS

1. Submittals shall be furnished to the Engineer by the Contractor as Shop Drawings in accordance with Section 01340, Shop Drawings, Working Drawings and Samples.

1.04 MONTHLY UPDATES

1. The Contractor, when applicable, shall provide on a monthly basis the following in a shop drawing submittal format:

   A. Monthly Schedule Updates and Revisions required with each Pay Application.

   B. Monthly Updates of Approved Record Drawings.

   C. Monthly Injury and Illness Report (including Subcontractors).

   D. Monthly NPDES inspection forms and certifications.

   E. Minority Business Enterprise/Women Business Enterprise (MBE/WBE) Report.

   F. Lien Waivers Received.

   G. Equal Employment Opportunity (EEO) Report.

   H. Potable and Irrigation Water Meter Readings.

1.05 RECORD DRAWINGS AND FINAL SUBMITTALS

1. The Contractor will submit up to date "As-Built Record/Redline Documents" at Substantial Completion and Final Submittals at Final Completion, to include, but not limited to the electronic and hard copy as-built data, for review and concurrence by the Engineer and Owner as required in Specification Section 01700, Contract Closeout and in accordance with Specification Section 01720, Project Record Documents.

2. As a prerequisite for submittal of DEP Form 62-555.900(9), Certification of Construction Completion and Request for Clearance to Place Permitted PWS Components into Operation, the Contractor will submit up to date "Record/Redline Documents", to include, but not limited to the electronic and hard copy as-built data, for use by the Engineer and/or Owner as a part of the submission to the Department of Health (DOH) for the clearance to tie the subject improvements into the existing water supply system. Submission should be in accordance with Specification Section 01720, Project Record Documents.

3. Once the clearance has been received from the DOH to tie the subject improvements into the existing water supply system and the Work has been performed by the Contractor to tie-in/complete the connection to the existing water supply system the Contractor will submit, within seven (7) days, up to date "Record/Redline Documents", to include, but not limited to the electronic and hard copy as-built data of the connection point/improvements, for review and concurrence by the Engineer and Owner. This in no way relieves the Contractor of his/her responsibility for “Final As-Builts” at project completion. Submission should be in accordance with Specification Section 01720, Project Record Documents.

4. The Contractor will submit up to date "As-Built Record/Redline Documents" at Substantial Completion and Final Submittals at Final Completion, to include, but not limited to the electronic

and hard copy as-built data, for review and concurrence by the Engineer and Owner as required in Specification Section 01700, Contract Closeout and in accordance with Specification Section 01720, Project Record Documents.

1.06 OWNER'S MANUAL

1. The Contractor, when applicable, shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. Do not include bulk materials such as pipe, fittings or other non-operating items in the OWNER'S MANUAL. It shall be written so that it can be used and understood by the CITY's operation and maintenance staff. When applicable refer to Section 01730 – Operating and Maintenance Data.

1.07 RECORD DRAWINGS

1. The Contractor shall keep and maintain, at the job site, one record set of Drawings. All project conditions, locations, configurations, and any other changes or deviations which vary from the details represented on the original Drawings, including buried or concealed construction and utility features which are revealed during the course of construction shall be recorded on the Record Drawings. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Drawings. The Record Drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master Record Drawings are the Contractor's representation of as-built conditions, including all revisions made necessary by addenda, change orders, RFIs, or other changes, and shall be maintained up-to-date during the progress of the Work.

2. The Record Drawings, when applicable, shall show all utility mains (e.g. force main, irrigation, water transmission, etc.), indicating lines, grades, materials, stationing at change in elevations, fittings, roadway intersections and at increments not more than 1000 feet, paving options and materials, storm drain size and type, directional bore elevations (starting point, ending point, and intermediate elevations), and gravity sewer stub invert elevations. Elevations shall be given at all structure bottom(s), gravity sewer pipe invert(s), rim and grate elevations, bleed down holes, and high/low points of the roadway.

3. Inspectors shall review As-Built Drawings once a month to determine that Drawings are being adequately updated. Requests for Progress payments received without this review of the Record Drawings will be returned as non-complying.

4. In the case of those drawings which depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the Record Drawings shall be updated indicating any portions which are superseded by change order drawings or final shop drawings including appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.

5. The Contractor's Record Drawings shall be accessible to the City and Engineer at all times during the construction period.

6. Prior to and as a requirement of Substantial Completion of the Work, the Contractor shall prepare and deliver a complete set of the Contractor's certified Record Drawings marked in red to the City. This information, submitted by the Contractor, shall be incorporated by the Engineer into the Record Drawings, will be assumed to be correct, and the Contractor shall be responsible for the accuracy of such information, and for any errors or omissions which may appear on the Record Drawings as a result of the Contractor's information.

7. After the Engineer has incorporated the Contractor's record information, the City and Contractor shall review the incorporated information and confirm in writing that the Record Drawings include the information as provided. Final payment will not be made until the Contractor has confirmed in writing the Engineer's Record Drawings are accurate and the Record Drawings have been delivered to the City.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULES

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Promptly after award of the Contract, prepare and submit to Engineer estimated construction progress schedules for the Work, with subschedules of related activities which are essential to it progress.

2. Submit revised progress schedules to maintain proposed schedule within 30 days of work in place.

1.02 RELATED REQUIREMENTS

1. Section 01010: Summary of Work.

2. Section 01041: Project Coordination.

3. Section 01200: Project Meetings.

4. Section 01340: Shop Drawings, Product Data and Samples.

1.03 FORM OF SCHEDULES

1. Prepare schedules in the form of:

A. Gant Chart.

B. Network Analysis System.

C. Other Method Accepted by Engineer.

2. Format of Listings: The chronological order of the start of each item of work.

1.04 CONTENT OF SCHEDULES

1. Construction Progress Schedule:

A. Show the complete sequence of construction by activity.

B. Show the dates for the beginning, and completion of each major element of construction. Specifically, list:

1) Site work.

2) Site utilities.

3) Demolition.

4) Structural work.

5) Subcontractor work.

6) Equipment installations.

7) Operating and Maintenance Data.

8) Start-up.

2. Submittals, Schedule for Shop Drawings, Product Data and Samples. Show:

A. The dates for Contractor's submittals.

B. The dates reviewed submittals will be required from the Engineer.

C. Provide sub schedules to define critical portions of prime schedules.

1.05 PROGRESS REVISIONS

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

2. Show changes occurring since previous submission of schedule:

A. Major change in scope.

B. Activities modified since previous submission.

C. Revised projections of progress and completion.

D. Other identifiable changes.

3. Provide a narrative report as needed to define:

A. Problem areas, anticipated delays, and the impact on the schedule.

B. Corrective action recommended, and its effect.

C. The effect of changes on schedules of other prime contractors.

1.06 SUBMISSIONS

1. Submit initial schedules within 5 days after the effective date of notice to Proceed.

A. Engineer will review schedules and return review copy within 3 days after receipt.

B. If required, resubmit within 3 days after return of review copy.

2. With each application for payment, submit progress schedule if revised since last payment request.

1.07 DISTRIBUTION

1. Distribute copies of the reviewed schedules to:

A. Engineer – Two (2) copies

B. Job site file.

C. Subcontractors.

D. Other concerned parties.

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

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01340

SHOP DRAWINGS

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work:

A. The Contractor shall submit to the Engineer for review and approval, such Shop Drawings, Test Reports and Product Data on materials and equipment (hereinafter in this Section called 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 Contract Drawings.

B. Within seven (7) calendar days after the Notice to Proceed date, 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 Specifications. This procedure is required in order to expedite final review of Shop Drawings. The Contractor shall include Shop Drawing review time on the Project schedule (see section 01310).

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

1) Submittal-Description and Number assigned.

2) Date to Engineer.

3) Date returned to Contractor.

4) Status of Submittal (Approved as Noted, Rejected/Re-submit).

5) Date of Resubmittal and Return (as applicable).

6) Date material release for fabrication.

7) Projected date of fabrication.

8) Projected date of delivery to site.

9) Status of O&M manuals submittal.

10) Specification Section.

11) Drawings Sheet Number.

2. Related Requirements Described Elsewhere:

A. General Conditions.

B. Progress Schedules: Section 01310.

C. Material and Equipment: Section 01600.

D. Project Record Documents: Section 01720.

1.02 CONTRACTOR'S RESPONSIBILITY

1. The Contractor shall furnish the Engineer a schedule of Shop Drawings submittals fixing the respective dates for the submission of Shop Drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

2. 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.

3. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than fifteen (15) calendar days for checking and appropriate action from the time the Engineer receives them.

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

A. Date.

B. Project Title and Number.

C. Contractor's name and address.

D. The number of each Shop Drawings, Project Data, and Sample submitted.
Notification of Deviations from Contract Documents.

1) 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 Contract Drawings, Project Specifications and referenced specifications or codes.

2) The Contractor shall also list any deviations from Contract Drawings, Project Specifications and referenced specifications or codes and identify in "green" ink prominently on the drawings.

E. Submittal Log Number conforming to Specification Log Number.

5. The Contractor shall submit all shop drawings in electronic format. Shop drawings which require the signature and seal of a registered professional shall be submitted in hard copy format. In addition to electronic submittals, the contractor may be required to submit additional hard copies of all submittals upon request from the City of Cape Coral or the Engineer.

6. 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.

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

8. The Contractor shall not use Shop Drawings as means of proposing alternate items to demonstrate compliance to Contract requirements. **Alternate items must be submitted during the bidding process.**

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

10. 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

1. The Engineer's review of Shop Drawings, Data and Samples as submitted by the Contractor, will be to determine if the items(s) conform to the information in the Contract Documents and are 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.

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

A. As permitting any departure from the Contract requirements.

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

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

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

4. "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.

5. "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.

6. "Rejected" - Contractor shall resubmit Shop Drawing for review by Engineer.

7. 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.

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

9. 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.

10. 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:

A. Systems.

B. Processes.

C. As indicated in specific Specifications Sections.

11. 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.

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

1.04 SHOP DRAWINGS

1. Shop Drawings shall be complete and detailed and shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale drawings, and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature, and performance and test data, shall be considered only as supportive information. 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.

2. Manufacturer's catalog sheets, brochures, diagrams, illustrations and other standard descriptive data shall be clearly marked to identify pertinent materials, product or models. Delete information which is not applicable to the Work by striking or cross-hatching.

3. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

   A. Project Title and Number.

   B. Name of Project building or structure.

   C. Number and title of the Shop Drawing.

   D. Date of Shop Drawing or revision.

   E. Name of contractor and subcontractor submitting drawing.

   F. Supplier/manufacturer.

   G. Separate details when pertinent.

   H. Specification title and number.

   I. Specification section.

   J. Application Contract Drawing Number.

4. Data on materials and equipment include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, 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.

5. 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.

1.05 WORKING DRAWINGS

1. 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.

2. Working Drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida.

1.06 SAMPLES

1. 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 work until approved by the Engineer.

2. Samples shall be of sufficient size and quantity to clearly illustrate:

   A. Functional characteristics of the product, with integrally related parts and attachment devices.
   B. Full range of color, texture and pattern.

   C. minimum of two (2) samples of each item shall be submitted.

3. Each sample shall have a label indicating:

   A. Name of Project.

   B. Name of Contractor and Subcontractor.

   C. Material or Equipment Represented.

   D. Place of Origin.

   E. Name of Producer and Brand (if any).

   F. Location in Project.

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

5. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required in Paragraph 1.06B. above. He shall enclose a copy of this letter with the shipment and send a copy of this letter 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.

6. Approved samples not destroyed in testing shall be sent to the Engineer or stored at the site of the Work. Approved Samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the approved Samples. Samples which 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 REQUIREMENTS INCLUDED

A. As the first shop drawing submittal, submit to the Engineer a Schedule of Values allocated to the various portions of the Work, within ten days after award of contract.

B. Upon the request of the Engineer, support the values with data which will substantiate their correctness.

C. The Schedule of Values, unless objected to by the Engineer, shall be exclusively used as the basis for the Contractor's Applications for Payment.

1.02 RELATED REQUIREMENTS

A. Section 01152: Application for Payment.

B. Section 01600: Products, Material and Equipment and Substitutions.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type schedule on 8-1/2-inch x 11-inch white paper; Contractor's standard forms and automated printout will be considered for approval by Engineer upon Contractors request. Identify schedule with:

1. Title of Project, location and (City, County, Owner) Project Number.

2. Engineer and Engineer's Project Number.

3. Name and Address of Contractor.

4. Date of Submission.

B. Schedule shall list the installed value of the component parts of the Work, in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents of these Specifications as the format for listing component items.

1. Identify each line item with the number and title of the respective major section of the specifications.

D. For each major line-item list sub-values of:

1. Major products or operations under the item.

2. Contract conditions, such as: bonds, insurance premiums, job mobilization, construction facilities and temporary controls.

E. For the various portions of the Work:

1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.

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

a. The cost of the materials, delivered and unloaded, with taxes paid.

b. The total installed value.

F. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.04 SUBSCHEDULE OF UNIT MATERIAL VALUES

A. Submit a subschedule of unit costs and quantities for:

1. Products specified under a unit cost.

2. Products on which progress payments will be requested for stored products.

B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.

C. The unit quantity for bulk materials shall include an allowance for normal waste.

D. The unit values for the materials shall be broken down into:

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

2. Installation costs, including Contractor's overhead and profit.

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

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01380

COLOR DVD PRECONSTRUCTION RECORD

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work: Prior to commencing work, the Contractor shall have a continuous color DVD recording taken along the entire length of the Project and at all proposed construction sites within the Project area to serve as a record of pre-construction conditions.

1.02 QUALITY ASSURANCE

1. The Contractor shall engage the services of a professional electrographer. The color DVD shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business or preconstruction color DVD documentation.

2. The electrographer shall furnish to the Engineer a list of all equipment to be used for the DVD, i.e., manufacturer's name, model number, specifications and other pertinent information.

3. Additional information to be furnished by the electrographer are the names and addresses of two references that the electrographer has performed color DVD for, on projects of a similar nature, within the last 12 months.

4. Owner's Representative must be present during filming. Provide Owner forty-eight (48) hours' notice prior to start of filming.

5. No construction shall begin prior to review and approval of the DVD covering the construction area by the Owner and Engineer. The Engineer shall have the authority to reject all or any portion of a DVD not conforming to specifications and order that it be redone at no additional charge.

6. The Contractor shall reschedule unacceptable coverage within five (5) days after being notified. The Engineer shall designate those areas, if any, to be omitted from or added to the DVD coverage.

7. DVD shall not be made more than ninety (90) days prior to construction in any area. All DVDs and written records shall become property of Owner.

PART 2 – PRODUCTS

2.01 VIDEO MEDIA

1. The video portion of the recording shall produce bright, sharp, and clear pictures with accurate colors and shall be free from distortion, tearing, rolls, and any other form of picture imperfection. The audio portion of the recording shall produce the commentary of the camera operator with proper volume, clarity, and be free from distortion.

2. Video media shall be standard Digital Video Disc (DVD) format.

3. DVD shall be new. Reprocessed DVDs will not be acceptable.

PART 3 - EXECUTION

3.01 EQUIPMENT

1. All equipment, accessories, materials and labor to perform this service shall be furnished by the Contractor.

2. The total audio-video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity and be free from distortion and interruptions.

3. When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall not be more than ten (10) feet. In some instances, DVD coverage may be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking or-special conveyance provided by the Contractor.

4. The color video camera used in the recording system shall have a horizontal resolution of 350 lines at center, a luminance signal to noise ratio of 45 dB and a minimum illumination requirement of one (1) foot candle.

3.02 RECORDED INFORMATION - AUDIO

1. Each DVD shall begin with the current date, project name and municipality and be followed by the general location, i.e., viewing side and direction of progress. The audio track shall consist of an original live recording. The recording shall contain the narrative commentary of the electrographer, recorded simultaneously with his fixed elevation video record of the zone of influence of construction. The Owner and Engineer reserves the right to supplement the audio portion of the DVD as deemed necessary. A representative of the Owner or Engineer shall be selected to provide such narrative.

3.03 RECORDED INFORMATION - VIDEO

1. All video recordings shall, by electronic means, display on the screen the time of day, the month, day and year of the recording. This time and date information must be continuously and simultaneously generated with the actual recording.

2. Each DVD shall have a log of that DVD's contents. The log shall describe the various segments of coverage contained on that DVD in terms of the names of streets or easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering stationing numbers and the date.

3.04 LIGHTING

1. All video shall be done during time of good visibility. No recording shall be done during precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.

3.05 SPEED OF TRAVEL

1. The rate of speed in the general direction of travel of the vehicle used during recording shall not exceed 44 feet per minute. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to maintain a clear view of the object.

3.06 AREA OF COVERAGE

1. Video coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio coverage. Such coverage shall include, but not be limited to, existing driveways, sidewalks, curbs, pavements, ditches, mailboxes, landscaping, culverts, fences, signs, and headwalls within the area covered, all the way to the right-of-way line and include station points and addresses.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 -- GENERAL

1.01 DEFINITION

1. Specific quality control requirements for the Work are indicated throughout the Specifications and Drawings. The requirements of this Section are primarily related to performance of the Work beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements performed by the Contractor. Quality Assurance refers to similar inspection and testing performed by the City to verify the quality control process.

1.02 SAMPLING AND TESTING

1. Unless otherwise indicated, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered.

2. The City reserves the right to make independent investigations and tests, and failure of any portion of the Work to meet any of the requirements of the Drawings or Specification, shall be reasonable cause for the City to require the removal or correction and reconstruction of any such work in accordance with the Contract Agreement.

1.03 INSPECTION AND TESTING LABORATORY SERVICE

1. Inspection and testing laboratory service shall comply with the following:

A. City may appoint, employ, and pay for services of an Independent Testing Laboratory to perform inspection and testing or will perform inspection and testing itself as a part of the Quality Assurance testing program.

B. The City or the Independent Testing Laboratory may, at the City's direction, perform inspections, testing, and other services specified in individual specification sections, even though the specification section specifically requires that the Contractor perform the test. This does not relieve the Contractor from their testing requirements.

C. Reports from the testing laboratory will be provided to the City in support of NON-COMPLIANCE NOTICES (NCN).

2. All quality control data, test results and records will be submitted to the City as a part of the Project Closeout.

1.04 CONTRACTOR SUBMITTALS

1. Contractor shall submit a Quality Control Plan. Submittals shall be in accordance with Section

01300 – Contractor Submittals.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.01 Inspection: The Contractor shall inspect materials or equipment upon the arrival on the job site and immediately prior to installation and reject damaged and defective items.

3.02 Measurements: The Contractor shall verify measurements and dimensions of the Work as an integral step of starting each installation.

3.03 Manufacturer's Instructions: Where installations include manufactured products, the Contractor shall comply with manufacturer's applicable instructions and recommendations for installation to whatever extent these are more explicit or more stringent than applicable requirements indicated in Drawings and Specifications.

3.04 Specialist Support: QA/QC Testing provided by Contractor is as follows:

1. Miscellaneous QA/QC testing not specified below as ordered by City.

2. Backfill Compaction Tests: Density tests at random intervals above pipe shall confirm compaction to the specified density as indicated in the Drawings. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around tie-ins, fire hydrants, etc. as a minimum. A minimum of one potable water line compaction test will occur between the beginning of and ending of the line segment. The locations of the compaction tests within the trench shall be in conformance with the following schedule:

   A. One test at the spring line of the pipe unless bedding material is provided to the spring line

   B. One test at an elevation of one foot above the top of the pipe

   C. One test for each 2 feet of backfill placed from one foot above the top of the pipe to finished grade elevation

   D. At least two test locations are required for each trench crossing existing pavement.

   E. One test for each 100 SF of filled area every 2 feet of backfill placed at tie-ins, fire hydrants, etc. from two feet above the tie-in, fire hydrant, etc. to finished grade.

3. LBR / Moisture: Limerock Bearing Ratio and moisture/density relationship reports to be conducted on samples, as required for FDOT, to establish proctor and LBRs.

4. Roadway Subgrade: Density tests within stabilized subgrade to confirm 98% compaction achieved for 4-lane roads and for local roads (98% when proof rolled). Tests to occur at approximately 300ft intervals with a minimum of at least one test per road crossing.

5. Roadway Base: Density tests within the base to confirm 98% compaction achieved. Tests to occur at approximately 300ft intervals with a minimum of at least one test per road crossing.

6. Asphaltic Concrete: Asphalt extractions to confirm conformance to asphalt concrete mix design.

7. Asphaltic Concrete: Pavement thickness and density testing to be conducted as required to confirm specified paving thickness and compaction has been achieved.

8. Asphaltic Concrete: Contractor shall utilize an appropriately sized screed for all asphalt paving.

9. Concrete Testing: Concrete compressive strength testing to be conducted at random driveway and sidewalk concrete or other placed concrete, as required by City.

10. Non-conformities to be identified to Contractor by City in writing.

11. Unsuitable fill and over excavation limits

3.05 CONTRACTOR QA/QC TESTING

A. Contractor shall provide any QA/QC testing not outlined in Paragraph 3.4 above as necessary to complete the Work in accordance with the Contract Documents.

END OF SECTION

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work:

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

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

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

2. Related Requirements Described Elsewhere:

A. Conditions of the Contract.

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

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

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

1) Excavating, Backfilling, and Compaction.

2) Stabilized Sub-Base.

3) Limerock Base.

4) Asphaltic Concrete Pavement.

5) Cast-in-Place Concrete.

E. Compaction and Backfill:

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. Subgrade: Every 300 ft at each lift of compaction minimum.	Contractor
Bacteriological	As required by local and state agencies.	Contractor
Concrete	Slump test each delivery and compression test five cylinders every 50 C.Y. minimum.	Contractor
Asphaltic Concrete Pavement	Surface Course: Every 300 ft at least three tests per lift minimum. For LS 23: At least 1 per 100 SF. Subgrade: At least 1 per 100 SF Base: At least 1 per 100 SF	Contractor
Pressure	As per Specification Section 02666	Contractor

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

1.02 CONTRACTOR'S RESPONSIBILITIES

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

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

3. 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.

4. Furnish incidental labor and facilities:

   A. To provide access to Work to be tested.

   B. To facilitate inspections and tests.

5. Notify Owner a minimum of one (1) working day 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

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Furnish, install and maintain temporary utilities required for construction, remove on completion of Work.

1.02 RELATED REQUIREMENTS

1. Section 01010: Summary of Work.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

1. Comply with National Electric Code.

2. Comply with Federal, State and local codes and regulations and with utility company requirements.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

1. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

1. Arrange with utility company, provide service required for power and lighting, and pay all costs for service and for power use.

2. Install circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction-type power cords.

3. Provide adequate artificial lighting for all areas of work when natural light is not adequate for work, and for areas accessible to the public.

2.03 TEMPORARY HEAT AND VENTILATION

1. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the

installation of materials, and to protect materials and finishes from damage due to temperature or humidity.

2. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.

3. Portable heaters shall be standard approved units complete with controls.

4. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

2.04 TEMPORARY WATER

1. Owner will provide reuse water for construction purposes for use by the Contractor at no expense. Contractor shall obtain a backflow preventer and meter from the City prior to use.

2. Make conservative use of water. Any negligence or wastefulness will be reason for waiving the provisions for free water.

3. All connections to hydrants to be made by Owner's personnel.

4. Water utilization for concrete plaster and mortar shall meet the respective requirements and standards set forth for water utilized in these construction materials.

5. The Owner will make water available at designated hydrants on the Owner's water system for use by the Contractor.

2.05 TEMPORARY SANITARY FACILITIES

1. Provide sanitary facilities in compliance with laws and regulations.

2. Service, clean and maintain facilities and enclosures.

2.06 TEMPORARY ACCESS ROAD AND PARKING (NOT USED)

2.07 TEMPORARY CONTROLS

1. Noise Control: See Section 00700 – General Conditions

2. Dust Control:

   A. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.

3. Debris Control:

   A. Maintain all areas under Contractor's control free of extraneous debris.

B. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, or along access roads and haul routes.

1) Provide acceptable containers for deposit of debris.

2) Prohibit overloading of trucks to prevent spillages on access and haul routes.

3) Provide periodic inspection of traffic areas to enforce requirements.

C. Schedule periodic collection and disposal of debris.

1) Provide additional collections and disposals of debris whenever the periodic schedule is inadequate to prevent accumulation.

4. Pollution Control:

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

1) Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.

C. Take special measure to prevent harmful substances from entering public waters.

1) Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants.

1) Prevent toxic concentrations of chemicals.

2) Prevent harmful dispersal of pollutants into the atmosphere.

PART 3 – EXECUTION

3.01 GENERAL

1. Comply with applicable requirements specified in Division 15 – Mechanical, and in Division 16 – Electrical.

2. Maintain and operate systems to assure continuous service.

3. Modify and extend systems as work progress requires.

3.02 REMOVAL

1. Completely remove temporary materials and equipment when their use is no longer required.

2. Clean and repair damage caused by temporary installations or use of temporary facilities.

3. Restore permanent facilities used for temporary services to specified condition.

   A. Prior to final inspection, remove temporary lamps and install new lamps.

END OF SECTION

SECTION 01505

MOBILIZATION

PART 1 -- GENERAL

1.01 GENERAL

1. Mobilization shall include the obtaining of all permits; moving onto the site of all necessary equipment; furnishing and erecting temporary buildings and other construction facilities; and implementing security requirements; all as required for the proper performance and completion of the Work. Mobilization shall include the following principal items:

   A. Mobilize to the site of all Contractor's equipment, personnel, supplies, and incidentals required for first month's operations.

   B. Project sign in accordance with Section 01580, if required.

   C. On-site sanitary facilities, safety equipment, and first aid supplies.

   D. Arrange for Work and storage yard in accordance with Section 01550.

   E. Mobilize full-time superintendent to the job site.

   F. Detailed approved schedule in accordance with Section 01310.

   G. Required submittals which allow the Contractor to commence Work.

   H. All required permits, insurance, bonds and licenses to commence Work.

   I. Post all OSHA, MSDS, SRF and NPDES required notices.

   J. Submittal of the affidavit of findings of the survey of burrowing owl, bald eagle and gopher tortoise nests and a plan for meeting the requirements if the nests are present.

   K. All Direct Purchase Order (DPO) requisitions, if required.

   L. Safety Plan.

   M. Submittal of all pre-construction videos per specification Section 01380.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

1. The Contractor shall be responsible for providing all temporary utilities for temporary facilities required for the completion of the Work.

2. The types of utility services that may be required for general temporary use at the project site and/or the field office include the following:

   A. Water service (potable for certain uses)

   B. Sanitary sewer

   C. Electric power service

   D. Telephone service

1.02 JOB CONDITIONS

1. Scheduled Uses: The Contractor shall, in conjunction with establishment of job progress schedule, establish a schedule for implementation and termination of service for each temporary facility; and when acceptable to City to change over from use of temporary utility service to permanent service.

PART 2 - PRODUCTS

2.01 MATERIALS

1. The Contractor shall provide either new or used materials and equipment, which are in substantially undamaged condition and without significant deterioration and which are recognized in the construction industry, by compliance with appropriate standards, as being suitable for intended use in each case. Where the utility company provides a portion of temporary utility, the Contractor shall provide remainder with matching and compatible materials and equipment and comply with recommendations of utility company.

PART 3 - EXECUTION

3.01 INSTALLATION OF TEMPORARY UTILITY SERVICES

1. General: The Contractor shall engage the utility company to install temporary service to the project; locate services where they will not interfere with project construction work, including

2. installation of permanent utility services; maintain temporary services as installed for required period of use; and relocate, modify or extend as necessary from time to time during that period as required to accommodate project construction work.

3. Approval of Electrical Connections: All temporary connections for electricity shall be subject to approval of the power company representative and the City, and shall be removed at the Contractor's expense prior to final acceptance of the Work.

4. Construction Wiring: All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Subpart K of the OSHA Regulations for Construction, and local electric codes.

3.02 INSTALLATION OF POWER DISTRIBUTION SYSTEM

1. Power: The Contractor shall provide all necessary power required for its operations under the Contract Agreement, and shall provide and maintain all temporary power lines required to perform the Work in a safe and satisfactory manner.

2. Temporary Power Distribution: The Contractor shall provide a weatherproof, grounded, temporary power distribution system sufficient to accommodate performance of entire Work of project, including, but not necessarily limited to, temporary electrical for heating and air conditioning (HVAC) where required, operation of test equipment and test operation of building equipment and systems which cannot be delayed until permanent power connections are operable, temporary operation of other temporary facilities, including permanent equipment and systems which must be placed in operation prior to use of permanent power connections (pumps, HVAC equipment, elevators, and similar equipment), and power for temporary operation of existing facilities (if any) at the site during change-over to new permanent power system. Provide circuits of adequate size and proper power characteristics for each use; run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible damage from construction operations, and result in least interference with performance of the Work; provide rigid steel conduit or equivalent raceways for wiring which must be exposed on grade, floors, decks, or other recognized exposures to damage or abuse.

3. Contractor shall pay for all lift stations power charges until substantial completion of the lift station.

3.03 INSTALLATION OF LIGHTING

1. Construction Lighting: All Work conducted at night or under conditions of deficient daylight shall be suitably lighted to ensure proper Work and to afford adequate facilities for inspection and safe working conditions.

2. Temporary Lighting: The Contractor shall provide a general, weatherproof, grounded temporary lighting system in every area of construction Work, as soon as overhead

floor/roof deck structure has been installed; and provide sufficient illumination for safe Work and traffic conditions; and run circuit wiring generally overhead, and rise vertically in locations where it will be least

3. exposed to possible damage from construction operations on grade, floors, decks, or other recognized areas of possible damage or abuse.

3.04 INSTALLATION OF SANITARY FACILITIES

1. Toilet Facilities: Fixed or portable chemical toilets shall be provided wherever required for the use of Contractor's employees. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Regulations for Construction. Provide separate field office facilities in conformance with Section 01590.

2. Sanitary and Other Organic Wastes: The Contractor shall establish regular collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of offsite in accordance with all laws and regulations pertaining thereto.

3.05 INSTALLATION OF COMMUNICATIONS

1. Telephone Services: The Contractor shall provide and maintain at all times during the progress of the Work not less than one telephone (cellular) in good working order, at or near the site of the Work.

3.06 OPERATIONS AND TERMINATIONS

1. Inspections: Prior to placing temporary utility services into use, the Contractor shall inspect and test each service and arrange for governing authorities' required inspection and tests, and obtain required certifications and permits for use thereof.

2. Protection: The Contractor shall maintain distinct markers for underground lines and protect from damage during excavating operations.

3. Termination and Removal: When need for a temporary utility service or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, and not later than time of substantial completion, the Contractor shall promptly remove temporary installation. The Contractor shall complete and restore areas which may have been delayed or affected by installation and use of temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces.

3.07 POTABLE AND IRRIGATION WATER FOR USE DURING CONSTRUCTION

1. Contractor shall meter all potable water used during the construction process including but not limited to filling, testing, flushing, etc. of main lines, positive service test, and

any other construction activities as listed below. Meter reading shall be read by the City monthly, no later than the Friday following the designated end of the month's pay period. Potable water shall only be used for filling, testing or flushing of potable water lines. All costs of water and meter rental (billed by the City) shall be in accordance with Section 01025.

A. Contractors may obtain non-potable irrigation water from the City of Cape Coral irrigation water system hydrants. The Owner will identify the location of hydrants to be used after award of contract. The volume of water will be metered but there will be no cost to the contractor. A $1,000.00 deposit will be required for each 2-inch metered irrigation water connection requested. Deposits are refundable if metering assemblies are returned in good condition. Contractor shall submit pictures of the meter's monthly reading to the City Utilities Collection/Distribution Division. The irrigation water may be used for all construction uses related to the Project, except for filling of potable water mains. The irrigation water may be used for dust control, testing wastewater and irrigation mains, etc. at no additional cost to the Contractor.

B. Extracting water directly from canals or other surface water will not be permitted.

END OF SECTION

SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 GENERAL

1. The Contractor shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than the original condition prior to such damage or temporary relocation, all in accordance with the Drawings and Specifications.

1.02 EXISTING FACILITIES/PRIVATE PROPERTY

1. The Contractor shall not perform work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, nor shall the Contractor enter any private property until authorization has been obtained from the appropriate party by the Contractor and approved by the City.
2. After authority has been obtained, the Contractor shall give said party due notice of its intention to begin work, if required by said party, and shall remove, shore, support, or otherwise protect or replace such pipeline, transmission line, ditch, fence, or any other structure, etc.

1.03 RESTORATION OF PAVEMENT

1. General: All paved areas cut or damaged during construction shall be restored in accordance with the Drawings and Specifications. Pavements that are subject to partial removal shall be neatly saw cut in straight lines and shall be swept clean as needed.
2. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, the Contractor shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.
3. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw cut back and trim the edge of pavement so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.
4. Pavement Markings: All striping and reflective markers shall be replaced in kind if damaged or removed.

1.04 EXISTING UTILITIES AND IMPROVEMENTS

1. General: The Contractor shall protect underground Utilities and other improvements that may be impaired during construction operations, regardless of whether or not the Utilities are indicated on the Drawings. The Contractor shall take all possible precautions for the

protection of unforeseen Utility lines to provide for uninterrupted service and to provide such special protection as may be necessary. Contractor shall not operate existing valves without prior approval from the City.

2. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 days nor more than 7 days prior to excavation so that a representative of said owners or agencies can be present during such work if they so desire. The Contractor shall also notify Sunshine at 1-800-432-4770 at least 48 hours, but no more than 14 days, prior to such excavation. When the Contractor performs excavations within 100' of signalized intersections, the Contractor shall make prior arrangements with a local Lee County approved signalization contractor to provide any necessary repair of damages to return signalization to working order at the intersection within 24 hours of the damage.

3. Field Location of Existing Utilities: Except where the Drawings indicate Utilities have been field- located during design, the Contractor shall be responsible for exploratory excavations as the Contractor deems necessary to determine the exact locations and depths of utilities which are part of or may interfere with the Work. All such exploratory excavations shall be performed as soon as practical after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor's progress. When such exploratory excavations show the utility location as shown on the Drawings to be inaccurate, the Contractor shall adjust the installation as directed by the City to protect, avoid, or relocate the existing utilities. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the existing utility.

4. Utilities to be Moved or Relocated: In case it shall be necessary to move the property of any public utility or franchise holder, the Contractor shall notify the City to determine any necessary remedial action required. When utility lines that are to be moved are encountered within the area of operations, the Contractor shall notify the City a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

5. Utilities to be Removed: Where the proper completion of the Work requires the temporary or permanent removal of an existing utility or other improvement, such removal shall be coordinated with the City and performed by the Contractor.

6. Contractor shall notify City of any identified asbestos cement (AC) pipe. If AC pipe must be removed, this can only be performed under the direct supervision of the City's selected OSHA certified competent person. If AC pipe is encountered, that must be removed and cannot be avoided, all work must cease immediately and the City's representative shall be contacted. The Contractor will be advised on how to proceed in compliance with OSHA and NESHAP's requirements. Under no circumstances should AC pipe be crushed, ground or cut using abrasive.

7. City's Right of Access: The right is reserved to the City and to the owners of public utilities

and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work.

8. Underground Utilities Indicated: Existing utility lines that are indicated or the locations of which are made known to the Contractor prior to excavation and that are to be retained, and all utility lines that are constructed as part of the Work shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced by the Contractor, unless otherwise repaired by the owner of the damaged utility. If the owner of the damaged facility performs its own repairs, the Contractor shall reimburse the utility owner for the costs of repair caused by its action.

9. Underground Utilities Not Indicated: In the event that the Contractor damages existing utility lines that are not indicated on Contract Drawings, identified through Florida Call Sunshine or Florida One-Call, or the locations of which are not made known to the Contractor prior to excavation, a verbal report of such damage shall be made immediately to the City and the owner of the facility and a written report thereof shall be made promptly thereafter.

10. Approval of Repairs: All repairs to a damaged Utility or improvement are subject to inspection and approval by an authorized representative of the Utility or improvement owner before being concealed by backfill or other work.

11. Maintaining in Service: Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and telecommunication wires and cables, etc., encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements are made with the City and owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The Contractor shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

12. Verification by Trial Excavation for Hot-Tap Connections: Where hot-tap connections are indicated as connections to the existing pressure piping utility systems, the Contractor is required to conduct a trial excavation to verify the existing piping prior to the procurement of the tapping sleeve and gate valve.

1.05 NON-EXOTIC TREES OR SHRUBS WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

1. General: The Contractor shall remove all trees, shrubs and vegetation in the ROW, inlets, services, etc. that directly impede construction activities. At least 60 days prior to excavation of utility lines the Contractor shall notify the affected property owner of their option to relocate vegetation outside of the right-of-way via certified mail or other verifiable proof. When trees, shrubs or vegetation must be removed, the Contractor shall exercise all necessary precautions so as not to damage or destroy any adjacent trees or shrubs designated to remain, including those lying within street rights- of-way and project limits not in conflict with installation of utilities proposed under this Work, and shall not

trim or remove any trees designated to remain unless such trees have been approved for trimming or removal by the jurisdictional agency, or the City. Existing trees and shrubs designated to remain that are damaged during construction shall be trimmed. Tree trimming shall be accomplished in accordance with the following paragraphs.

2. Replacement: The Contractor shall immediately notify the City if any tree designated to remain is damaged by the Contractor's operations. If, in the opinion of the City, the damage is such that replacement is necessary, the Contractor shall replace the tree at the Contractor's expense. The tree shall be of a like size and variety as the tree damaged. If the damaged tree is located on private property, the Contractor shall replace the tree at the Contractor's expense with a tree of like size and variety as damaged, or the Contractor shall pay to the owner of said tree a compensatory payment acceptable to the tree owner. Planting of replacement trees and shrubs shall be in accordance with the recommendations of the nursery furnishing the plants. The Contractor shall water and maintain such replacement trees and shrubs as specified under Section 02920 – Restoration. Trees in the medians of divided roads that must be removed for construction shall be replaced at the Contractor's expense.

3. Trimming: Symmetry of the tree shall be preserved. Stubs, splits, and torn branches shall be removed. Clean cuts shall be made close to the trunk or large branch.

1.06 LAWN AREAS

1. Lawn or landscaped areas damaged during construction shall be repaired to match the pre- construction condition as per Section 02920- Restoration.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

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

PART 3 - EXECUTION (NOT USED)

3.01 GENERAL

1. Install facilities of a neat and reasonably uniform appearance, structurally adequate for the required purposes.

2. Maintain barriers during entire construction period.

3. Relocate barriers as required by the progress of construction.

3.02 FENCES

1. Provide and maintain fences necessary to assure security of the site during construction to keep unauthorized people and animals from the site when construction is not in progress.

2. Gates shall have locks; and keys shall be furnished to the Owner.
3. Provide additional security measures as deemed necessary and approved by the Engineer.

3.03 TREE AND PLANT PROTECTION

1. Preserve and protect existing trees and plants at site which are designated to remain, and those adjacent to site.

2. Consult with the Engineer, and remove agreed-on roots and branches which interfere with construction.

   A. Employ qualified tree surgeon to remove branches and treat cuts.

3. Provide temporary barriers to a height of six feet, around each, or around each group, of trees and plants.

4. Protect root zones of trees and plants:

   A. Do not allow vehicular traffic or parking.

   B. Do not store materials or products.

   C. Prevent dumping of refuse or chemically injurious materials or liquids.

   D. Prevent puddling or continuous running water.

5. Carefully supervise excavating, grading and filling, and other construction operations, to prevent damage.

6. Replace, or suitably repair, trees and plants designated to remain which are damaged or destroyed due to construction operations.

3.04 REMOVAL

1. Completely remove barricades, when construction has progressed to the point that they are no longer needed and when approved by Engineer.

END OF SECTION

SECTION 01540

HURRICANE PREPAREDNESS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor is responsible for having plans for protection of the WORK site during hurricanes, and shall prepare and submit a Hurricane Preparedness Plan prior to any construction activity and mobilization.

2. The Hurricane Preparedness Plan shall be submitted to the City at the Preconstruction Meeting for approval and shall include the following:

   A. Items and equipment that must be removed from the WORK site.

   B. Methods and materials that will be utilized to secure the materials and WORK site.

   C. Methods and materials that will be utilized to protect uncompleted WORK items.

   D. Plan for maximizing traffic lanes for evacuation.

   E. Items that must commence at the time of hurricane watch in order to be completed prior to evacuation.

3. When the National Weather Service issues a Hurricane Watch for Lee, Charlotte, or Collier County, the Contractor shall immediately implement the Hurricane Preparedness Plan.

4. The cost of preparing and implementing the Hurricane Preparedness Plan shall be the responsibility of the Contractor. Hurricane watch and warning will be grounds for contract time extensions.

5. When the National Weather Service issues a Hurricane Warning for Lee, Charlotte, or Collier County, the Contractor shall immediately take down and securely store all project signs. Signs shall be restored to the site prior to commencing construction activities.

6. The Contractor shall notify the City upon activation of the hurricane preparedness plan, when preparations are complete, when the job site is secure, and when the job site is shut down.

1.02 CONTRACTOR SUBMITTALS

1. Submittals of the Hurricane Preparedness Plan shall be in accordance with Section 01300 Contractor Submittals.

PART 2 –- PRODUCTS (NOT USED)

PART 3 –- EXECUTION (NOT USED)

END OF SECTION

SECTION 01550

SITE ACCESS AND STORAGE

PART 1 -- GENERAL

1.01 HIGHWAY LIMITATIONS

1. The Contractor shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the Contractor's responsibility to construct and maintain any haul roads required for its construction operations and repair any damage to public and private roads caused by the Contractor's construction operations.

1.02 TEMPORARY CROSSINGS

1. General: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, hospitals and any other public facilities. Safe and adequate public transportation stops and pedestrian crossings on major roadways shall be maintained as determined by City. The Contractor shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except, when necessary, construction precludes such access for reasonable periods of time.

2. Temporary Bridges: Wherever necessary, the Contractor shall provide suitable temporary bridges or steel plates over unfilled excavations. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the Contractor shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

3. Street Use: Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the Work hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No roadway shall be closed to the public using type III barricades and signage without first obtaining permission of the City. Permission must be obtained two (2) weeks prior to closure. Where excavation is being performed in 4-lane roads or highways, one lane in each direction shall be kept open to traffic at all times except in extreme cases when approved by the City. Toe boards shall be provided to retain excavated material if required by the City or the agency having jurisdiction over the street or highway. Operating fire hydrants on or adjacent to the Work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the Contractor to assure the use of sidewalks (unless posted with Sidewalk Closed signage) and the proper functioning of all

gutters, storm drain inlets, and other drainage facilities.

4. Traffic Control: Traffic control shall be provided by Contractor as specified in Section 01570 – Maintenance of Traffic.

5. Temporary Street Closure: If closure of any street is required during construction, the Contractor shall submit such requests in writing to the City. When the closure of a 4-lane road is allowed by the City, a request must be submitted at least (4) weeks in advance of the required closure in order to coordinate with the City and any other jurisdictional agency. The traffic control plan indicating detours and emergency access to cul-de-sacs shall accompany any request. The Contractor shall provide placards reading "Road Closed Local Traffic Only" during the closure of any street.

6. Temporary Mailbox Cluster(s): The Contractor shall provide temporary mailbox clusters where the permanent mailboxes are not accessible for delivery due to construction.

1.03 TEMPORARY SOIL TRACKING PROTECTION MEASURES

1. General: The Contractor shall provide temporary soil tracking protection measures at the entrance to central storage areas that affect paved roads. The temporary protection measures shall be in accordance with the 'Florida Erosion and Sediment Control Inspectors Manual.' Proposed details for the temporary construction entrance are shown in the contract drawings.

2. Temporary Soil Tracking Protection Measures shall be constructed with FDOT No. 1 Coarse aggregate (1.5 - 3.5 in. stone) as indicated in FDOT Standard Specifications for Road and Bridge Construction. The thickness of the aggregate layer shall be a minimum of 6 inches and shall cover the full width of the vehicular ingress/egress area. The entrance shall be a minimum of 50 feet and accommodate a turning radius for large trucks. The temporary Soil Tracking Protection Measures shall follow the contour of the natural terrain. Slopes shall not exceed 10 percent. The road shall be stabilized with 2-inch stone to reduce erosion and degradation of the temporary roadbed.

3. The area for the temporary Soil Tracking Protection Measures shall be cleared of all vegetation, roots and other unsuitable material. A geotextile shall be laid directly underneath the gravel layer.

4. Soil Tracking Protection Measures shall be maintained in a condition which prevents tracks or flow of mud into the public right of way. The Contractor shall be responsible for the maintenance of Soil Tracking Protection Measures during the construction period.

1.04 CONTRACTOR'S WORK AND STORAGE AREAS

1. The Contractor shall make its own arrangements for all temporary storage, shop, or field office areas necessary for the proper execution of the Work and shall obtain prior written permission from any owner whose property is used for such purposes.

2. The Contractor's temporary areas shall be kept in a clean and orderly fashion at all times. The areas will be sloped to drain off all storm runoff. The entrance to the storage areas shall be constructed in accordance with the drawings with a drainage pipe to protect the swale and an entrance driveway of 6 inches of crushed stone road base laid on suitable geotextile (filter fabric). Sediment control traps shall be positioned so as to ensure that downstream catch basins and drains are protected from runoff containing silt from the temporary areas. A sedimentation trap can be constructed by either excavating below grade or building an embankment across a swale and an open-channel spillway provided. Silt fence shall be provided around all central storage areas, limerock and central soil stockpiles.

3. Storage of materials and equipment on corners, intersections, or turn lanes shall not obstruct line of sight in intersection and shall be at least 6 feet off of the edge of pavement. All central storage sites shall be posted with "No Trespassing" signs every 100 feet around the site.

4. The Contractor shall construct and use a separate storage area for hazardous materials used in constructing the Work and shall obtain written permission from any owner whose property is used for storage or shop areas.

   A. For the purpose of this paragraph, hazardous materials to be stored in the separate area are defined as all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.

   B. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.

   C. The Contractor shall develop and provide to the City a plan for storing and disposing of the materials above.

   D. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials. Such authorities include the Florida Department of Environmental Protection.

   E. All hazardous materials that are delivered in containers shall be stored in the original containers until use. Hazardous materials that are delivered in bulk shall be stored in containers that meet the requirements of authorities having jurisdiction.

5. The Contractor shall maintain the storage area while it is in use and restore it to its original condition at the completion of the Project. Restoration shall include removal of temporary culverts and driveways and establishing grass by seeding or sodding disturbed construction and storage areas. All areas must be completely restored and have an established stand of grass in accordance with Section 02920 - Restoration. Downstream sediment traps shall

be removed once the restoration is complete and the grass has stabilized the area from significant erosion.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

END OF SECTION

SECTION 01570

MAINTENANCE OF TRAFFIC

PART 1 - GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall be responsible for the maintenance of traffic within the limits of the project for the duration of the construction and temporary suspensions of the Work in accordance with the requirements of the Contract Documents. The term" Maintenance of Traffic" (MOT) includes all of such facilities, devices, and operations required for the safety and convenience of the public as well as for minimizing public nuisance.

2. Provide, operate and maintain equipment, services and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow around the construction area.

3. Remove temporary equipment and facilities when no longer required, restore grounds to original (based on Contractor provided preconstruction video/photos), or to specified conditions.

4. All maintenance of traffic shall be in accordance with Florida Department of Transportation standards, latest edition.

1.02 RELATED REQUIREMENTS

1. Section 01041: Project Coordination.

2. Section 01500: Construction Facilities and Temporary Controls.

3. Section 01530: Barriers.

1.03 CONTRACTOR SUBMITTALS

1. General: Submittals shall be furnished in accordance with Section 01300 - Contractor Submittals.

2. Traffic Control Plans for 2-lane roads shall be submitted to the Construction Manager a minimum of two weeks prior to the scheduled commencement of the work. Traffic Control Plans for 2-lane roads shall be typical plan submittals. Traffic Control Plans for 4-lane roads shall be submitted to the City a minimum of 4 weeks prior to the scheduled commencement of the Work. Traffic Control Plans for 4-lane roads shall be dimensioned pictorial plans of the positioning of the proposed signage, pavement markings, and delineators, etc. All Traffic Control Plans shall be prepared in.

3. accordance with FDOT and FHWA's Manual on Uniform Traffic Control Devices (MUTCD).

4. MOT message boards will be required on Maintenance of Traffic plans pertaining to 4-lane roads. The message board wording is to be submitted by the Contractor for approval by the City, and is required to be in place at each end of the MOT section two weeks prior to the start of construction on the 4-lane road. The Contractor shall maintain the message boards for a period not less than 4 weeks after construction commencement on the 4-lane road. The City reserves the right to modify the locations of the message boards to suit the overall MOT phasing works with adjoining contract areas.

1.04 TRAFFIC SIGNALS AND SIGNS

1. Provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under Contractor's control, or affected by Contractor's operations.

2. Provide traffic control and directional signs, mounted on barricades or standard posts:

   A. At each change of direction of a roadway and at each crossroad.

   B. At detours.

   C. At parking areas.

1.05 FLAGMEN

1. Provide qualified and suitably equipped flagmen when construction operations encroach on traffic lanes, as required for regulation of traffic.

1.06 FLARES AND LIGHTS

1. Provide flares and lights during period of low visibility:

   A. To clearly delineate traffic lanes and to guide traffic.

   B. For use by flagmen in directing traffic.

2. Provide illumination of critical traffic and parking areas.

1.07 CONSTRUCTION PARKING CONTROL

1. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's Operations, or construction operations.

2. Monitor parking of construction personnel's private vehicles.

   A. Maintain free vehicular access to and through parking areas

B. Prohibit parking on or adjacent to access roads, or in non-designated areas.

1.08 HAUL ROUTES

1. Consult with governing authorities, establish public thoroughfares which will be used as haul routes and site access.

2. Confine construction traffic to designated haul routes.

3. Provide traffic control at critical areas of haul routes to expedite traffic flow, to minimize interference with normal public traffic.

PART 2 - PRODUCTS

1. Barricades, flashers, lights, and “Danger”, “Caution”, “Road Closed – Local Traffic Only”, etc. signs shall meet the requirements of the Florida Department of Transportation and the MUTCD and shall be inspected and maintained in working condition, weighed down with sandbags or by other suitable means.

PART 3 – EXECUTION

3.01 GENERAL

1. The Contractor shall implement the Traffic Control Plan. At the end of the Contract, the Contractor shall remove temporary equipment and facilities when no longer required, and restore grounds to original or improved conditions.

2. All Work specified in this section shall conform to the current edition of the MUTCD, the Florida Department of Transportation Roadway and Traffic Design Standards (600 Series), and the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 2000 edition (Green Book).

3. The Contractor is responsible for communicating with the Traffic Control company on any matters concerning deficiencies with the traffic control plan at any time, day or night. The Contractor shall be in possession of the barricade company’s 24-hour number. The barricade company’s representative shall be certified by the American Traffic Safety Services Association or the International Municipal Signal Association.

4. All existing drainage must be maintained to prevent flooding of roadways and adjoining property. Where temporary construction causes flooding of the right-of-way, the Contractor shall provide temporary facilities to connect to the permanent drainage system.

5. Curb inlets shall have temporary traffic-bearing traversable grates placed on top where applicable until the curb and gutter is constructed.

6. Temporary pipe shall be used under driveways to convey drainage where necessary.

7. Access to private residences and commercial businesses shall be maintained at all times during construction. The Contractor shall coordinate with the City on any temporary access closings prior to beginning Work in the area.

8. The Contractor shall supply signage to identify entrances for affected businesses.

3.02 TRAFFIC CONTROL PLAN

1. Generic traffic control plans are acceptable for all construction work affecting 2-lane local roads for the Contract. These generic plans shall be submitted for the approval by the City. Traffic Control Plans affecting 4-lane roads shall be site specific and shall include the detailed requirements. 4-lane traffic control plans requiring reduction to 2-lane opposing traffic or that will remain in place for more than 10 hours in one 24-hour period will be prepared by the Contractor's Traffic Engineer. A pre-design meeting will be held to review the Contractor's preliminary submittal.

2. The Traffic Control Plan shall be reproducible, dimensioned, pictorial plans of the area of the proposed MOT showing all signs, devices, tapers, and buffer zones listing the proper distances and lengths per the Manual of Uniform Traffic Control Devices and Florida Department of Transportation (Roadway and Traffic Design Standards Index Series 600).
3. The Traffic Control Plan must include a brief description of the Work being done, along with the start and completion dates, Work hours, night activity, etc. It also must include a 24-hour

4. emergency telephone number of the supervisor responsible for the maintenance of the Traffic Control Plan.

5. The Traffic Control Plan shall cover the major construction operations for this project. The Contractor shall be responsible for the proper execution of the traffic control during related minor construction operations.

6. Locations for advance warning and other construction signs as depicted on the Traffic Control Plans shall be approximate considering the existing field conditions.

7. For the protection of traffic in public or private streets and ways, the Contractor shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, flag persons and other safety devices in accordance with the requirements of the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations," published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1) and the appropriate indexes (600-660) of the FDOT Roadway and Traffic Design Standards.

   A. The Contractor shall take all necessary precautions for the protection of the Work and the safety of the public. Barricades and obstructions shall be illuminated at night, and all lights shall be kept lit from sunset until sunrise. Cones are not acceptable for night time use. The Contractor shall station guards or flag persons and shall conform to such special safety regulations relating to traffic control as

may be required by the public authorities within their respective jurisdictions. Signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction. Lights shall be inspected and maintained at least once per week to ensure proper operation.

B. The City shall be allowed access to observe these traffic control plans in use. The City may make changes to the MOT as field conditions warrant.

C. The Contractor shall remove traffic control devices when no longer needed, repair all damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.

8. The traffic control plan shall include any pedestrian crossing or walkway issues.

9. Arrows on the Traffic Control Plans denote direction of traffic only and do not reflect pavement markings unless otherwise noted.

3.03 MAINTENANCE OF TRAFFIC

1. The Contractor shall take all necessary precautions to prevent injury to public.

2. All manholes, valve boxes, or other similar structures shall each be adequately barricaded and lighted if they pose a danger to the public or are within 6 feet of the edge of pavement. Cones shall not be used.

3. Excavated material and construction materials shall not be stockpiled in such manner as to unnecessarily hinder or confuse traffic adjacent to work. Materials shall be stored at least 6 feet beyond the edge of pavement and at least 10 feet from the radius of any intersection or as necessary to maintain proper site distances.

4. Toe boards shall be provided to retain excavated material if required by the City or by the agency having jurisdiction over the street or highway.

5. Maintain all lanes that are being used for the maintenance of traffic, including those on detours and temporary facilities, under all weather conditions. Keep the lanes reasonably free of dust, and, when necessary to accomplish this, sprinkle them with water, or apply some other dust palliative. Grade roads as necessary to provide a smooth, pot hole-free driving surface.

6. The alteration of existing traffic patterns to create a Work zone shall not commence until all labor and materials are available for the construction in that area.

7. The Contractor shall repair all potholes in new and existing asphalt created from the construction process as soon as practical and shall maintain a supply of asphalt cold mix

on the project site to expedite those repairs.

8. If during construction any manhole or valve box cover protrudes higher than one inch above the pavement, the contractor shall place an asphalt wedge around the cover. If any obstructions extend more than one inch above the roadway, they shall be protected with at least one Type II lighted barricade.

9. Contractor shall restore roadways to a minimum of 20’ wide clear travel lanes within 24 hours of backfilling at the end of a work-day.

10. Throughout the project limits where sidewalks currently exist, pedestrian and wheelchair travel- ways shall be maintained on the project at all times. The travel-way shall be a minimum of 4 feet in width, smooth, but not slick with waterproof surface, and shall be ramped as necessary for continuity.

11. The Contractor shall maintain safe vehicular access to all adjacent property at all times.

12. Traffic disruptions which are not shown by the Traffic Control Plan, but which are necessary to construct the project, shall be submitted in writing to the City for approval two weeks prior to commencement of Work. Submitted material shall include sketches, calculations and other data required by the City.

13. During and after completion of construction, the Contractor shall provide all necessary temporary pavement markings (i.e. lane lines, arrows, crosswalks, stop bars, etc.) until permanent markings are installed.

14. Conflicting existing pavement markings shall be removed. Removal of existing pavement marking shall be accomplished by milling, grinding, sand or hydro–blasting, or by any other method approved by the City. Use of black paint to cover existing pavement markings shall be prohibited. Any conflicting existing pavement markings that have been removed shall be replaced upon completion of the project.

15. Contractor shall remove or cover any existing or proposed signs that conflict with the Traffic Control Plans. When the conflict no longer exists, the Contractor shall restore the signs to their original condition. Unnecessary construction signs and markers that are no longer applicable are to be covered or removed at the end of each workday.

16. The Contractor shall repair and maintain roads and shoulders, including four-lane roads used for two-way traffic during the installation of the Work, throughout the duration of the Contract. Repairs shall be made to any low or rutted-out shoulders and restored to the condition at which it was at the beginning of the Work. Road shoulders shall be maintained within 2” from the top of pavement, throughout the duration of the Contract and shall provide adequate drivability.

3.04 DETOURS

1. The Contractor shall notify the City at least 2 weeks in advance for a 2-lane road closure so that all notifications of such closings can be completed at least 48 hours in advance. The

Contractor shall notify the City at least 4 weeks in advance for a planned 4-lane road closure. To the greatest extent possible, no more than one (1) lane of roadway shall be closed to vehicles and pedestrians. With any such closings adequate provision shall be made for the safe expeditious movement of vehicles and pedestrians.

2. Traffic may only be detoured upon approval of the City. The Contractor shall construct and maintain detour facilities wherever it becomes necessary to divert traffic from an existing roadway. While traffic is detoured, the Contractor shall expedite construction operations. When detours are allowed, they will be strictly controlled by the City. Detours of 4-lane traffic onto residential 2-lane roadways will not be allowed unless approved by the City.

3. The Contractor shall be responsible for notifying Police, Fire and Ambulance Departments and Lee County School Board whenever roads are impassable. Contractor shall confirm schedule with the City at least 48 hours before road closure and immediately upon the reopening of the road.

4. Temporary travel lanes shall be no less than 10 feet in width, except as allowed or directed by the City.

3.05 ACCESS REQUIREMENTS

1. The CONTRACTOR shall provide necessary facilities for access to residences, businesses, etc., along the project. Access to residence will be provided to the property line by the end of the work-day. Additional access requirements shall be provided as specified in Section 01550 – Site Access and Storage and Section 02920 - Restoration.

3.06 MAINTENANCE, REMOVAL, AND REINSTALLATION OF EXISTING TRAFFIC SIGNS

1. The City will be given a 48-hour advance notice for any removal or relocation of any stop sign. The removal or relocation of stop signs will be the responsibility of the Contractor. A portable stop sign may only be used in case of an emergency and shall be mounted at a height of 7 feet to the bottom of the sign.

2. The maintenance and/or removal and reinstallation of any existing traffic control sign, or street name sign, (hereinafter termed traffic control devices) within the area of the project will be the responsibility of the Contractor.

3. The Contractor shall conduct all operations such that they will in no way obstruct or interfere with the operation of any existing traffic control device.

4. The Contractor will be held responsible for any existing traffic control devices which are damaged or removed without approval of the City, and will be charged for their replacement. This includes, but is not limited to, traffic signal loop, detector loops embedded in the street, signal conduits, cable, synchronization cables, and pull boxes at signalized intersections.

5. The Contractor will be held liable for any damage from any accident resulting from the removal, relocation or failure of any existing traffic control devices by construction operations.

6. The Contractor shall coordinate with the appropriate jurisdictions.

7. The Contractor shall be responsible to construct, relocate, and maintain all traffic control signs, pavement markings, barriers, barricades and other devices to cover and or remove signs as needed, and to do all Work necessary to maintain a safe Work zone. The Contractor shall respond within 2 hours of notification by the City or his representative to correct any missing or deficient traffic control devices.

8. Barricades and obstructions shall be illuminated at night and all lights shall be left on from sunset until sunrise. Signs, signals and barricades shall conform to the requirements of Subpart G. Part 1926 of the OSHA Safety and Health Standards for Construction, FDOT and MUTCD.

9. Existing permanent pavement markings shall be maintained by the Contractor. Any temporary pavement markings required to reroute traffic during construction operations will be the responsibility of the Contractor.

END OF SECTION

SECTION 01580

PROJECT SIGN

PART 1 – GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide one project identification sign, complete, in accordance with the Drawings and Specifications.

1.02 SUBMITTAL

1. The Contractor shall submit a shop drawing of the Project Sign in accordance with Section 01300 for approval.

PART 2 – PRODUCTS

2.01 SIGN CONSTRUCTION

1. The sign shall be constructed of a minimum 3/4-inch Medium Density Overlay (MDO) plywood with 4-inch by 4-inch supports and 2-inch by 4-inch cross bracing. The sign shall be bolted to the support allowing for easy removal during the Hurricane Preparedness Plan.

2. An experienced professional sign maker shall fabricate sign.

2.02 COLORS

1. Sign colors and lettering are shown in the Contract Drawings.

2.03 SIGN CONTENT

1. Sign content and size shall be as indicated on the Drawings. The relationships of letter size and logo size shall be as indicated on the Drawings.

PART 3 – EXECUTION

3.01 SIGN LOCATION

1. The project sign shall be located at the site in the PUE at such a location so as to be highly visible and not obstruct pedestrian or vehicular traffic. The City will determine sign location.

2. The sign shall be set 4 feet above the ground, measured from grade to the lower edge of the plywood sheet.

3.02 REMOVAL

1. The Contractor shall remove the project sign upon receipt of the Notice of Completion or when directed by the City.

END OF SECTION

SECTION 01590

FIELD OFFICES

PART 1 - GENERAL

1.01 CONTRACTOR'S FIELD OFFICE

1. Contractor may, at their own expense, establish and maintain a field office on this project. The Contractor shall have one (1) complete, up-to-date set of As-Built Drawings, Specifications, and Contract Documents (including all Addenda, Change Orders, RFIs, Directives, etc. and SRF requirements) in this office at all times, available for reference at any time. The office shall be provided with telephone service, toilet facilities, light, air conditioning, and heat; the cost of which shall be borne by the Contractor. Notices, instructions, orders, directions, or other communications from the Engineer, left at this office, shall be considered as received by the Contractor.

2. Construction trailers shall be limited to 200 square feet for single family residential areas per code. Field offices located in other areas may be combined for both Contractor and Resident Representative's use. A single-family residence or commercial property may be used to facilitate field office space if such said residence/commercial property complies with current code and regulations for said use. Refer to additional requirements outlined in the Cape Coral Land Use and Development Regulations.

PART 2 –- PRODUCTS (NOT USED)

PART 3 –- EXECUTION (NOT USED)

END OF SECTION

SECTION 01600

PRODUCTS, MATERIALS, EQUIPMENT AND SUBSTITUTIONS

PART 1 – GENERAL

1.01 DEFINITIONS

1. The word "Products," as used herein, is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for the project or taken from Contractor's existing stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

2. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

1.02 QUALITY ASSURANCE

1. Source Limitations: To the greatest extent possible for each unit of Work, the Contractor shall provide products, materials, and equipment of a singular, generic kind from a single manufacturer.

2. Compatibility of Options: Where more than one choice is available as an option for the Contractor's selection of a product, material, or equipment, the Contractor shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.03 PRODUCT DELIVERY AND STORAGE

1. The Contractor shall deliver and store the products, materials and equipment in accordance with manufacturer's written recommendations and by methods and means that will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long term storage of products at site and overcrowding of construction spaces. In particular, the Contractor shall ensure coordination to ensure minimum holding or storage times for flammable, hazardous, easily damaged, or sensitive materials to deterioration, theft, and other sources of loss.

1.04 TRANSPORTATION AND HANDLING

1. Products shall be transported by appropriate methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.

2. The Contractor shall provide equipment and personnel to handle products, materials, and equipment including those provided by City, by methods to prevent soiling and damage.

3. The Contractor shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

4. Lift heavy components only at designated lifting points.

1.05 STORAGE AND PROTECTION

1. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate-controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.

2. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

3. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter. Loose granular and aggregate material shall be stored at least 6 feet beyond the edge of pavement and at least 10 feet from the radius of any intersection or as necessary to maintain proper site distances.

4. Storage shall be arranged to provide access for inspection. The Contractor shall periodically inspect storage sites to ensure products are undamaged and maintained under required conditions.

5. Valves, gaskets and seals shall be covered to protect from sunlight.

6. Pipe shall not be stored more than two bundles high.

7. During such periods of time that are designated by the United States Weather Bureau as being a hurricane warning or alert, construction materials or equipment shall be secured against displacement by wind and storm surge forces.

1.06 MAINTENANCE OF STORAGE

1. Stored products shall be periodically inspected on a scheduled basis.

2. The Contractor shall comply with manufacturer's product storage requirements and recommendations.

3. The Contractor shall maintain manufacturer’s required environmental conditions continually.

4. The Contractor shall ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.

5. For mechanical and electrical equipment, the Contractor shall maintain a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.

6. Products and equipment requiring service shall be serviced on a regularly scheduled basis prior to acceptance by the City. Service records shall be submitted with Owner’s Manuals.

1.07 PROPOSED SUBSTITUTIONS OR "OR-EQUAL" ITEM

1. Whenever materials or equipment are indicated in the Drawings or Specifications by using the name of a proprietary item or the name of a particular Supplier, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or equal" indicating that a substitution is permitted, materials or equipment of other suppliers may be accepted if sufficient information is submitted by the Contractor to allow the City to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

   A. The burden of proof as to the type, function, and quality of any such substitution product, material or equipment shall be upon the Contractor.

   B. The City will be the sole judge as to the type, function, and quality of any such substitution and the City’s decision shall be final.

   C. The City may require the Contractor to furnish additional data about the proposed substitution.

   D. The City may require the Contractor to furnish a special performance guarantee or other surety with respect to any substitution.

   E. Acceptance by the City of a substitution item proposed by the Contractor shall not relieve the Contractor of the responsibility for full compliance with the Contract Documents and for adequacy of the substitution.

   F. The Contractor shall be responsible for resultant changes including design and construction changes resulting from the changes which the accepted substitution requires in the Contractor's Work, and the Work of its subcontractors.

2. The procedure for review by the City will include the following:

A. If the Contractor wishes to provide a substitution item, the Contractor shall make written application to the City.

B. Unless authorized in writing by the City a substitution request shall be submitted within the 35-day period after award of the Contract.

C. Wherever a proposed substitution item has not been submitted within said 35-day period, or wherever the submission of a proposed substitution material or equipment has been judged to be unacceptable by the City, the Contractor shall provide the material or equipment indicated in the Drawings and Specifications.

D. The Contractor shall certify that the proposed substitution will perform adequately the functions and achieve the results called for by the general design, and be similar and of equal substance to that indicated, and be suited to the same use as that specified.

E. The City will evaluate each proposed substitution within fourteen (14) days.

F. The City reserves the right to reject any substitution at the City's sole discretion.

G. As applicable, no shop drawing submittals shall be made for a substitution item nor shall any substitution item be ordered, installed, or utilized without the City's prior written acceptance of the Contractor's indicating a substitution request.

3. The Contractor's substitution request shall contain the following statements and information that shall be considered by the City in evaluating the proposed substitution:

A. The evaluation and acceptance of the proposed substitution will not cause a delay in the Contractor's achievement of substantial completion.

B. Whether or not acceptance of the substitution for use in the Work will require a change in any of the Drawings or Specifications to adopt the design to the proposed substitution.

C. Whether or not incorporation or use of the substitution in connection with the Work is subject to payment of any license fee or royalty.

D. All variations of the proposed substitution from the items originally specified will be identified.

E. Available maintenance, repair, and replacement service will be indicated. The manufacturer shall have a local service agency that maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

F. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitution, including cost of redesign and claims of other subcontractors affected by the resulting change.

4. Without any increase in cost to the City, the Contractor shall be responsible for and pay all costs in connection with proposed substitutions and of inspections and testing of equipment or materials submitted for review prior to the Contractor's purchase thereof for incorporation in the Work, whether or not the City accepts the proposed substitution or proposed equipment or material.

PART 2 - PRODUCTS

2.01 QUALIFIED PRODUCTS LIST (QPL)

1. The City, or its designated representative, shall maintain a Qualified Products List (QPL). The QPL shall consist of products that have been reviewed and accepted by the City. The QPL shall be maintained in a separate document and updated as deemed necessary by the City. The Contractor is responsible for verifying and utilizing the most current version of the QPL. The Contractor also is required to verify conformance of products in the QPL with American Iron and Steel (AIS) requirements.

2. A Product Review Committee, consisting of department staff with specific product expertise will coordinate the review of any new products or materials that could potentially be used in the Cape Coral Utilities system, as well as to review existing products or materials currently in use in order to determine whether the product or material meets the objectives and requirements of the department.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

City of Cape Coral
Qualified Products List

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
02269.2.3.C						TEMPORARY EROSION CONTROL	TENCATE (MIRAFI)	Y	12/30/2015	
02340.2.1.B	Y	Y	Y			SPACERS FOR CASING PIPE	BWM Co CASCADE POWERSEAL RACI	Y	5/25/2016	
02340.2.1.C	Y	Y	Y	Y		ELECTRONIC LOCATE MARKERS FOR CASING PIPE	3M XR/ID	N	5/25/2016	
02590.2.1.C	N	N	N	N	N	STORM DRAIN PIPE HDPE	ADVANCED DRAINAGE SYSTEMS (N-12 WT) QUALITY CULVERTS, INC	Y	1/5/2016	
02590.2.2.C	N	N	N	N	N	STORM DRAIN PIPE PVC	CONTECH CONSTRUCTION PRODUCTS (A-2000)	Y	1/5/2016	
02590.2.4.G	N	N	N	N	N	STORM DRAIN PIPE REINFORCED CONCRETE	HANSEN RINKER	Y	1/5/2016	
02594.2.3.A	Y	Y	Y	N	Y	HIGH DENSITY POLYETHYLENE PIPE	DURA-LINE (POLYPIPE) J-M EAGLE NATIONAL PIPE AND PLASTICS PERFORMANCE PIPE (DRISCOPIPE)	Y	3/16/2016	
02594.2.3.B	Y	Y	Y	N	Y	HIGH DENSITY POLYETHYLENE PIPE FITTINGS BUTT FUSION, ELECTROFUSION	CENTRAL PLASTICS INTERGRITY FUSION PRODUCTS ISCO PERFORMANCE PIPE SPECIFIED FITTINGS	Y	8/17/2016	
02595.2.2	Y	Y	N	N	N	FITTINGS FOR POLYETHYLENE PIPE FOR SERVICE CONNECTIONS	SEE SPECIFICATION 15001 FOR PRODUCTS		1/19/2016	
02595.2.3	Y	Y	N	N	N	POLYETHYLENE PIPE FOR SERVICE CONNECTIONS	ENDOT (ENDOPURE)	Y	2/3/2016	

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
02596.2.2.C	N	N	N	Y	N	SDR 26 PVC GRAVITY SEWER PIPE	DIAMOND PLASTIC CORP (SANI-21) J-M EAGLE NATIONAL PIPE AND PLASTICS, INC (EVER-GREEN) NORTH AMERICAN PIPE CORP	Y	1/5/2016	
02596.2.3.D	N	N	N	Y	N	PVC GRAVITY SEWER PIPE FITTINGS	HARCO MULTIFITTINGS	N	3/16/2016	
02596.2.3.E	N	N	N	Y	N	PVC GRAVITY SEWER PIPE TEE WYE	MULTIFITTINGS (TRENCH-TOUGH SDR 26 HEAVY WALL TEE-WYE)	N	1/19/2016	
02596.2.6.A	N	N	Y	Y		EARLY WARNING LOCATING TAPE	EMPIRE LEVEL MFG. CORP (MAGNATEC) PRESCO PRODUCTS PRO-LINE SAFETY PRODUCTS REEF INDUSTRIES (TERRA TAPE)	Y	5/25/2016	
02596.2.6.B	N	N	N	Y	Y	ELECTRONIC LOCATING MARKER	3M (EMS 1424 XR ID)	N	1/5/2016	
02597.3.4.X			Y			LOCATING DEVICES TRACER WIRE FOR FORCE MAIN	COPPERHEAD (1230-G-HS) PRO-LINE SAFETY PRODUCTS PRO-TRACE (HF-CCS PE) 3M (DBR/Y-6) SPLICE KIT	Y	7/29/2016	
02597.2.2.I	N	N	Y	N	N	PVC FORCE MAIN PIPE	DIAMOND PLASTIC CORPORATION J-M EAGLE NATIONAL PIPE AND PLASTICS, INC NORTH AMERICAN PIPE CORP	Y	1/19/2016	
02597.2.2.J	N	N	Y	N	N	MECHANICAL JOINT RESTRAINTS FOR PVC FORCE MAIN	EBBA IRON, INC FORD (UNI FLANGE) ROMAC INDUSTRIES (GRIP RING) SIGMA (ONE LOK SLC SERIES) SIP STARGRIP (SERIES 4000)	Y	7/26/2016	
02597.2.2.K	N	N	Y	N	N	BELL RESTRAINT HARNESSES FOR PVC PIPE	EBBA IRON, INC (SERIES 1600) FORD (UNI FLANGE) SIGMA (PVP SERIES) SIP STARGRIP (SERIES 1100)	Y	7/26/2016	

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
02597.2.3.G	N	N	Y	N	N	DUCTILE IRON LINED FORCE MAIN PIPE	AMERICAN CAST IRON PIPE COMPANY McWANE DUCTILE U.S. PIPE	Y	4/14/2016	
02597.2.3.I	N	N	Y	N	N	MECHANICAL JOINT RESTRAINTS FOR DUCTILE IRON FORCE MAIN PIPE	AMERICAN DUCTILE IRON PIPE (FLEX RING) EBBA IRON (MEGALUG SERIES 1100) FORD (UNI FLANGE) ROMAC IND (GRIP RING) SIGMA (ONE LOK SDL) SIP STARGRIP (SERIES 3000) U.S. PIPE (TR FLEX)	Y	7/26/2016	
02597.2.5.D	N	N	Y	N	N	DUCTILE IRON FITTINGS FOR FORCE MAIN PIPE	AMERICAN CAST IRON PIPE COMPANY TYLER UNION SIGMA SIP STAR U.S. PIPE	Y	5/25/2016	
02597.2.8.A			Y			EARLY WARNING LOCATING TAPE	EMPIRE LEVEL MFG CORP (MAGNATEC) PRESCO PRODUCTS PRO-LINE SAFETY PRODUCTS REEF INDUSTRIES (TERRA TAPEA0	Y	5/25/2016	
02597.2.8.B	N	N	Y	Y	Y	ELECTRONIC LOCATING MARKER SEWER (FORCE MAIN)	3M (1424 XR ID)	N	1/19/2016	
02598.2.1.H	Y	N	N	N	N	PVC POTABLE WATER MAIN PIPE	DIAMOND PLASTIC CORPORATION J-M EAGLE NATIONAL PIPE AND PLASTICS, INC NORTH AMERICAN PIPE CORP	Y	1/19/2016	
02598.2.1.I	Y	N	N	N	N	MECHANICAL JOINT RESTRAINTS FOR PVC PIPE	EBBA Iron, Inc. (Series 2000PV) Ford (Uni-Flange) Romac Industries (Grip Ring) Sigma (One Lok SLC Series) SIP Stargrip (Series 4000)	Y	7/26/2016	
02598.2.1.J	Y	N	N	N	N	POTABLE WATER MAIN BELL RESTRAINTS FOR PVC PIPE	EBBA IRON, INC (Series 1600) FORD (UNI-FLANGE) SIGMA (PVP Series) SIP STARGRIP (Series 1100)	Y	7/26/2016	

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
02598.2.2.G	Y	N	N	N	N	DUCTILE IRON CEMENT LINED POTABLE WATER MAIN	AMERICAN CAST IRON PIPE COMPANY McWANE DUCTILE U.S. PIPE	Y	4/14/2016	
02598.2.2.I	Y	N	N	N	N	MECHANICAL JOINT RESTRAINTS FOR DUCTILE IRON PIPE	AMERICAN DUCTILE IRON PIPE EBBA IRON, INC FORD ROMAC INDUSTRIES STARGRIP SIGMA SIP U.S. PIPE	Y	7/26/2016	
02598.2.3.D	Y	N	N	N	N	DUCTILE IRON FITTINGS FOR POTABLE WATER MAIN PIPE	AMERICAN CAST IRON PIPE COMPANY ROMAC SIGMA SIP STAR TYLER UNION U.S. PIPE	Y	6/28/2016	
02598.2.6.A	Y	N	N	N	N	EARLY WARNING LOCATING TAPE WATER	EMPIRE LEVEL MFG. CORP(MAGNATEC) PRESCO PRODUCTS PRO-LINE SAFETY PRODUCTS REEF INDUSTRIES (TERRA TAPE)	Y	5/25/2016	
02598.2.6.B	Y	N	N	N	N	ELECTRONIC LOCATING MARKER WATER	3M (3M)	N	1/19/2016	
02598.3.4.C	Y					LOCATING DEVICES TRACER WIRE FOR POTABLE WATER MAIN	COPPERHEAD (1230-B-HS) PRO-LINE SAFETY PRODUCTS PRO-TRACE (HF-CCS PE) 3M (DBR/Y-6) SPLICE KIT	Y	7/29/2016	
02599.2.6.C		Y				LOCATING DEVICES TRACER WIRE FOR REUSE MAINS	COPPERHEAD (1230-P-HS) PRO-LINE SAFETY PRODUCTS PRO-TRACE (HF-CCS PE) 3M (DBR/Y-6) SPLICE KIT	Y	7/29/2016	
02599.2.1.G	N	Y	N	N	N	PVC PIPE FOR IRRIGATION (REUSE) MAINS	DIAMOND PLASTIC CORPORATION J-M EAGLE (J-M) NATIONAL PIPE AND PLASTICS, INC NORTH AMERICAN PIPE CORP	Y	1/19/2016	

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
02599.2.1.H	N	Y	N	N	N	MECHANICAL JOINT RESTRAINTS FOR IRRIGATION (REUSE) PVC PIPE	EBBA IRON, INC (Series 200PV) FORD (Uni-Flange) ROMAC INDUSTRIES (Grip RIng) SIGMA (One Lok SLC Series) SIP STARGRIP (Series 4000)	Y	7/26/2016	
02599.2.1.I	N	Y	N	N	N	BELL RESTRAINT HARNESSES FOR IRRIGATION (REUSE) PVC PIPE	EBBA IRON (SERIES 1600) FORD (UNI-FLANGE SERIES 1390) SIGMA (PVP SERIES) SIP STARGRIP (SERIES 1100)	Y	7/26/2016	
02599.2.2.G	N	Y	N	N	N	DUCTILE IRON LINED IRRIGATION (REUSE) PIPE	AMERICAN CAST IRON PIPE COMPANY McWANE DUCTILE U.S. PIPE	Y	4/14/2016	
02599.2.2.I	N	Y	N	N	N	MECHANICAL JOINT RESTRAINTS FOR DUCTILE IRON IRRIGATION (REUSE) PIPE	American Ductile Iron Pipe, (Flex-Ring) EBBA Iron, Inc., (Megalug, Series 1100) Ford, (Uni-Flange) Romac Industries, (Grip Ring) Sigma (One Lok SDL Series) SIP Stargrip (Series 3000)	Y	7/26/2016	
02599.2.3.D	N	Y	N	N	N	DUCTILE IRON FITTIINGS FOR IRRIGATION (REUSE) PIPE	AMERICAN CAST IRON PIPE COMPANY ROMAC STAR SIGMA SIP TYLER UNION U.S. PIPE	Y	6/28/2016	
02599.2.6.A	N	Y	N	N	N	EARLY WARNING LOCATING TAPE - IRRIGATION	EMPIRE LEVEL MFG. CORP(MAGNATEC) PRESCO PRODUCTS PRO-LINE SAFETY PRODUCTS REEF INDUSTRIES (TERRA TAPE)	Y	5/25/2016	
02599.2.6.B	N	Y	N	N	N	ELECTRONIC LOCATING MARKER IRRIGATION	3M (XR ID 1258) LAVENDER	N	1/19/2016	
02900	N	N	N	N	Y	GRASS PAVERS FOR LIFT STATION ACCESS DRIVES	TUFF TRACK	Y	2/8/2016	
03400.2.1.G	N	N	N	Y	Y	PRECAST CONCRETE STRUCTURES MANHOLES JOINT SEAL	RAM-NEK(HENRY) JOINT WRAP(BIDCO)	N	1/19/2016	

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
03400.2.1.J				Y	Y	PRE-CAST CONCRETE MANHOLES, VALVE VAULTS, AND WET WELLS	CAST SYSTEMS COASTAL PRECAST OF FLORIDA OLDCASTLE PRECAST, INC. U.S. PRECAST CORP	Y	6/22/2016	
03400.2.2.B	N	N	N	Y	N	PRECAST CONCRETE STRUCTURES FRAMES AND COVERS	EAST JORDAN IRON WORKS U.S. FOUNDRY *GMI COMPOSITE (SEE NOTES) *ARPRO COMPOSITE ADJUSTING RING (SEE NOTES)	Y	5/25/2016	
03400.2.3.I	N	N	N	Y	Y	PRECAST CONCRETE STRUCTURES MANHOLES FLEXIBLE CONNECTION BOOT	KOR-N-SEAL LINK SEAL LS-316	Y	1/19/2016	
03400.2.5.A	N	N	N	N	N	PRECAST CONCRETE STRUCTURES STORM INLETS TYPE "C" & TYPE "E"	CAST SYSTEMS COASTAL PRECAST OF FLORIDA OLDCASTLE PRECAST U.S. PRECAST	Y	1/19/2016	
03400.2.5.B						STORM INLET GRATES	U. S. FOUNDRY	Y	1/19/2016	
05500.2.6.A	N	N	N	N	Y	IMPACT ANCHORS	HILTI POWERS(RAWLPLUG) REDHEAD	Y	1/19/2016	
05530.2.4.A	N	N	N	N	Y	ALUMINUM FRAME AND COVER	U.S. FOUNDRY HALLIDAY	Y	6/16/2016	
09800.3.10.A	N	N	N	N	N	PROTECTIVE COATINGS IMMERSION	TNEMEC			
09800.3.10.B	N	N	N	N	N	PROTECTIVE COATINGS	TNEMEC			
09800.3.11.A	N	N	Y	Y	Y	PROTECTIVE INTERIOR COATINGS FOR LIFT STATION WET WELLS AND MASTER AND RECIEVING MANHOLES	IET SYSTEMS	N	2/8/2016	
09800.3.12.A	N	N	N	Y	Y	PROTECTIVE COATINGS	TNEMEC			
09800.3.12.A	N	N	N	Y	Y	PROTECTIVE EXTERIOR COATINGS FOR LIFT STATION WET WELLS, MANHOLES, AND MASTER MANHOLES	TNEMEC (HI BUILD TENEME-TAR (46H-413))	Y	1/19/2016	
09800.3.14	N	N	N	N	N	PROTECTIVE COATINGS NON-IMMERSION EXTERIOR	TNEMEC			
09800.3.15	N	N	N	N	N	PROTECTIVE COATINGS	TNEMEC			
09800.3.9.D	N	N	N	N	N	PROTECTIVE COATINGS	TNEMEC			
11148.2.7.A	N	N	N	N	Y	SUBMERSIBLE PUMPS	MYERS	N	1/19/2016	

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
11148.2.7.B	N	N	N	N	Y	SUBMERSIBLE PUMPS	FLYGT EBARA	N	1/19/2016	
15000.2.2.G	Y	Y	Y	N	Y	FLANGE GASKET	AMERICAN DUCTILE IRON PIPE GARLOCK (STYLE 3000) JOHN CRANE (STYLE 2160)	Y	1/19/2016	
15001.2.1.B	Y	Y	N	N	N	RESILIANT WEDGE GATE VALVES FOR SERVICES 2"	AMERICAN FLOW CONTROL CLOW VALVE KENNEDY VALVE MUELLER	Y	1/19/2016	
15001.2.2.B	Y	N	Y	N	N	ADJUSTABLE VALVE BOXES FOR WATER SEWER	M & H PRO SELECT RUSSELL PIPE TYLER U.S. FOUNDRY	Y	8/18/2016	
15001.2.2.C	N	Y	N	N	N	OCTOGONAL ADJUSTABLE VALVE BOXES FOR IRRIGATION (REUSE)	FASTEC GENERAL FOUNDRIES SIGMA	Y	8/18/2016	
15001.2.3.D	Y	Y	N	N	N	RESIDENTIAL/ COMMERCIAL WATER AND IRRIGATION METER BOX	OLDCASTLE (CARSON) SEE ATTACHED TABLE FOR PART NUMBERS	Y	1/19/2016	
15001.2.4.D	Y	Y	N	N	N	SERVICE SADDLES	A.Y. McDONALD JCM FORD SMITH-BLAIR MUELLER DRESSER ROMAC INDUSTRIES	Y	1/19/2016	
15001.2.5.B	Y	Y	Y	N	N	CORPORATION STOPS	A.Y. McDONALD (74704B-22) FORD (FB1100) MUELLER (P-25028)	N	7/20/2016	

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
15001.2.6.B	Y	Y	N	N	N	CURB STOPS AND BRASS FITTINGS	A.Y. McDONALD FORD MUELLER SEE TABLE (ATTACHMENT) BELOW FOR QUALIFIED PRODUCTS AND PART NUMBERS	N	7/21/2016	
15060.2.1	Y	Y	N	N	Y	PVC PRESSURE PIPE , SOLVENT WELDED	CHARLOTTE PIPE AND FOUNDRY	Y	3/15/2016	
15060.2.3	Y	Y	N	N	Y	PVC PRESSURE PIPE , SOLVENT WELDED FITTINGS	CHARLOTTE PIPE AND FOUNDRY	Y	1/19/2016	
15060.2.4	Y	Y	N	N	Y	PVC PRESSURE PIPE , SOLVENT WELDED GLUE AND PRIMER	OATLEY	Y	1/19/2016	
15201.2.1.C	Y	Y	Y	N	N	TAPPING VALVES AND SLEEVES	American Flow Control, A-D, (Series 2800 & Series 1004) M&H (1574) Mueller (H-615) TYLER UNION U.S. Pipe (T-9)	Y	1/19/2016	
15201.2.1.D	Y	Y	Y	N	N	TAPPING VALVES	AMERICAN FLOW CONTROL (SERIES 865) CLOW (F 6114) KENNEDY VALVE (4950) M&H (3751) MUELLER (T2361)	Y	3/31/2016	
15202.2.1.F	Y	Y	Y	N	N	BUTTERFLY VALVES	DEZURIK HENRY PRATT COMPANY MUELLER	Y	6/28/2016	
15203.2.2.L	Y	Y	Y	N	N	SWING CHECK VALVES 4" AND LARGER	VAL-MATIC APCO	Y	1/19/2016	
15203.2.2L.1	N	N	N	N	Y	SWING CHECK VALVES FOR SANITARY LIFT STATIONS	Val-Matic Swing-Flex Check 500 Series	N	1/19/2016	
15206.2.3.E	Y	Y	N	N	N	RESILIENT WEDGE GATE VALVES	AMERICAN FLOW CONTROL CLOW VALVE KENNEDY VALVE MUELLER (2361)	Y	3/31/2016	
15206.****	Y	Y	Y	N	Y	LINE STOP, INSERT A VALVE	TEAM (INSERT VALVE)	Y	8/18/2016	
15207.2.1.D	N	N	Y	N	N	PLUG VALVES	VAL-MATIC DEZURIK CLOW VALVE HENRY PRATT COMPANY	N	1/19/2016	

City of Cape Coral
Qualified Products List

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
15207.2.1.D	N	N	N	N	Y	PLUG VALVES FOR LIFT STATIONS	DEZURIK (PEC SB16, F1 (Flanged) or MJ)	N	1/19/2016	
15208.2.1.B	Y	Y	Y	N	N	AIR RELEASE AND COMBINATION AIR/VACUUM RELEASE VALVES	H-TEC (986-SS)	N	1/19/2016	
15208.2.3.D	Y	Y	Y	N	N	AIR RELEASE AND COMBINATION AIR/VACUUM RELEASE PEDESTAL	CHANNELL	Y	1/19/2016	
15235.2.1.C	Y	Y	N	N	N	HYDRANTS (FIRE HYDRANTS)	AMERICAN-DARLING (B-84-B-5) CLOW (MEDALLION F 2545) MUELLER (SUPER CENTURION 250) M & H (929 RELIANT)	Y	8/18/2016	
15235.2.2.B	Y	Y	N	N	N	HYDRANT OFFSETS	GRADELOK	Y	1/19/2016	
15235.2.3.B	Y	Y	N	N	N	HYDRANT FLUSHING UNITS	MUELLER (HYDROGUARD)	Y	1/19/2016	
15236.2.1.A	Y	Y	N	N	N	POST HYDRANT OR BLOW OFF FOR FLUSHING WATER AND REUSE	CLOW MUELLER M & H	Y	8/17/2016	
16070. 2.04.A.1					Y	ELECTRICAL SUPPORTING DEVICES	ALLIED TUBE AND CONDUIT CINCH CLAMP, INC UNISTRUT DIVERSIFIED PRODUCTS	Y	6/2/2016	
16070. 2.04.A.2					Y	ELECTRICAL DEVICES CONDUIT SEALING BUSHINGS	KILLARK ELECTRIC MFG. CO. RACO, INC. THOMAS & BETTS	Y	6/2/2016	
16120. 2.2.B.3.					Y	ELECTRICAL DEVICES WIRES AND CABLES CONTROL WIRE	AMERICAN CAROL CABLE	Y	6/2/2016	
16120. 2.2.C.4.					Y	ELECTRICAL DEVICES WIRES AND CABLES INSTRUMENTATION CABLE	BELDEN	Y	6/2/2016	
16120. 2.2.C.5.					Y	ELECTRICAL DEVICES WIRES AND CABLES INSTRUMENTATION CABLE	BELDEN	Y	6/2/2016	
16120. 2.4.A.					Y	ELECTRICAL DEVICES WIRES AND CABLES CABLE TERMINATION	THOMAS & BETTS	Y	6/2/2016	
16120. 2.4.B.					Y	ELECTRICAL DEVICES WIRES AND CABLES CABLE TERMINATION	BURNDY THOMAS & BETTS	Y	6/2/2016	
16120. 2.4.C.					Y	ELECTRICAL DEVICES WIRES AND CABLES ELECTRICAL TAPE	3M SCOTCH (33)	Y	6/2/2016	
16130. 2.01.A.1.					Y	ELECTRICAL DEVICES RACEWAYS AND CONDUIT	ALLIED TUBE AND CONDUIT CARLON ROBROY INDUSTIRES	Y	6/2/2016	
16130. 2.01.A.2.					Y	ELECTRICAL DEVICES RACEWAYS AND CONDUIT LIQUIDTIGHT CONDUIT	CARLON ELECTRIC-FLEX	Y	6/2/2016	
16130. 2.01.A.3.						ELECTRICAL DEVICES RACEWAYS AND CONDUIT CONDUIT BODIES	APPLETON ELECTRIC CARLON KILLARK ELECTRIC MFG. CO. ROBROY INDUSTIRES	Y	6/2/2016	
16130. 2.01.A.4.						ELECTRICAL DEVICES RACEWAYS AND CONDUIT CONDUIT THREAD PAINT	CRC CHEMICALS, USA SHERWIN WILLIAMS	Y	6/2/2016	
16140. 2.2.A.						ELECTRICAL WIRING DEVICES LIGHTING SWITCHES	HUBBELL	Y	6/2/2016	

City of Cape Coral
Qualified Products List

Full Specification Reference	Water	Reuse	Force Main	Gravity Sewer Main	Lift Stations	Long Description	Manufacturer	City Approved Equal	Revision Date	
16140. 2.3.A.						ELECTRICAL WIRING DEVICES GENERAL PURPOSE RECEPTACLES	HUBBELL (GF-52621)	Y	6/2/2016	
16151. 2.01.B.						VARIABLE FREQUENCY DRIVE UNIT	EATON ELECTRICAL	Y	6/2/2016	
16151. 2.01.C.						VARIABLE FREQUENCY DRIVE UNIT	EATON ELECTRICAL	Y	6/2/2016	
16420. 2.01.A.1.						ELECTRICAL DEVICES MOTOR CONTROLERS	SQUARE D	Y	6/2/2016	
16450. 2.0.D.						ELECTRICAL WIRING DEVICES GROUNDING CONNECTORS	BURNDY	Y	6/2/2016	
16450. 2.1.C.						ELECTRICAL WIRING DEVICES GROUNDING EXOTHERMIC WELDING	ERICO PRODUCTS (CADWELD)	Y	6/2/2016	
16460. 2.6.						ELECTRICAL WIRING DEVICES ELECTRIC MOTORS	BALDOR U.S. MOTORS	Y	6/2/2016	
16480. 2.2.N	N	N	N	N	Y	VARIABLE FREQUENCY DRIVES FOR LIFT STATION CONTROL PANEL	SQUARE D	Y	2/26/2016	
16480. 2.2.N.	N	N	N	N	Y	PUMP START ALTERNATOR FOR LIFT STATIONS	DIVERSIFIED ELECTRONICS (ARB 120 ABA) M P E (008-120-13) TIME MARK	N	2/26/2016	
16480. 2.2.N.	N	N	N	N	Y	EMERGENCY GENERATOR RECEPTACLE AND ACCESSORIES FOR LIFT STATIONS	SEE ATTACHED TABLE	N	2/26/2016	
16480. 2.2.N.1.j.	N	N	N	N	Y	FLOAT SWITCH FOR LIFT STATIONS	ROTO FLOAT (S50N0 TYPE 5 {NORMALLY OPEN} 50' LEAD)	N	2/26/2016	
16480. 2.2.R.					Y	PUMP CONTROL PANELS FOR LIFT STATIONS	SUNCOAST HYDRAULIC ELECTRIC ECS CONTROL SYSTEMS STA-CON	N	6/2/2016	
16480.2.2.R.					Y	SURGE ARRESTOR FOR LIFT STATION CONTROL PANELS	SQUARE D (SDSA-3650)	Y	7/26/2016	
17250. 2.1.M.					Y	REMOTE TELEMETRY UNITS LIFT STATIONS	HSQ (MODEL 25X86)	Y	6/2/2016	
17250. 2.3.B.					Y	DIRECTIONAL ANENNA FOR REMOTE TELEMETRY UNITS	YAGI (DB499-K)	N	6/2/2016	

City of Cape Coral
Qualified Products List

03400.2.5	STORM GRATES			
		U.S. FOUNDRY		
03400.2.5.B	GRATES IN PAVED AREAS TYPE "C" & "E" INLETS			
	FRAME	4160		
	GRATE	6209		
03400.2.5.B	GRATES IN GRASSED AREAS			
	GRATE TYPE "C" INLET	6210		
	GRATE TYPE "E" INLET	6300		

City of Cape Coral
Qualified Products List

15001. 2.4.D SERVICE SADDLES							
		A Y MCDONALD	DRESSER	FORD	JCM	ROMAC	SMITH BLAIR
15001 .2.4.D	BRASS SADDLES TO 8"	3806	91	S912	402	101B	
15001 .2.4.D	DUCTILE IRON SADDLES 10" AND LARGER		91	F202	418	202NU	313

City of Cape Coral
Qualified Products List

15001.2.6	CURB STOPS AND BRASS FITTINGS	A Y MCDONALD	FORD	MUELLER
15001.2.6.B.1	1" SINGLE POTABLE WATER (RESIDENTIAL SHORT AND LONG SIDE) BALL TYPE CURB STOP W/CTS COMPRESSION X FNPT	76102W 22	B41-444W-CN-NL	P25170N
15001.2.6.B.2	1" SINGLE IRRIGATION (RESIDENTIAL SHORT AND LONG SIDE) BALL TYPE CURB STOP W/CTS COMPRESSION X FNPT	76102W 22RWT	BRW41-444W-CN-NL	
15001.2.6.B.3	1" DOUBLE POTABLE WATER (RESIDENTIAL SHORT AND LONG SIDE) (2) 3/4" BALL TYPE CURB STOP FNPT X FNPT 1" X 3/4" X 3/4"X 6-1/2" U BRANCH	76101W 708U2M	B11 333W NL U48 46 65 NL	B20200N P15363N
15001.2.6.B.4	1" DOUBLE IRRIGATION (RESIDENTIAL SHORT AND LONG SIDE) 1" CTS X 1" CTS X 1" CTS WYE (2) 1"BALL TYPE CURB STOP CTS X FNPT FOR RECLAIMED WATER	708YS-22 76102W 22RWT	Y44-244-CN-NL BRW41-444W-CN-NL	
15001. 2.6.B.5a	2" POTABLE WATER (COMMERCIAL/RESIDENTIAL) - HDPE OPTION BALL TYPE CURB STOP W/CTS COMPRESSION X FNPT	76102W 22	B41-777W-CN-NL	P25170N
15001. 2.6.B.5b	2" POTABLE WATER (COMMERCIAL/RESIDENTIAL) - PVC OPTION BALL TYPE CURB STOP W/PVC COMPRESSION X FNPT	76102W 44	B71-777W-CN-NL	V25108N
15001. 2.6.B.6a	2" IRRIGATION (COMMERCIAL/RESIDENTIAL) - HDPE OPTION BALL TYPE CURB STOP W/CTS COMPRESSION X FNPT	76102W 22RWT	BRW41-777W-CN-NL	
15001. 2.6.B.6b	2" IRRIGATION (COMMERCIAL/RESIDENTIAL) - PVC OPTION BALL TYPE CURB STOP W/PVC COMPRESSION X FNPT	76102W 44RWT	BRW71-777W-CN-NL	

City of Cape Coral
Qualified Products List

16480.2.2.N LIFT STATION PANELS EMERGENCY GENERATOR ACCESSORIES				
	THOMAS & BETTS	RUSSELLSTOLL	ROYAL ELECTRIC	AMERICAN MUSTANG
GENERATOR RECEPTACLE				
1PH-240V	DF1414FRA	DF1414FRAC0		
3PH-480V, 240V, 208V	DF2414FRA	DF2414FRA00		
GENERATOR PLUG				
1PH-240V		DS141MP000/900782		
3PH-480V, 240V, 208V		DS241MP000/900781		
GENERATOR POWER CABLE				
1PH-240V			2AWG-3 TYPE G-GC P-122-54 HSHA	
3PH-480V, 240V, 208V				3/0 TYPE G-GC P-136-35-MSHA

CITY OF CAPE CORAL UTILITIES
DEPARTMENT QUALIFIED
PRODUCTS LIST

15001. 2.3.D	METER BOXES			
		CARSON		
15001.2.3.D.2a	SINGLE RESIDENTIAL 1" POTABLE WATER SERVICE BLACK	1419 6093		
15001.2.3.D.2b	DOUBLE RESIDENTIAL 1" POTABLE WATER SERVICE BLACK	1220 6031		
15001.2.3.D.2.c	SINGLE COMMERCIAL/RESIDENTIAL POTABLE WATER SERVICE 2" BLACK	1730 6020		
15001.2.3.D.2.d	SINGLE AND DOUBLE RESIDENTIAL IRRIGATION SERVICE 1" LAVENDER	1419 6026		
15001.2.3.D.2.e	SINGLE COMMERCIAL/RESIDENTIAL IRRIGATION SERVICE 2" LAVENDER	1730 6065		

SECTION 01630

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Furnish and install Products specified, under options and conditions for substitutions stated in this Section.

1.02 RELATED REQUIREMENTS

1. Section 01410: Testing Laboratory Services.

2. Section 01670: Testing Piping Systems

3. Section 01700: Contract Closeout.

1.03 PRODUCTS LISTS

1. Within 30 days after award of Contract, submit to Engineer five copies of complete list of major Products which are proposed for installation.

2. Tabulate Products by specification section number and title.

3. For products specified only by preference standards, list for each such Product:

A. Name and address of manufacturer.

B. Trade Name.

C. Model or catalog designation.

D. Manufacturer's data:

1) Reference standards.

2) Performance test data.

1.04 CONTRACTOR'S OPTIONS

1. For Products specified only by reference standard, select product meeting that standard, by any manufacturer.

2. For products specified by naming several products or manufacturers, select any one of those products and manufacturers named which complies with Specifications.

3. For products specified by naming one or more products or manufacturers and stating "or equal," select one of those named products or manufacturers. After award of the Contract, submit a request as for substitutions, for any product or manufacturer which is not specifically named.

4. For products specified by naming only one product and manufacturer, there is no option and no substitution will be allowed.

1.05 SUBSTITUTIONS

1. Substitutions will only be considered after contract award. All work, materials, and equipment must be provided/performed in accordance with the City's most recent utility standards.

2. Substitutions will not be considered for acceptance when:

   A. They are indicated or implied on Shop Drawings or product data submittals without a formal request from Contractor.

   B. They are requested directly by a subcontractor or supplier.

   C. No data relating to changes in construction schedule.

   D. Any effect of substitution on separate contracts.

   E. List of changes required in other work or products.

   F. Lack of accurate cost data comparing proposed substitution with product specified.

   G. Designation of required license fees or royalties.

   H. Lack of designation of availability of maintenance services, sources of replacement materials.

   I. Acceptance will require substantial revision of Contract Documents.

3. Substitute products shall not be ordered or installed without written acceptance of Engineer.

4. Engineer will determine the acceptability of proposed substitutions.

1.06 CONTRACTOR'S REPRESENTATION

1. In making formal request for substitution Contractor represents that:

   A. He has investigated proposed product and has determined that it is equal to or superior in all respects to that specified.

   B. He will provide the same warranties or bonds for substitution as for product specified.

C. He will coordinate installation of accepted substitution into the Work, and will make such changes as may be required for the Work to be compiled in all respects.

D. He will provide same warranties or bonds for substitution as for product specified.

E. He will coordinate installation of accepted changes as may be required for the Work to be complete in all respects.

F. He waives claims for additional costs caused by substitution which may subsequently become apparent.

G. Cost data is complete and includes related costs under his Contract, but not:

1) Costs under separate contracts.

2) Engineer's costs of redesign or revision of Contract Documents.

1.07 ENGINEER'S DUTIES

1. Review Contractor's requests for substitutions with reasonable promptness.

2. Notify Contractor, in writing, of decision to accept or reject requested substitution.

3. Review Submittals with the City

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01650

STARTING OF MECHANICAL SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Provide material and labor required to perform start-up of each respective item of equipment and system. Startup shall include adjustment and balance procedures.

   A. Provide information and assistance required, cooperate with test, adjust and balance services.

2. Comply strictly with specified procedures in starting up mechanical systems.

3. Contractor to provide assistance, as required during startup. Contractor will obtain services of Factory Service Representative for actual startup.

1.02 RELATED REQUIREMENTS

1. Section 01041: Project Coordination.

2. Each Specification Section as Applicable.

1.03 START-UP PROCEDURES

1. Motors:

   A. Check each motor for amperage comparison to nameplate value.

   B. Correct conditions which produce excessive current flow, and which exist due to equipment malfunction.

2. Pumps:
   1) Check mechanical seals for cleanliness and adjustment before running pump.

   2) Inspect shaft sleeves for scoring.

   3) Inspect mechanical faces, chambers, and seal rings, replace if defective.

   4) Verify that piping system is free of dirt and scale before circulating liquid through the pump.

3. Tighten flanges after system has been placed in operation.

   A. Replace flange gaskets which show any sign of leakage after tightening.

4. Inspect screwed joints for leakage.

   A. Promptly remake each joint which appears to be faulty, do not wait for rust to form.

   B. Clean threads on both parts, apply compound and remake joints.

5. After system has been placed in operation, clean strainers, dirt pockets, orifices, valve seats and headers in fluid systems, to assure being free of foreign materials.

6. Check each electrical control circuit to assure that operation complies with specifications and requirements to provide desired performance.

7. Inspect each pressure gauge for calibration.

   A. Replace items which are defaced, broken, or which read incorrectly.

8. Repair damaged insulation.

9. Check piping for leaks at every joint, and at every screwed, flanged, or welded connection, using “Leak-Tek” or other approved compound.

1.04 ADJUSTMENTS (NOT USED)

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01670

TESTING PIPING SYSTEMS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

1. Perform specified services with Contractor's qualified personnel, or employ and pay for a qualified organization to perform specified services.

2. Leakage testing requirements for pump stations and shall include pressure testing from the pump base elbow through the valve vault to the point of connection with the existing from main piping.

1.02 RELATED REQUIREMENTS

1. Section 01041: Project Coordination.

2. Section 01700: Contract Closeout.

3. Section 02666: Pressure Testing of Piping.

1.03 DESCRIPTION

1. Perform testing of piping systems as specified below.

2. Provide instruments required for testing of piping systems.

   A. Make instruments available to Engineer to facilitate spot checks during testing.

   B. Retain possession of instruments; remove from site at completion of services.

3. Provide all water required for flushing and testing, if not available from the City.

4. Provide all necessary pumping equipment and other equipment, materials and facilities required for proper completion of the flushing and testing specified.

5. Source and quality of water, procedure and test equipment shall be acceptable to the Engineer.

6. All tests shall be made in the presence of the Engineer. Notify Engineer at least 48 hours before any Work is to be inspected or tested.

7. If inspection or test shows defects, the piping system(s) shall be repaired and replaced and inspection repeated, until such piping is acceptable to the Engineer.

8. All pipe, fittings, valves and joints shall be carefully examined during test. Leaky joints shall be tightened by remaking the joint. Repair of lead joints with a caulking tool using wicking, or tinfoil will not be accepted.

9. Sections of the system may be tested separately, but when so tested it shall be distinctly understood that any defect which may subsequently develop in a section already tested and accepted shall promptly be corrected and that section re-tested.

10. Disposal of the water used for testing shall be subject to the approval of the Engineer.

1.04 QUALITY ASSURANCE

1. The organization which performs the testing shall, prior to testing, provide their qualifications and demonstrate their ability to perform the services to the satisfaction of the Engineer.

1.05 SUBMITTALS

1. Preliminary:

A. Submit three (3) copies of documentation to confirm compliance with Quality Assurance provisions:

1) Organization supervisor and personnel training and qualifications.

2) Specimen copy of each of the report forms proposed for use.

2. At least fifteen (15) days prior to Contractor's request for final inspection, submit three copies of final reports on applicable reporting forms, for review.

A. Each individual final reporting form must bear the signature of the person who recorded data and that of the supervisor of the reporting organization.

B. Identify instrument of all types which were used, and last date of calibration of each.

1.06 JOB CONDITIONS

1. Prior to start of testing of piping systems, verify that required "Job Conditions" are met:

A. System or system element installation is complete.

B. All required materials, water, instruments, etc. are on hand.

C. All other preparations are completed.

1.07 TESTING PROCEDURES

1. Domestic and Small Diameter Process Systems Test:

A. Domestic water and process system 4 inches and under in size, water supply lines, chemical handling and process systems, shall all be tested and approval obtained prior to painting, placing of any backfill, installation of insulating covering, or concealment within the building construction.

B. All such piping systems shall be tested at a pressure of 100 psi unless written approval for a lesser test pressure is obtained from the Engineer.

2. Exterior and Interior Process Piping Systems:

A. Exterior and interior process piping shall pass a hydrostatic pressure test and a leakage test as defined below before acceptance. The pressure and leakage test shall be made after all jointing operations are completed and after backfilling is completed. All concrete reaction blocks, or other bracing and restraining facilities, shall be in place at least 14 days before the initial filling of the line.

B. The pressure and leakage test may be applied to an individual section of line isolated between the existing line valves, or may be applied to shorter sections of line at the Contractor's option. If shorter sections are tested, test plugs or bulkheads required at the ends of the test section shall be furnished and installed by the Contractor at his expense, together with all anchors, braces, and other devices required to withstand the hydrostatic pressure on such plug or plugs, without imposing any hydraulic thrust on the pipe line or any part thereof. The Contractor shall be solely responsible for any and all damage to the pipe line, and/or to any other facility, which may result from the failure of test plugs furnished by him or supports therefore, in any case.

C. Tests:

1) Hydrostatic Tests.

a. The section of line to be tested shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves.

b. Hydrostatic test pressure shall be as follows:

System	Pressure Test Rating
Potable Water	150 psi
Wastewater Pressure Pipe	100 psi

c. After the section of the line to be tested has been filled with water, the specified test pressure shall be applied and maintained for a period of not less than two hours or whatever longer period as may be necessary for the Engineer to complete the inspection of the line under test and to locate any and all defective joints and pipe line materials. If the repairs are needed, such repairs shall be made, the line refilled, and the test pressure applied as before; this operation shall be repeated until the line and all parts of it withstand the test

pressure in a satisfactory manner.

d. There shall be no leakage allowed in threaded, flanged, mechanical joint or welded pipeline construction whether buried or exposed. The field welded pipe joints shall be inspected for pinholes and tested for leaks prior to the application of field applied protective coating and lining. The field welded joints shall be tested by means of soap suds and vacuum look box or other methods acceptable to the Engineer. Pinholes and leaks shall not be repaired by peening. The defective portion of weld shall be cut out and rewelded. All testing and repairs shall meet the approval of the Engineer at all times.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

1. Prior to testing, flush all piping systems with water to remove all debris in the system.

2. For testing refer to the Testing Procedures above.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.01 DESCRIPTION

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

2. Related Requirements Described Elsewhere:

A. Start-Up: Section 01650

B. Cleaning: Section 01710

C. Project Record Documents: Section 01720

D. Operating and Maintenance Data: Section 01730

E. Warranties and Maintenance Bond: Section 01740

1.02 SUBSTANTIAL COMPLETION (UTILITY WORK)

1. The Work will be substantially complete, and Contractor may request substantial completion inspection upon completion of the following submittals and work:

A. All Operation and Maintenance manuals have been submitted and approved to the requirements of Section 01730.

B. All equipment has been checked-out by the equipment manufacturer and Certificates of Manufacturer's Check-Out have been submitted as required by Section 01650.

C. All start-up and demonstration testing completed and Certificates of Completed Demonstration submitted to the requirements of Section 01650.

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

E. All training of Owner's personnel completed.

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

G. All painting, finishes, fencing, cleanup, final grading, grassing, planting, sidewalk construction, and the first lift of all roadway pavement shall have been completed and are ready for inspection.

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

I. All Direct Purchase Orders (DPO)s requests are submitted, approved and paid. No additional time will be given to Contractors to complete DPO procedures.

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

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

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

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

A. The Engineer will promptly notify the Contractor in writing, giving the reasons therefore.
B. Contractor shall remedy the deficiencies in the Work within 1 months and send another written notice of substantial completion to the Engineer.
C. The Engineer will within reasonable time re-inspect the Work. The Contractor will be liable for re-inspection fees as described in Paragraph 1.06, herein.

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

A. 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.

B. 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.

C. 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 Certificate of Substantial Completion with a revised list of items to be completed or corrected. Any incomplete work allowed on a punchlist must be re-inspected upon completion and any deficiencies found will be added to the punchlist.

1.03 FINAL COMPLETION (UTILITY WORK)

1. Prior to Contractor's request for Final Utility Completion the following submittals and work must be complete:

A. Project Record Documents must be approved.

B. All spare parts and maintenance materials must be suitably delivered to the Owner per the requirements of the Specifications.

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

2. After satisfying the requirements of Paragraph 1.03 1. and when Contractor considers the Utility Work complete, he shall submit written certification that:

A. Contract Document requirements have been met.

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

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

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

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

3. The Engineer will, within reasonable time, make an inspection to verify the status of Final Utility Work completion after receipt of such certification.

4. Should the Engineer consider that the Final Utility Work is incomplete or defective:

A. The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective Utility Work.

B. Contractor shall take immediate steps to remedy the stated deficiencies, and send another written certification to the Engineer that the Utility Work is complete.

C. The Engineer will, within a reasonable amount of time, re-inspect the Utility Work and the Contractor shall be liable for re-inspection fees as described in Paragraph 1.04, herein.

1.04 SUBSTANTIAL COMPLETION (FINAL ASPHALT)

1. The Work will be substantially complete, and Contractor may request final asphalt completion inspection upon completion of the following submittals and work:

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

B. The final lift of all roadway pavement shall have been completed and are ready for inspection.

C. All deficiencies noted on inspection reports or non-conformances are corrected or

the correction plan approved.

2. When the conditions of paragraph 1.04 1. are met the Contractor shall submit to the Engineer:

   A. A written notice that he considers the final asphalt Work is substantially complete, and request an inspection.

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

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

4. Should the Engineer determine that the Final Asphalt Work is not substantially complete:

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

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

   C. The Engineer will within reasonable time re-inspect the Work. The Contractor will be liable for re-inspection fees as described in Paragraph 1.06, herein.

5. When the Engineer finds that the Final Asphalt Work is substantially complete, he will:

   A. 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.

   B. Prepare and deliver to Owner a tentative Certificate of Substantial Completion with the punchlist of items to be completed or corrected before final inspection.

   C. 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 Certificate of Substantial Completion with a revised list of items to be completed or corrected. Any incomplete work allowed on a punchlist must be re-inspected upon completion and any deficiencies found will be added to the punchlist.

1.05 FINAL ASPHALT COMPLETION

1. Prior to Contractor's request for Final Asphalt Completion the following submittals and work must be complete:

   A. Final lift of asphalt pavement including adjustment of manhole rims and valve boxes

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

2. After satisfying the requirements of Paragraph 1.05 1. and when Contractor considers the Asphalt Work complete, he shall submit written certification that:

A. Contract Document requirements have been met.

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

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

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

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

3. The Engineer will, within reasonable time, make an inspection to verify the status of Final Asphalt Completion after receipt of such certification.

4. Should the Engineer consider that the Final Asphalt Work is incomplete or defective:

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

B. Contractor shall take immediate steps to remedy the stated deficiencies, and send another written certification to the Engineer that the Asphalt Work is complete.

C. The Engineer will, within a reasonable amount of time, re-inspect the Asphalt Work and the Contractor shall be liable for re-inspection fees as described in Paragraph 1.06, herein.

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

1.06 REINSPECTION FEES

1. Should the Engineer perform re-inspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:

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

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

1.07 CONTRACTOR'S CLOSEOUT SUBMITTALS

1. Warranties and Maintenance Bonds: Refer to requirements of Section 01740.

2. Evidence of Payment and Release of Liens: Refer to requirements of General and Supplementary Conditions.

3. Certificate of Insurance for Products and Completed Operations.

1.08 FINAL ADJUSTMENT OF ACCOUNTS

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

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

   A. The original Contract Sum

   B. Additions and deductions resulting from:

      1) Previous change orders or written amendments

      2) Allowances

      3) Unit prices

      4) Deductions for uncorrected work

      5) Penalties and bonuses

      6) Deductions for liquidated damages

      7) Deductions for re-inspection payments

      8) Other adjustments

   C. Total Contract Sum, as adjusted

   D. Previous payments

   E. Sum remaining due

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

1.09 FINAL APPLICATION FOR PAYMENT

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

1.10 FINAL WARRANTY INSPECTION

1. Three months prior to the expiration of the warranty period, the Engineer:

   A. Schedule a walk-through of the facility to include the Owner and Contractor.

   B. Prepare and deliver to Owner a list of outstanding warranty items to be completed or corrected before the end of the warranty period.

   C. After completion of all outstanding warranty items, the performance and payment bonds will be released by the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

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

1.02 DISPOSAL REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 MATERIALS

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

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

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

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

1. 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.

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

3. Remove waste materials, debris and rubbish from the site as needed and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

1. The Contractor shall employ construction techniques that minimize the production and distribution of dust and particulate matter, limiting the area exposed for dust generation.

2. When construction activities must occur that generate dust, the Contractor shall employ dust control measures including using dust suppressants (palliatives) such as water, water absorbing products, organic non-petroleum-based products, polymers, Type A tackifiers and

soil stabilizers, physical barriers, and mulch and vegetation or a combination thereof. Contractor shall water disturbed areas at least three times per day unless directed by the City.

3. Non-potable irrigation water or groundwater from dewatering system may be used for dust control. Use of potable water by the Contractor for dust control is prohibited.

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

5. 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

1. Employ skilled workmen for final cleaning.

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

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

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work: Maintain, for the Engineer, one (l) record copy of:

   A. Drawings.

   B. Specifications.

   C. Addenda.

   D. Change Orders and other modifications of the Contract.

   E. Engineer's Field Orders or written instructions.

   F. Approved Shop Drawings, Working Drawings and Samples.

   G. Field Test records.

   H. Construction photographs.

2. Related Requirements Described Elsewhere:

   A. Field Engineering: Section 01050.

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

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

1. Store documents and samples apart from documents used for construction.

   A. Provide files and racks for storage of documents.

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

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

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

4. Make documents and samples available at all times for inspection by the Engineer.

5. As a prerequisite for monthly Progress payments, the Contractor is to exhibit the currently updated “Record Documents” for review by the Engineer and Owner. In addition, Contractor shall provide a CADD file (.dwg) with accurate state plane coordinate and elevation data for all pipe, fittings and structures for which payment is being requested. Payment may be withheld if record documents are not satisfactorily maintained.

1.03 MARKING DEVICES

1. Provide felt tip making pens for recording information in the color code designated by the Engineer.

1.04 RECORDING

1. Label each document "PROJECT RECORD" in neat large printed letters.

2. Record information concurrently with construction progress.

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

3. Drawings: Legibly mark to record actual construction:

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

   B. 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.

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

   D. Field changes of dimension and detail.

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

   F. Details not on original Contract Drawings.

   G. Equipment and piping relocations.

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

   I. Architectural schedule changes according to Contractor’s records and shop drawings.

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

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

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

5. Shop Drawings (after final review and approval): Provide five (5) sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

6. The AutoCAD Civil3D 2011 record drawing layering requirements are revised as follows:

   A. For each of the utility systems (potable water, irrigation water, wastewater force main, gravity sanitary sewer, storm sewer and fiber optic conduit) and the roadways, the Contractor is required to submit a separate coordinate file (i.e., comma-separated values (CSV) record survey points file) for use by the Engineer and the City. Do not combine CSV from any of the six required data sets (the utility systems plus roadways). For each of the six data sets, the CSV data may be submitted incrementally as portions of the system(s) are certified for partial substantial completion, and/or periodically as mutually agreed by the Contractor and Engineer. The surveyor shall clearly identify the location of the project area for which the CSV record data is being submitted (i.e. street names, area map delineating the area).

   B. For each of the systems, the Contractor is required to submit a separate dwg base file when significant deviations from the design have been constructed, such as horizontal deflections around obstacles. The Contractor may edit the dwg base files previously provided by the Engineer to show the significant deviations from the design. The surveyor shall clearly identify where a significant deviation from the design has been constructed (i.e. bubble around the deviation with appropriate notation).

   C. The as-built survey data collection requirements are revised as follows:

System	Survey Data Collection Requirements
Potable Water, Irrigation Water, and Wastewater Force Main	• Valves • Fittings • Changes in direction • Changes in material type (DIP/PVC/HDPE, etc.) • Point of connection to existing utility mains • 100’ minimum between shots • Hydrants on potable water mains • Blowoffs on irrigation water mains • Meter boxes/curb stops on potable water & irrigation water mains • Air release valves on potable water, irrigation water and wastewater force mains
Force Main (Lift Stations)	• Top of slab elevation • Bottom of wet well elevation • All wet well invert elevations • Bottom of electrical panel elevation • Electrical conduit to LCEC pedestal
Gravity Sanitary Sewer	• Manhole locations • Manhole invert elevations • Manhole rim elevations • Sewer service lateral cleanout locations
Storm Sewer	• Top of grate elevations • Drainage pipe invert elevations • Bleeder invert elevations
Roadways	• Roadway section (EOP-Crown-EOP) at each storm drainage structure • Roadway section (EOP-Crown-EOP) 200’ minimum between sections

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

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

   B. Changes made by Field Order or by Change Order.
   Shop Drawings (after final review and approval): Provide six (6) sets of record shop drawings within the Operation and Maintenance Manual, for each process equipment, piping, electrical system and instrumentation system (see Section 01730).

1.05 SUBMITTAL

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

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

   A. Date.

   B. Project title and number.

   C. Contractor’s name and address.

   D. Title and number of each Record Document.

   E. 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

1. Scope of Work:

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

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

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

2. Related Requirements Described Elsewhere:

A. Contract Closeout: Section 01700

B. Project Record Documents: Section 01720

C. Equipment: Division 11

D. Mechanical: Division 15

E. Electrical: Division 16

1.02 QUALITY ASSURANCE

1. Preparation of data shall be done by personnel:

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

B. Familiar with requirements of this Section.

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

D. Skilled as draftsman competent to prepare required drawings.

1.03 FORM OF SUBMITTALS

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

2. Format:

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

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

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

   D. Drawings:

      1) Provide reinforced punched binder tab, bind in with text.

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

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

      1) Provide typed description of projects and major component parts of equipment.

      2) Provide identified tabs.

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

      1) Title of Project

      2) Identity of separate structure as applicable

      3) Identity of general subject matter covered in the manual

3. Binders:

   A. 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.

   B. Maximum D-ring width: 2 inches.

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

4. In addition to standard operation and maintenance manuals, all manufacturers supplying equipment specified in Divisions 11, 15, and 16 shall submit their operation and maintenance manuals on magnetic media/compact disks in Microsoft Word, WordPerfect or text, ".txt" formats. All graphic files shall be in BMP, PCS, CDR, JPEG, DWG or DXF formats.

1.04 CONTENTS OF MANUAL

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

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

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

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

      1) Subcontractor, manufacturer and installer name, addresses and telephone numbers

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

      3) Identify area of responsibility of each.

      4) Local source of supply for parts and replacement equipment including name, address and telephone number

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

2. Product Data:

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

   B. Annotate each sheet to:

      1) Clearly identify specific product or part installed.

      2) Clearly identify data applicable to installation.

      3) Delete references to inapplicable information.

   C. Operation and maintenance information as herein specified.

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

3. Drawings:

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

1) Relations of component parts of equipment and systems

2) Control and flow diagrams

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

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

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

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

B. Provide logical sequence of instruction of each procedure.

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

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

1) Proper procedures in event of failure

2) Instances which might affect validity of warranties or bonds

1.05 MANUAL FOR MATERIALS AND FINISHES

1. Submit six (6) copies of complete manual in final form.

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

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

1) Catalog number, size, composition

2) Color and texture designations

3) Information required for reordering special manufacturing products

B. Instructions for care and maintenance.

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

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

3) Recommended schedule for cleaning and maintenance.

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

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

1) Applicable standards

2) Chemical composition

3) Details of installation

B. Instructions for inspection, maintenance and repair.

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

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

1. Submit six (6) copies of complete manual in final form.

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

A. Description of unit and component parts

1) Function, normal operating characteristics, and limiting conditions

2) Performance curves, engineering data and tests

3) Complete nomenclature and commercial number of replaceable parts

4) Summary of information listed on equipment and motor data plates

B. Operating procedures:

1) Start-up, break-in, routine and normal operating instructions

2) Regulation, control, stopping, shut-down and emergency instructions

3) Summer and winter operating instructions

4) Special operating instructions

C. Maintenance procedures:

1) Routine operations

2) Guide to "trouble-shooting"

3) Disassembly, repair and reassembly

4) Alignment, adjusting and checking

D. Servicing and lubrication required

E. Manufacturer's printed operating and maintenance instructions

F. Description of sequence of operation by control manufacturer

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

1) Predicted life of parts subject to wear

2) Items recommended to be stocked as spare parts

H. As-installed control diagrams by controls manufacturer

I. Each Contractor's coordination drawings

1) As-installed color coded piping diagrams

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

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

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

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

demonstration test certification.

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

   A. Description of system and component parts

      1) Function, normal operating characteristics, and limiting conditions

      2) Performance curves, engineering data and tests

      3) Complete nomenclature and commercial number of replaceable parts

   B. Circuit directories and panelboards

      1) Electrical service

      2) Controls

      3) Communications

   C. As installed color coded wiring diagrams

   D. Operating procedures:

      1) Routine and normal operating instructions

      2) Sequences required

      3) Special operating instructions

   E. Maintenance procedures:

      1) Routine operations

      2) Guide to "trouble-shooting"

      3) Disassembly, repair and reassembly

      4) Adjustment and checking

   F. Manufacturer's printed operating and maintenance instructions

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

H. Other data as required under pertinent sections of specifications

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

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

1.07 SUBMITTAL SCHEDULE

1. Submit two (2) copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 30 days after approval of submittals.

2. Submit two (2) copies of completed data in preliminary form no later than 20 days following Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01300, but no later than delivery of equipment. One (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.

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

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

5. Provide two (2) compact discs containing each operation and maintenance manual in PDF format.

1.08 INSTRUCTION OF OWNER'S PERSONNEL

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

2. 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.

3. 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.

4. The Contractor shall provide a list to the Owner indicating the date, time and instructors that will be present for all training sessions.

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

6. All instruction sessions shall be recorded with portable video recording cameras and digital media supplied by the Contractor. Recordings shall be made by the Contractor under the direction of the Owner. Recording equipment shall provide files in a digital format that is compatible with personal computers and DVD players.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work:

A. Compile specified warranties and bonds as specified in these Specifications.

2. Related Work Described Elsewhere:

A. Contract Closeout: Section 01700.

1.02 SUBMITTAL REQUIREMENTS

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

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

3. Table of Contents: Neatly typed, in orderly sequence. Provide complete information 0for each item.

A. Product of work item.

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

C. Scope.

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

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

F. Provide information for Owner's personnel:

1) Proper procedure in case of failure.

2) Instances which might affect the validity or warranty or bond.

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

1.03 FORM OF SUBMITTALS

1. Prepare in duplicate packets.

2. Format:

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

1) Fold larger sheets to fit into binders.

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

1) Title of Project.

2) Name of Contractor.

3. 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

1. 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.

2. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Divisions 11: Equipment; 15: Mechanical; and 16: 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.

3. 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.

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

5. 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

SPARE PARTS

PART 1 – GENERAL

1.01 DESCRIPTION

1. Contractor shall furnish spare parts and maintenance materials as specified in the individual Specification Sections.

2. Two complete spare sets of all shaft seals or packing shall be supplied as a part of electrical control equipment furnished by the Contractor, unless otherwise specified.

1.02 SUBMITTALS

1. Provide a letter of transmittal including the following:

   A. Date of letter and transfer of parts and materials

   B. Contract title and number

   C. Contractor's name and address

   D. A complete inventory of the parts and material, listing the applicable Specification Section for each

   E. A place for the City to sign and signify receipt of the parts and materials

2. A complete list of spare parts to be furnished shall be submitted to the City for approval as a part of the working drawing submittal.

1.03 DELIVERY AND HANDLING

1. Parts and materials shall be furnished in manufacturers' unopened cartons, boxes, crates or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. They shall be clearly marked and identified.

2. All parts shall be securely boxed and tagged, and clearly marked on the box and individually for identification as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least ten (10) years.

3. During construction, store parts in buildings or trailers with floor, roof and closed sides and in accordance with manufacturers' recommendations. Protect from weather, condensation and humidity.

4. Parts and materials shall be delivered to the City upon completion of the Work. Contractor shall then place them in permanent storage rooms or areas approved by the City.

5. Contractor shall be fully responsible for loss or damage to parts and materials until they are transmitted to the City.

6. Upon acceptance of the spare parts by the City, the Contractor shall deliver the spare parts to the designated storage area.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 02090

SOIL BORINGS

PART 1 - GENERAL

1.01 DESCRIPTION

1. Geotechnical soil borings were not prepared for this project.

2. The subsurface information (SUE) contained herein was obtained for existing utility location purposes and may not be an adequate representation of actual conditions for project construction. All risks resulting from use or interpretation of the subsurface data shown shall be borne by the Contractor.

3. If additional subsurface information is required by the Bidder/Contractor, it shall be the Bidder's/Contractor's responsibility to obtain such data.

4. Refer to Section 00700 – General Conditions Article 5, and Section 00800 – Supplementary Conditions for further explanation of subsurface conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The work of this Section includes measures required during the Contractor's initial mobilization onto the Site to protect existing fences, houses and associated improvements, streets, and utilities downslope of construction areas from damage due to boulders, trees or other objects dislodged during the construction process; clearing, grubbing and stripping; and regrading of certain areas to receive embankment fill. Contractors shall fully comply with the requirements of Ch. 556, F.S. including but not limited to notifying utility owners and providing the required information through the Sunshine One Call of Florida, Inc. (811) System, not less than two full business days in advance of beginning any construction.

1.02 SITE INSPECTION

1. Prior to moving onto the Site, the Contractor shall inspect the Site conditions and the City's property and right-of-way lines.

2. The Contractor's attention is directed to any Soil Erosion and Sediment Control Ordinances in force. The Contractor shall comply with all applicable sections of these ordinances and NPDES requirements.

1.03 PRE-CONSTRUCTION VIDEO

1. A pre-construction video is required for all projects conducted by the City of Cape Coral, and any work within City owned right of ways and/or City owned property, public utility easements, or other areas that may be required by the City of Cape Coral. Prior to any work being performed, the Contractor shall prepare a preconstruction video in accordance with Section 01380.

PART 2 -- PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PRIMARY SITE ACCESS

1. The Contractor shall develop any necessary access to the Site, including access barriers to prohibit entry of unauthorized persons.

2. Utility Interference: Where existing utilities interfere with the WORK, notify the utility owner and the city before proceeding per Section 01530 Protection of Existing Facilities.

3.02 CLEARING AND GRUBBING

1. Except as otherwise directed the Contractor shall cut, grub, remove and dispose of all

trees, stumps, brush, shrubs, roots and any other objectionable material within the limits of the construction.

2. All trees, stumps, brush, shrubs, roots and other objectionable material shall be cut, grubbed, removed and disposed of from areas needed to construct buildings, structures, roads, pipelines and any other areas to be stripped.

3. Contractor shall protect trees or groups of trees, designated by the City to remain, from damage by all construction operations by erecting suitable barriers, or by other approved means. Clearing operations shall be conducted in a manner to prevent falling trees from damaging trees designated to remain.

4. Areas outside the easements or limits of clearing shall be protected from damage and no equipment or materials shall be stored in these areas, unless prior written permission is granted before use of these areas.

5. No stumps, trees, limbs, or brush shall be buried in any fills or embankments.

3.03 STRIPPING

1. The Contractor shall strip topsoil from all areas to be excavated or filled. Avoid mixing topsoil with subsoil and stockpile topsoil in areas on the Site as approved by the city. Topsoil shall be free from brush, trash, large stones and other extraneous material and protected until it is placed as directed. Dispose of any remaining topsoil as directed by the city.

3.04 DISPOSAL OF MATERIALS

1. All tree trunks, limbs, roots, stumps, brush, foliage, other vegetation and objectionable material shall be removed from the Site and disposed of in a manner satisfactory to the City. Disposal (including hauling) of cleared, grubbed, and unsuitable material and debris shall be the responsibility of the Contractor.

2. Burning of cleared and grubbed materials will not be permitted.

3.05 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

1. The Contractor shall avoid unnecessary disturbance of private property along the route of the construction. See Section 02920-Restoration for requirements.

2. The Contractor shall clean up the construction site across private property immediately after construction is completed.

3.06 PRESERVATION OF PUBLIC PROPERTY

1. The appropriate paragraphs of Articles 3.01, 3.02, and 3.05 of these specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, private easement, public utility easement, and all other damaged areas.

3.07 EXCAVATED MATERIALS UNSUITABLE FOR CONVENTIONAL DISPOSAL

1. It will be the Contractor's responsibility to properly dispose of materials unsuitable for conventional disposal. The cost of disposal shall be included in the Contractor's Bid Price.

- END OF SECTION -

SECTION 02120

WORKMANSHIP

PART 1 – GENERAL

1.01 DESCRIPITION

1. Specific requirements for the Work are indicated throughout the Specifications and Drawings. The requirements of this Section are primarily related to the Workmanship and Craftmanship skills, necessary to obtain a finish product of quality.

1.02 DEFINITIONS

1. "Workmanship" - The degree of skill with which a product is made, or a job done, skill in an occupation or trade, the skill and quality of a product based on a design, is measured by the skill of the person, the quality of the materials, and the craft involved in their use.

2. "Craftmanship" - A person who practices or is highly skilled in a craft, a skill in a particular craft, the quality of design and work shown in something made by hand, the skill with which something was made or done.

1.03 WORKMANSHIP/CRAFTMANSHIP

1. The Contractor is to perform the essential workmanship to obtain a finish product of quality.

2. The Contractor is to supply sufficient qualified personnel and/or firm(s), for all aspects of work relating to the project/contract.

3. The Contractor is to comply with industry standards except when more restrictive tolerances, as referenced in specified requirements, indicate more ridged standards or more precise craftmanship.

1.04 PERFORMANCE

1. Work is to be performed to produce a specified finish product of quality.

2. Work is to be performed to Specifications, details, and/or referenced standards.

3. Work is to be performed in accordance with Industry standards.

4. Work is to be performed in accordance with Manufacturer's standards.

5. Work is to be performed by persons qualified in accordance with manufacturer's qualifications/instructions and/or other detailed instructions or project/component specific requirements.

6. Work is to be performed by persons qualified to achieve the more restrictive tolerances of specific project requirements, project standards or project workmanship.

7. Work is to be performed by persons qualified to operate specialized equipment and/or machinery to provide proper handling, rigging, lifting, and transportation of components by approved methods.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

1. The City reserves the right to request removal of any personnel and/or firm, not deemed competent by City staff.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide all labor, materials, and equipment necessary to dewater trench and structure excavations, in accordance with the requirements of the contract Documents. The Contractor shall secure all necessary permits to complete the requirements of this Section of the Specifications. Refer to Specification Sections 01065 – Permits & Fees and Section 01066 – NPDES Requirements.

1.02 QUALITY CONTROL

1. It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

2. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.

3. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement, which may develop. The responsibility for conducting the dewatering operation in a manner, which will protect adjacent structures and facilities, rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

4. All dewatering shall comply with the regulations of the South Florida Water Management District and any other agency with jurisdiction.

PART 2 -- PRODUCTS

2.01 EQUIPMENT

1. Dewatering may include the use of well points, deep wells, and temporary pipelines for water disposal. The temporary pipelines shall not be used as permanent piping for the WORK. Standby pumping equipment shall be maintained on the jobsite.

PART 3 -- EXECUTION

3.01 GENERAL REQUIREMENTS

1. The Contractor shall provide all equipment necessary for dewatering. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to assure

efficient dewatering and maintenance of dewatering operation during power and or mechanical failure.

2. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

3. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

4. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

5. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with crushed rock meeting FDOT Specification No. 57 gradation requirements.

6. The Contractor shall maintain the water level one-foot below the bottom of excavation in all work areas where groundwater occurs during excavation, construction, backfilling, and testing.

7. The Contractor shall prevent flotation by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages, which may result from failure to adequately keep excavations dewatered.

8. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. Well points cannot be jetted in with City irrigation water. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. IMMEDIATELY UPON WITHDRAWAL OF WELL POINTS, THE Contractor SHALL BACKFILL THE HOLE WITH CLEAN SAND, BEDDING ROCK MEETING FDOT No. 89 GRADATION REQUIREMENTS OR EQUAL.

9. The Contractor shall dispose of water from the WORK in a suitable manner without damage to adjacent property. The Contractor shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction unless hydraulic compaction is employed as their means of compaction and with prior approval of the City. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system.

10. The reestablishment of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.

11. Contractor shall provide sound attenuating structures for the above ground pumps as required and directed by the City.

- END OF SECTION -

SECTION 02150

TRENCH SAFETY

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide Trench Safety in accordance with the Florida Trench Safety Act to ensure worker safety at the construction site. The Contractor shall be responsible for the implementation and maintenance of trench safety standards.

1.02 SUBMITTALS

1. The Contractor shall prepare and submit a trench safety plan which shall include the means to be utilized and the conditions determining which type of trench safety standard(s) will be used during construction.

2. The trench safety plan shall include the names, positions, experience, and training information of "Competent Persons", who shall assure the implementation of the measures and standards for complying with the Florida Trench Safety Act.

PART 2 -- PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 The Contractor shall provide Trench Safety measures as required and shall maintain the necessary supervision on site at all times to assure the Trench Safety requirements are being implemented on their project. The Contractor shall monitor his Subcontractors to assure they comply also with the Florida State Trench Safety Act.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall perform all earthwork indicated and required for construction of the work, complete and in place, in accordance with the Contract Documents. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform the work.

2. The Contractor shall examine the site and review the results of subsurface investigations provided including soil borings, prior to commencing the work. In particular, the Contractor shall make a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which may arise as a result of nearby water courses and flood plains, especially in areas where construction activities may encounter water bearing sands and gravels. The Contractor shall make his own investigations necessary to determine ground conditions at the project site.

3. Any damage caused by the Contractor's excavation, backfill, or compaction efforts will be the sole responsibility of the Contractor to repair, at no expense to the city.

1.02 QUALITY CONTROL

1. The Contractor shall engage the services of a qualified testing firm which is approved by the City of Cape Coral to provide quality control testing and inspection services during earthwork operations as required in the Contract Documents. The Contractor shall provide the testing firm access to the site and earthwork under construction at such times as the testing firm requests and as necessary for testing of the work.

1.03 QUALITY ASSURANCE BY OTHERS

1. The city may utilize its own personnel or retain its own testing firm to perform quality assurance of the quality control functions performed by the city. The quality assurance function is to confirm and document the accuracy of testing provided by the Testing Laboratory. The City and the Contractor shall cooperate with the City's quality assurance program and shall provide access and samples when requested.

1.04 CONTRACTOR SUBMITTALS

1. The Contractor shall provide access for the Testing Laboratory to the source location of all bedding and backfill materials proposed to be used in the work in accordance with the requirements in Section 01300 - Contractor Submittals. The sample sizes shall be as determined by the Testing Laboratory.

2. The Contractor shall provide submittals for any alternative methods of placement of materials, in accordance with the requirements in Section 01300 - Contractor Submittals.

3. 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 Engineer.

4. Submit to the Engineer for review the Report, as performed by a Professional Engineer, that indicates all muck has been removed from the proposed project area and that backfilling has been conducted in substantial accordance with the project specifications herein.

PART 2 -- PRODUCTS

2.01 MATERIAL REQUIREMENTS

1. General: Materials for use as bedding and backfill, whether insitu or borrow, shall be as described herein. Fill, backfill, and embankment materials shall be suitable materials selected from the onsite operations or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other organic material.

2. Common Fill: Common fill material shall be non-cohesive and shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash and other objectionable material which may be compressible, or which cannot be properly compacted. Common fill shall not contain stones larger than 6 inches in any dimension, asphalt, broken concrete, masonry, rubble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally, common fill shall be no more than 12 percent by weight finer than the No. 200 mesh sieve unless finer material is approved for use in a specific location by the City.

3. Select Common Fill: Select common fill material shall be as specified above from common fill, with the exception that the material shall contain no stones more than 1-1/2 inches in largest dimension and shall be no more than 5 percent by weight finer than the No. 200 mesh sieve.

4. Bedding Rock: Bedding rock material used in pipe trench within pipe zone, under abutments, and under concrete structures shall be crushed stone or gravel meeting the gradation and durability requirements of FDOT No. 89 and FDOT No.57 stone, as indicated on the Contract Drawings. With written approval from the City, number 131 and 132 Screenings may be substituted for FDOT No. 89 and FDOT No. 57 stone.

5. Structural Fill: Materials for structural fill shall be bedding rock or select common fill as specified herein or suitable material as approved by the City.

6. Unsuitable Material: Materials deemed not suitable for use on the project by the City.

2.02 USE OF FILL, BACKFILL, AND BEDDING MATERIAL TYPES

1. Backfill and bedding material types shall be used as indicated in the Drawings.

2. Structural Fill shall be used as backfill against the exterior walls of structures, or as shown on the Contract Drawings.

PART 3 -- EXECUTION

3.01 EXCAVATION - GENERAL

1. General: Excavation shall include the removal of all existing soil materials encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of these materials shall conform to the lines and grades indicated in the Contract Drawings. Where indicated, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the Florida Trench Safety Act and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926). The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations.

2. 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 City is of the opinion that sufficient or proper supports have not been provided, the City 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 besides 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 City.

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 Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall conform to the design, and certification of this shall be provided by the Professional Geotechnical Engineer. The city reserves the right to require sheeting and bracing where it is deemed necessary, at the sole discretion of the City.

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 City 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 city 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 City.

G. The right of the City 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.

3. Pumping and Drainage

A. All dewatering activities shall be in accordance with specification 02140, when applicable.

B. 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. 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 City or the authority having jurisdiction, at no cost to the City.

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 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

1. General: Excavations shall conform to the elevations and dimensions shown on the Contract Drawings within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing formwork, installation of piping services and other construction, and inspection. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.

2. Excavation for Structures and Embankments: Except where otherwise indicated for a particular structure, excavation shall be carried to the grade of the bottom of the footing or slab. Where unsuitable materials are encountered at the bottom of a footing or slab, areas beneath the structures or fills shall be over-excavated and backfilled to grade with Structural Fill material compacted to the requirements of the adjacent fill material.

3.03 PIPELINE AND UTILITY TRENCH EXCAVATION

1. General: Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches as indicated in the Contract Drawings.

2. Trench Bottom: The bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe bedding.

3. Open Trench: The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. For open trenches greater than 500 feet in length, pre-approval from the City of Cape Coral must be obtained. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. If steel plates are used, no more than 40 feet in length along the trench will be allowed. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located more than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades, orange safety fences, and warning lights meeting safety requirements shall be provided and maintained.

4. Over-Excavation: Where trenches or excavations are required to be over-excavated to remove unsuitable materials, the excavation shall be to the minimum depth required to remove the unsuitable material and shall be backfilled with common fill to the grade of the bottom of the pipe bedding as indicated in the Contract Drawings. Classification of the material as unsuitable shall be made by a City approved testing laboratory based on test results and or inspection of the material in the excavation at the time of construction.

5. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

3.04 ROCK EXCAVATION

1. Rock excavation shall include removal and disposal of the following:

   A. All boulders and rock, which require breaking by the use of special equipment or extraordinary excavation methods (may include hammers, wrecking balls, rock trenchers, drills, or other approved equipment).

   B. All rock material in ledges, bedding deposits, and unstratified or conglomerate masses which cannot be removed using normal excavation methods and equipment.

2. Rock excavation shall be performed by the Contractor. The cost for removal and disposal shall be included in the Contractor's Bid Price

3. Blasting will not be permitted without prior written authorization of the city.

3.05 DISPOSAL OF EXCESS EXCAVATED MATERIAL

1. The Contractor shall remove and dispose of all excess excavated material not suitable or required for use on the project at a site selected and obtained by the Contractor at his own expense. The removal shall be timely, and the disposal of all excess excavated materials shall be performed at least once a month.

2. Backfill replacement for unsuitable materials shall be provided from excess common fill available from on-site stockpiles. Refer also to Section 02100 – Site Preparation.

3. The Contractor shall obtain all required permits, landowner, and agency approvals for disposal of excess excavated material and shall pay all costs associated with the removal and disposal.

4. Depositing clean fill on private property within the City of Cape Coral limits will not be permitted unless the property owner possesses a current building permit that requires fill. Contractors shall provide proof of said permit to the Engineer for review and approval prior to placing clean fill on the permitted property.

3.06 BACKFILL - GENERAL

1. The Contractor shall examine the areas and conditions under which excavating, filling and grading are to be performed, and shall not proceed with the work until unsatisfactory conditions have been corrected. The Contractor shall examine existing grade prior to commencement of the work and report to the City if elevations of existing grade vary from elevations shown on the Drawings.

2. The Contractor shall employ a qualified testing laboratory for all testing required. The Contractor shall notify the City a minimum of 48 hours in advance of any scheduled testing.

3. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength (minimum of 75% of the 28-day design strength) to support the loads imposed.

4. Except for rock bedding materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation, and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.

5. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally, The Contractor shall not drag trench

   shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.

6. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock materials removed. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

7. The surface of filled areas shall be graded to smooth true lines, strictly conforming to

grades indicated on the Drawings. No soft spots or uncompacted areas will be allowed in the work.

8. Backfill shall be compacted to 98 percent of maximum density (AASHTO T-180) under structures and paved areas, and 95 percent of maximum density (ASSHTO T-180) elsewhere unless otherwise indicated on the drawings.

3.07 PLACING AND SPREADING OF BACKFILL MATERIALS

1. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that when compacted, each layer shall not exceed 6 inches in thickness. Thicker lifts of backfill may be permitted when the Contractor has satisfactorily demonstrated that proper compaction has been achieved with the methods and materials in use. The use of thicker lifts will be at the sole discretion of the City.

2. The use of flooding and jetting methods to achieve compaction may be permitted upon approval. The Contractor shall submit methods documenting procedures to be utilized for approval to the Engineer and for the City for final approval.

3. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Backfill around pipes shall be manually spread around the pipe so that when compacted the backfill will provide uniform bearing and side support.

4. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved.

5. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

   A. Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength (minimum of 75% of the 28-day design strength).

   B. Bedding rock shall be used for bedding under all structures and pipe as indicated 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 the bedding.

   C. In locations where pipes pass through structure walls, Structural Fill shall be placed for a distance of not less than 3 feet either side of the vertical center line of the pipe and the Contractor shall make special efforts to consolidate the fill up to the horizontal centerline of the pipe.

3.08 COMPACTION OF FILL, BACKFILL, AND BEDDING MATERIALS

1. Any damage caused by the Contractor's compaction efforts will be the sole responsibility of the Contractor to repair, at no expense to the city.

2. Each layer of backfill materials shall be compacted to the density indicated on the Drawings. A compacted effort approved by the City shall be employed to compact backfill layers before the water table is reestablished. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.

3. Hydraulic compaction will be an acceptable alternative under certain soil conditions. Contractor shall submit methods to the City for approval.

4. Flooding, ponding, or jetting shall not be used for backfill around structures, for final backfill materials, or aggregate base materials without written authorization of the City.

5. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

3.09 PIPE AND UTILITY TRENCH BACKFILL

1. Backfilling over and around pipes shall begin as soon as practical after the pipe has been laid, jointed and inspected.

2. After compacting the bedding, the Contractor shall perform a final trim using a string line or other method for establishing grade, such that each pipe section when laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells shall be made as required.

3. Bedding and backfill under, around and over pipes shall be compacted using light, hand operated, vibratory compactors and rollers. After completion of at least two feet of compacted backfill over the top of pipeline, heavier compaction equipment may be used to complete the trench backfill.

4. If a moveable trench shield is used during backfill operations the shield shall be lifted so as to not displace the pipe or backfill while the shield is being moved.

3.10 FILL AND EMBANKMENT CONSTRUCTION

1. The area where a fill or embankment is to be constructed shall be cleared of all vegetation, roots and organic material. The surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers. Each layer shall be moistened or aerated, as necessary. Each layer shall not exceed 6 inches of compacted thickness. The embankment, fill, and the scarified layer of underlying ground shall be compacted.

2. When an embankment or fill is to be made and compacted against hillsides or fill slopes steeper than 4:1, the slopes of hillsides or fills shall be horizontally benched to key the

embankment or fill to the underlying ground. A minimum of 12 inches normal to the slope of the hillside or fill shall be removed and re-compacted as the embankment or fill is brought up in layers. Material thus cut shall be re-compacted along with the new material at no additional cost. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

3. Where embankment or structure fills are constructed over pipelines, the first 2 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe. Heavy construction equipment shall maintain a minimum distance from the edge of the trench equal to the depth of the trench until at least 2 feet of fill over the pipe has been completed.

3.11 QUALITY CONTROL TESTING

1. Compaction Tests: Three compaction test locations shall normally be required for each lot. A Lot shall not exceed 300 linear feet of pipe or 100 square feet of backfill around structures, or as shown on the Drawings. The locations of the compaction tests within the trench shall be in conformance with the following schedule:

   A. One test at the spring line of the pipe.

   B. One test at an elevation of one foot above the top of the pipe.

   C. One test for each 2 feet of backfill placed from one foot above the top of the pipe to finished grade elevation.

   D. At least two test locations are required for each trench crossing existing pavement.

   E. Manholes, Wet Wells, and Vaults: A minimum of two tests for every 2 twelve-inch (12") lifts of backfill. Tests will be taken no less than 6 inches or no more than 3 feet away from each structure alternating around the structure.

2. Lift Station Pads. Prior to placement of concrete pads, a minimum of one test will be taken for each pad. Lift Station Pads shall be treated as structures for the purposes of determining density.

3. In case the test of the fill or backfill show non-compliance with the required density, the Contractor shall accomplish such remedy as may be required to ensure compliance.

4. The Contractor shall provide test trenches and excavations including excavation, trench support, and groundwater removal for the soils testing operations. The trenches and excavations shall be provided at the locations and to depths required by the testing firm. All work for test trenches and excavations shall be provided at no additional cost.

END OF SECTION

SECTION 02269

TEMPORARY EROSION CONTROL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The CONTRACTOR shall provide effective temporary erosion control and sediment control measures during construction or until permanent erosion controls become effective so as to prevent pollution of water, detrimental effects to public or private property adjacent to the project and damage to WORK on the project.

2. The CONTRACTOR'S attention is called for complying with all necessary NPDES requirements during the execution of the WORK.

3. All temporary erosion control measures shall be in accordance with FDOT specifications section 104 and 125. If a conflict exists between the FDOT and the City Specifications, the Contractor shall bring that discrepancy to the attention of the City for clarification prior to construction.

4. Related Specification Sections:

   A. 01066 - NPDES Requirements

   B. 01300 – CONTRACTOR Submittals

   C. 02920 – Restoration

1.02 CONTRACTOR SUBMITTALS

1. Submittals shall be in accordance with Section 01300 - CONTRACTOR Submittals.

2. Product Data: Manufacturer's catalog sheets on geotextile fabrics.

PART 2 – PRODUCTS

2.01 GENERAL

1. Temporary erosion and water pollution control features consist of, but are not limited to, temporary grassing, temporary sodding, temporary mulching, turbidity barriers, and silt fence.

2.02 SEEDING AND SODDING

1. Seeding and sodding material will be in accordance with Section 02920-Restoration.

2.03 FILTER FABRIC

1. Fabric shall be woven or non-woven consisting of long-chain polymeric filaments or yarns such as polypropylene, polyethylene, polyester, or polyamide. The base plastic shall contain stabilizers and/or inhibitors to make the filaments resistant to deterioration due to ultra-violet light, heat exposure and chemicals. The fabric shall be free of any treatment that may significantly alter its physical properties. The edges of the fabric shall be salvaged or otherwise finished to prevent the outer yarn from pulling away from the fabric.

2. Fabric shall have the following properties:

Parameter	Standard Method	Value
Grab tensile strength	ASTM D 4632	100 lb.
Burst strength	ASTM D 3786	200 psi
Apparent opening size	ASTM D 4751	Between 200 and 70 sieve size

3. Fabric Manufacturer, or City Approved equal:

   A. Mirafi

2.04 FENCING

1. Woven wire fabric fencing shall be galvanized, mesh spacing of 6 inches, maximum 14- gauge, at least 30 inches tall.

2.05 FASTENERS

1. Fasteners to wood posts shall be steel, at least 1 1/2 inches long.

2. Fasteners to steel posts shall be galvanized clips or tie wire.

2.06 SYNTHETIC BARRIERS

3. All synthetic barriers shall be in accordance with FDOT Standard Specifications section 104. The use of hay bales is not permitted.

PART 3 -- EXECUTION

3.01 GENERAL

1. The CONTRACTOR shall prevent pollution of streams, canals, lakes, reservoirs, and

other water impoundments with fuels, oils, bitumen's, calcium chloride, or other harmful materials. The CONTRACTOR shall conduct and schedule operations to avoid or otherwise minimize pollution by siltation.

2. Provide and maintain, for the duration of the project, erosion control barriers as required to prevent erosion and silt loss from the Site. Erosion control measures shall remain in place until an adequate stand of grass has been established, per FDOT standards.

3. The CONTRACTOR shall not commence clearing, grubbing, earthwork, or other activities that may cause erosion until barriers are in place.

3.02 SEEDING AND SODDING

1. Seeding and sodding shall be placed in accordance with Section 02920-Restoration.

3.03 HANDLING AND STORAGE

1. The geotextile fabric shall be wrapped in a protective covering which is sufficient to protect it from sunlight, dirt, and other debris during shipment and storage.

3.04 INSTALLATION

1. Barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

2. Attach the woven wire fencing to the posts that are spaced a maximum of 6 feet apart and embedded a minimum of 12 inches. Install posts at a slight angle toward the source of the anticipated runoff.

3. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. Lay fabric along the edges of the trench. Backfill and compact.

4. Securely fasten the fabric materials to the woven wire fencing with tie wires or galvanized clips.

5. Reinforced fabric barrier shall have a minimum height of 18 inches.

6. Provide the filter fabric in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

3.05 MAINTENANCE

1. Regularly inspect and repair or replace damaged components of the barrier. Unless otherwise directed, maintain the erosion control system until final acceptance; then remove erosion and sediment control systems promptly.

2. Remove sediment deposits when silt reaches a depth of 6 inches or 1/2 the height of the

barrier, whichever is less. Dispose of sediments at an acceptable site arranged by the CONTRACTOR that is not in or adjacent to a stream, floodplain, canal, lake, reservoir, or other water impoundments.

3. During periods of heavy rain, the CONTRACTOR shall monitor the temporary erosion control measures to ensure that they are not causing localized flooding. The CONTRACTOR may be required to cut slits in the fabric to drain flooded areas. Fabric shall be replaced after heavy rain events.

- END OF SECTION -

SECTION 02340

BORING AND JACKING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide bored and jacked steel casing, complete and in place, in locations as shown on the Contract Drawings and General Details. Pipe installation within the steel casing shall be in accordance with the requirements contained within this Section and the applicable portions of other Sections. Casings may also be installed by open cut methods for future driveways for new construction. Bedding material is not required on direct buried casings.

2. In the performance of the Work, the Contractor shall comply with the requirements of the affected railway companies, public agencies, and owners of public utilities or other facilities for the safeguarding of traffic and improvements which might be endangered by the boring and jacking operations. Approach trenches and jacking pits in public streets will not be permitted to remain open for extended periods of time and must be covered at night and other non-working hours. All excavations in public streets must comply with the applicable Maintenance of Traffic and permit requirements.

3. If the Contractor is not ready to place the carrier pipe in the casing at the time of completion of boring and jacking operations, the ends shall be bulkheaded, and the approach trenches shall be backfilled, temporary surfacing placed thereon, and the affected portion of the street reopened to traffic.

4. The Contractor shall be responsible for maintaining the required line and grade, and for preventing settlement of overlying structures, or other damage due to the boring and jacking operations.

5. Depending on circumstances the City may allow an open cut methodology of local roads, however all pipe placed under pavement in City owned right of way and easements shall be ductile iron pipe.

6. Special written permission must be obtained by the City's transportation division for any proposed open cuts on collectors and major arterial roadways.

1.02 BORING AND JACKING AT CONTRACTOR'S CONVENIENCE

1. The Contractor may choose for his own convenience to install additional pipes and/or casing by boring and jacking at locations in addition to those shown on the Drawings. The Contractor shall request permission, in writing, for any such operation at least 3 days prior to installation. Payment for such operations will be considered only for the items of Work normally included in an open cut operation, these being the installation of the pipe,

2. restoration of the grass or sod and restoration of the driveway or pavement. The quantity of pavement patching will be based on the typical top width of the trenches above to the

boring operation multiplied by the length of the pipe or casing installed by the bore and jack method. The quantity of restoration will be based on the linear foot of pipe under non-paved areas above the boring operation.

3. The Contractor may jack and bore under driveways with the casing extending not more than depicted in the Contract Drawings and General Details on either side of the driveway. Where restrained joints are required on the piping, the carrier pipe shall be restrained. The casing shall be sized to accommodate the carrier pipe restraint system. The piping length inside the casing shall not be included in the restraining length calculation.

4. Where restrained joints are not required on the piping, no more than one unrestrained joint shall be allowed in the casing.

1.03 EXISTING FACILITIES AND UTILITIES

1. Contractor shall undertake the following steps prior to commencing boring and jacking operations in this project location that contains existing underground facilities.

   A. Contact the utility location/notification service and other agencies as required for the construction area.

   B. Positively locate and stake all existing lines, cables, or other underground facilities including exposing any facilities which are located within 10 feet of the designed jack and bore path.

   C. Modify boring and jacking practices to prevent damage to existing facilities.

2. Contractor shall be responsible for locating any and all underground facilities regardless of any previous efforts in this regard. Contractor shall be responsible for all losses and repairs occasioned by damage to underground facilities resulting from boring and jacking operations.

1.04 SHOP DRAWINGS

1. Shop Drawings: The Contractor shall submit shop drawings of pipe casing in accordance with the requirements in Section 01300 - Contractor Submittals, and the following supplemental requirements as applicable:

   A. Installation Plan which includes schedules of excavation, pipeline installation, and backfill operations.

   B. Material list including diameter, thickness, and class of steel casing.

   C. Detailed locations and sizes of all boring and jacking and receiving pits.

   D. Permits associated with the boring and jacking operations.

   E. Letters of notification to all other utilities within the limits of construction

2. Certifications: Welders qualifications per ANSI/AWS D.1.1

1.05 QUALITY CONTROL

1. Boring and jacking operations shall be done by qualified personnel with sufficient experience involving Work of a similar nature. Documentation of prior work experience shall be provided to the City of Cape Coral.

2. The Contractor shall give the City a minimum of 3 days advance notice of the start of excavation or boring operations.

3. Work shall be performed in the presence of the City, unless granted prior approval to perform such Work in its absence.

4. Welding Requirements: Welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the type of materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local agency prior to commencing Work on the casing or pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests. The Contractor shall be responsible for all material and bear the expense of qualifying welders.

PART 2 -- PRODUCTS

2.01 GENERAL

1. The steel pipe casings shall be new and conform to ASTM A 139, straight seam, Grade B with a minimum 35,000 psi yield strength or equal, subject to the following supplemental requirement: The Contractor may recommend to the Utilities a greater diameter or thickness or different material for the method of Work and loadings involved, site conditions, and possible interferences.

2. Casing spacers shall be manufactured by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** and shall be sized to fit the carrier pipe and casing.

3. Each end of the steel casing shall be equipped with electronic markers as manufactured by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.** Markers should not be located more than four (4) feet deep.

4. Casing pipe ends shall be sealed in accordance with the General Details.

PART 3 – EXECUTION

3.01 INSTALLATION OF STEEL CASING

1. Jacking Pit: The excavations for the boring or jacking operations shall comply with the Florida Trench Safety Act, shall be adequately shored to safeguard existing substructures and surface improvements, and ensure against ground movement in the vicinity of the jack supports. Heavy guide timber, structural steel, or concrete cradles of sufficient length shall be provided to assure accurate control of boring or jacking alignment. The Contractor shall

provide adequate space within the excavation to permit the insertion of the lengths of casing to be bored or jacked. Timbers and structural steel sections shall be anchored to ensure action of the jacks in line with the axis of the casing. A bearing block, consisting of a timber or structural steel framework, shall be constructed between the jacks and the end of the casing to provide uniform end bearing over the perimeter of the casing and distribute the jacking pressure evenly.

2. Control of Alignment and Grade: The Contractor shall control the application of the jacking pressure and excavation of materials ahead of the casing as it advances to prevent the casing from becoming earthbound or deviating from the required line and grade. The Contractor shall restrict the excavation of the materials to the least clearance necessary to prevent binding in order to avoid loss of ground and consequent settlement or possible damage to overlying structures. Allowable grade deviations in horizontal and vertical alignments shall be no greater than 0.2 feet per 100 feet in any direction over the length of the jacking or boring to a maximum deviation of 0.5 feet at any point.

3. Installation: The installation of the casing shall be in accordance with the Contract Documents and be subject to the approval of the agency having jurisdiction over the area containing the boring and jacking operations.

3.02 INSTALLATION OF CARRIER PIPE

1. Carrier pipe shall be installed in accordance with the instructions of the pipe spacer manufacturer. After jacking equipment and excavated materials from the boring or jacking operations have been removed from the jacking pit, the Contractor shall prepare the bottom of the jacking pit as a pipe foundation. The Contractor shall remove loose and disturbed materials below pipe grade down to undisturbed earth and shall re-compact the material in accordance with Section 02200 - Earthwork.

END OF SECTION

SECTION 02347

HORIZONTAL DIRECTIONAL DRILLING

PART 1 – GENERAL

1.01 THE REQUIREMENT

1. All horizontal direction drills shall require written pre-approval from the City of Cape Coral.

2. The Contractor shall obtain all necessary permitting prior to performing and directional drilling. A separate permit with the City of Cape Coral is required for all directional drills.

3. This Section provides the minimum requirements for installing the utilities by horizontal directional drilling (HDD).

4. The Work of this Section includes all labor, machinery, construction equipment, material, and appliances required to perform, in a good workmanlike manner, all horizontal directional drilling delineated in the Drawings.

   A. The overall Work scope shall include, but not be limited to, directional boring (drilling) equipment, boring pits and equipment, sheeting, supporting, location signs as required, miscellaneous appurtenances to complete the entire Work as shown on the Drawings, and restoration, including irrigation system replacement. Directional boring operations shall be performed within the right-of- way and/or easements shown on the Drawings.

   B. The equipment used in directional boring, also known as Horizontal Directional Drilling, shall be of adequate commercial size and satisfactory working condition for successful operation, in conformance with the local, state, and federal safety requirements, and may be subject to approval by the State or County at the discretion of the City. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workmen experienced in directional boring operations shall be used in performing the Work.

   C. The Contractor shall expect to install the specified HDD crossings in the material as described in the borehole logs and subsurface information included in the Contract Documents. The Contractor attests to the practicality and feasibility of the Contractor's selected method based on the available soil and subsurface data/conditions and/or any other investigations and analysis performed by the Contractor or others.

   D. Furnish structures, safety equipment, and professional services required to provide for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the regulatory agencies having jurisdiction.

E. Take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, and appurtenances from damage due to directional boring work. Responsibility and payment for correction of such damage shall be the sole responsibility of the Contractor.

F. The Directional Boring work is to be performed in a manner to eliminate the discharge of water, drilling mud, and cuttings to water channels, bodies or to the land areas involved during the construction process.

G. The HDD pipe shall be installed at a radius no more than 80% of the manufacturer's maximum recommended value.

H. The Contractor shall attach three (3) continuous 10-gauge UF solid insulated braided copper tracer wires to the pipe prior to directional drill.

I. The Contractor shall record location and depth at intervals of ten (10) feet over the course of the bore.

1.02 RELATED WORK

1. Section 02200 - Earthwork

2. Section 02594 - High Density Polyethylene (HDPE) Pipe

3. Section 02599 - Irrigation Water Pipe

4. Section 02666 - Pressure Pipe Testing and Disinfecting

1.03 QUALIFICATIONS

1. Contractor Qualifications and Experience: The Contractor shall have demonstrated successful experience installing pipelines using the horizontal directional drilling process on at least five (5) projects with similar diameters, installation lengths, and ground and groundwater conditions. The Contractor shall demonstrate successful completion of at least three (3) projects where HDPE pipe was installed with horizontal directional drilling techniques.

1.04 CONTRACTOR SUBMITTALS

1. Submit shop drawings in accordance with Section 01300 – Contractor Submittals. Submittals requiring the ENGINEER's review shall be submitted to the City, prior to commencing any horizontal directional drilling activities at the crossing location.

2. Submit list and description of materials and equipment to be used.

3. Submit written documentation of Contractor's qualifications for company and personnel experience in accordance with Article 1.03.1 of this Section. Submit evidence of OSHA certification for the Site Safety Representative.

4. The Contractor shall prepare and submit an installation plan indicating, but not limited to, the following: construction schedule, the location and limits of installation pits, pit support system, mitigation plan for potential operation induced damages to adjacent utilities/structures (settlement, frac out, heave, fluid leak), equipment and material to be used, and a general procedure to be used in the installation to the City for review. Upon completion, the Contractor shall submit all data from the locator/tracking system including the location and depth measurements every ten (10) feet over the course of the bore.

PART 2 -- PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE PIPE

1. Installed pipe shall be as described in Section 02594 - High Density Polyethylene (HDPE) Pipe.

2.02 HDPE / PVC TRANSITION

1. In accordance with the General Details.

2.03 DRILLING FLUID

1. The drilling fluid shall be a Bentonite/water slurry that is totally inert and poses no environmental risk. Technical criteria for the Bentonite slurry shall be as described in API Specification 13A, “Specification for Oil Well Drilling Fluids Material” for fresh water drilling fluids.

2. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor’s drilling plan presented to the city for review. The City retains the right to sample and monitor the waste drilling mud, cuttings, and water.

3. Disposal to be off-site and in accordance with all Local, State, and Federal regulations.

2.04 DRILL PIPE

1. Drill pipe shall be API Steel Drill Pipe, Range 2, premium class or higher, Grade S-135 in diameter, with sufficient strength to withstand the maximum rated pullback and pushing load of the drilling equipment. Drill pipe joints shall be flush and capable of transmitting maximum rated torque of the drilling equipment.

2.05 DRILLING EQUIPMENT

1. The directional boring equipment shall be suitable for installing pipe sizes as denoted on the Drawings or the Contractor submitted and approved HDD plan.

2. The Contractor shall provide all materials for completing the installation and for adequate protection of the Work.

3. Drilling equipment shall have a maximum sound power level of 72 dBA (as defined in ANSI S1.4) at 10 feet. Measure sound power level in accordance with ISO 3740 and 3744.

4. Mixing, pumping, and holding/separation tanks shall be capable of delivering mixed drilling fluid to the cutting head. Drilling fluids circulating equipment shall be designed to minimize spillage.

2.06 DOWNHOLE TOOLS

1. Cutting heads, back reamers, and hole openers shall be suitable for the soil conditions anticipated by the Contractor.

2. Grips, pulling heads, and swivels shall be compatible with the pipe material. Design shall transmit the maximum rated pullback force of the equipment used without distortion. Grips, pulling heads, and swivels shall be specifically engineered for directional drilling applications.

3. Tracking equipment shall be capable of determining the location of the cutting head within ±3 inches horizontally and vertically.

2.07 WATER

1. Contractor is responsible for obtaining, transporting, and storing of any water required for drilling fluids.

2. It will be the responsibility of the Contractor, to legally dispose of any excess water, left over from HDD activities.

PART 3 -- EXECUTION

3.01 GENERAL

1. The Contractor shall comply with Florida's "Trench Safety Act" in the performance of all Work. The Contractor shall be responsible for the design, installation, maintenance and removal of any sheeting and shoring necessary for the drilling operation, including fluid containment and permitted disposal practices.

3.02 INSTALLATION

1. The pipe shall follow the line and grade shown in the Drawings or the Contractor submitted and approved HDD plan, and shall exit the ground within 1 foot of the design location.

2. Install the pipe in a manner that does not cause upheaval, settlement, cracking, movement, or distortion of the surface materials including bridge walls, rock and concrete retaining walls, channel bottoms, and other structural improvements.

3. Locate the entrance and exit pits within the City's right-of-way.

3.03 EARTHWORK AND TRENCHING

1. Accomplish trenching and earthwork in accordance with Section 02200 - Earthwork.

3.04 PIPE JOINING

1. For HDPE/PVC Transition connections, refer to Standard Details in the Drawings.

2. For HDPE Pipe, refer to Section 02594 – High Density Polyethylene (HDPE) Pipe.

3. Where the staging area permits, join entire length of pipe to be pulled through bore prior to commencement of pullback operation. If not feasible because of the length of the bore and the size of the staging area, each pipe section may be fused or welded to the previous section before the pull back. Support weight of joined pipe suspended on rollers to minimize pulling forces.

3.05 PRE-BORE AND POST-BORE PRESSURE TESTING

1. Prior to pulling the HDPE pipe through the directional bore hole, the pipe shall be pressure tested in accordance with Section 02666 – Pressure Pipeline Testing and Disinfection. Perform pressure testing again after final installation of the HDPE pipe and before final acceptance by the City. Only potable water shall be used for testing any part of the potable water system.

2. At the Contractor's option, pipe need not be pressure tested before pulling the pipe through the bore hole. In such case, if the pipe does not pass the pressure test after installation, then remove the entire pipe from the bore hole, repair the pipe, and perform pressure testing prior to reinstalling the pipe and again after reinstallation, at no additional cost to the City.

3.06 PILOT BORE

1. Construct a pilot bore at least 6 inches in diameter at the centerline alignment and grade as shown in the Drawings. Circulate drilling fluids to maintain an open bore at all times. If the path of the pilot bore is successfully completed, then proceed with the reaming procedure, and pull the pipe from the receiving location (exit pit) to the sending location (entry pit). If the pilot bore could not be successfully completed, then do not proceed with the reaming procedure until the City, Engineer and Contractor have met to discuss alternative options for the pipeline. The pilot bore and reaming procedure shall be controlled by a magnetic survey system including accelerometers, magnetometers, connector wire, and survey probe. The guidance system shall be capable of measuring depth, location, pitch, and roll of the bore and shall be able to indicate depth up to 40 feet.

2. As-Built Survey: At the completion of pilot hole drilling, the Contractor shall submit tabulation and drawings(s) of coordinates referenced to the drilled entry point, which accurately describe the location of the pilot hole, the drilled exit point, the transition points between pipe material changes, and the lowest point of the pilot hole to the City for review.

3.07 DRILLING FLUIDS

1. During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. These fluids must not be discharged into the waterways. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions. Drilling fluid pressure in the borehole shall not cause any leakage to the adjacent utilities; Contractor will be responsible for repair of all the related damages. All drilling operations shall occur within the right of way or City owned easement, including temporary construction easements.

3.08 BACKREAMING AND PIPE INSTALLATION

1. Upon completion of an acceptable pilot hole, the hole opening or enlarging phase of the installation shall begin. The borehole diameter shall be increased to accommodate the pullback operation of the HDPE pipe. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the Contractor's discretion.

2. The pipes shall be assembled in a manner that does not obstruct adjacent roads or City, and/or public activities adjacent to the layout areas.

3. The Contractor shall provide adequate support/rollers along the stringing area to support the required length of the HDPE pipe for each bore. Such support/rollers shall be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback.

4. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining. See Sections 02594 - High Density Polyethylene (HDPE) Pipe for additional requirements on HDPE pipe.

5. Pulling Loads: The maximum pull (axial tension force) exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not overstressed.

6. Torsion and Stresses: A swivel shall be used to connect the HDPE pipeline and tracer wires to the drill pipe to prevent torsional stresses from occurring in the pipe.

7. Pipeline Support: The pipelines shall be adequately supported during installation so to prevent overstressing or buckling.

8. The Contractor shall at all times handle the HDPE pipe in a manner that does not overstress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 80% of the manufacturer's maximum recommended value for yield stress for flexural

bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.

9. During the pullback operation, the Contractor shall monitor roller operation and sidebooms if required to assist movement of the HDPE pipe. Surface damage shall be repaired by Contractor before pulling operations resume.

10. The lead end of the pipe shall be closed during the pullback operation.

11. After the carrier pipe is completely pulled through the tunnel, a sufficient relaxation period, as recommended by the specified pipe manufacturer, shall be provided prior to the final pipe tie- in.

12. The Contractor shall install, maintain, and leave in place any sheeting, underpinning, cribbing, and other related items (other than that required for the boring and receiving pits) to support any structure or facility affected by the boring operations. The City, depending upon existing conditions, may require that additional sheeting for the excavation be left in place.

13. Contractor shall hydrostatically test each line in accordance with the testing procedures defined in the Specification Section 02666 – Pressure Pipeline Testing and Disinfection. Pressure and temperature shall be monitored with certified instruments during the test.

3.09 NEARBY UTILITIES

1. Nearby Utilities: The Contract Drawings show existing buried utilities that are believed to be near the directional drill alignment. There is no guarantee that these utilities are located as shown or that other utilities may not be present. It will be the Contractor's responsibility to locate all nearby utilities or other subsurface obstructions (such as retaining wall tie backs, and anchors) that may interfere with the Work by excavating windows on the pipeline alignment or other means. Additionally, the Contractor shall be required to supply proof of written notices to all potential utilities within the limits of construction to the City of Cape Coral and the City's Engineering Inspector. The Contractor shall accept responsibility for any and all damage of utilities caused by construction.

2. Monitoring Nearby Utilities: The nearby utilities within the zone of influence of construction (depending on the depth and diameter of the HDD hole) shall be monitored and surveyed by the Contractor prior to construction to set up the baseline and during construction to adjust the operation and avoid damages. All the data shall be submitted to the City on daily basis.

3.10 CLEANING, SIZING AND PIGS

1. After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check

for abnormalities in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dents, buckles, gouges, and internal obstructions) greater that 2-percent of the nominal pipe diameter, or excessive out-of-roundness greater than 5- percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less. Pipe out-of-roundness shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, out-of- roundness locations are those defined above which exceed a span of five feet.

3.11 SUCCESSFUL COMPLETION

1. The Contractor shall be considered as having completed the requirements of any directional boring when he has successfully completed the Work and tested the pipe to the satisfaction of the City.

END OF SECTION

SECTION 02512

ASPHALTIC CONCRETE PAVEMENT, BASE AND STABILIZED SUBBASE (FDOT)

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall perform all WORK associated with Asphaltic Concrete Pavement and Base as shown and as specified herein including all labor, materials, equipment supplies, and facilities associated with providing a finished product satisfying all the requirements of the Contract Documents.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

1. Codes: All codes, as referenced herein, are specified in Section 01090 – Reference Standards.

1.03 CONTRACTOR SUBMITTALS

1. The Contractor shall provide to the City materials testing reports, job-mix formulas, and other pertinent information demonstrating that the materials and methods Contractor proposes to utilize will comply with the provisions of this Section. Submittals shall be in accordance with Section 01300 – Contractor Submittals. Where the Contractor is using a standard mix from an established plant facility, the plant's mix and standards may be submitted for review.

PART 2 -- PRODUCTS

2.01 STABILIZED SUBBASE

1. Stabilized sub-base shall be Type "B" with a minimum LBR of 40, per Section 160 of FDOT Standard Specifications.

2.02 BASE

1. Materials for base shall comply with Section 285 of the FDOT Standard Specifications. The Optional Base Group shall be as depicted on the Roadway and Sidewalk General Details in the Contract Drawings.

2. Lime rock, if used, shall comply with Sections 200 and 911 of the FDOT Standard Specifications, shall have a minimum LBR of 100. The base material shall be produced from approved FDOT sources. Each delivery ticket shall be sealed and certified as FDOT material. Limerock shall not be used when ground water estimated seasonal high level is within 2 feet of the bottom of the base.

3. If crushed concrete is to be used as base material, the location and thickness shall be approved by the City and shall comply with FDOT Standard Specifications Section 204. The base course shall have a minimum LBR of 100. The base material shall be produced from approved FDOT sources. Each delivery ticket shall be sealed and certified as FDOT

material. The limits of the base shall be shown on As-builts; complete street shall be provided, not just sections.

4. Limerock stabilized base, if used, shall be as specified in Section 230 of the FDOT Standard Specifications. The limerock material shall meet the requirements of Paragraph 2.02.2. above.

5. Use of reclaimed asphalt pavement (RAP) shall be for a base course only, on non-limited access paved shoulders in accordance with Section 283 of the FDOT Standard Specifications.

2.03 PRIME COAT

1. Prime coat shall be as specified in FDOT Standard Specification Section 300-2.1. Prime coat shall be applied per FDOT Standard Specification Section 300-7. Cover for prime coat shall be as specified in FDOT Standard Specification Section 300-2.2.

2.04 TACK COAT

1. Tack coat material shall be as specified in Section 300-2.3 of the FDOT Standard Specifications. Tack coat shall be applied per FDOT Standard Specification Section 300-8. Emulsified asphalt shall comply with the requirements of AASHTO M 140 (ASTM D 977) or M 208 (ASTM D 2397).

2.05 MINERAL AGGREGATE

1. Mineral aggregate shall be crushed stone, crushed slag, crushed gravel, stone or slag screening, sand, mineral filler, or a combination of two or more of these materials. Aggregate for asphaltic concrete shall be as specified in Section 334-2 of the FDOT Standard Specifications. Coarse and fine aggregates shall comply with all the quality requirements, except soundness, of ASTM D 692 and D 1073, respectively. Coarse aggregate failing to comply with abrasion requirements may be used if experience has demonstrated it to be satisfactory.

2. Mineral filler shall comply with ASTM D 242.

3. Combinations of aggregates having a history of polishing shall not be used in surface courses.

2.06 ASPHALT PAVEMENT

1. Asphalt pavement shall be SP 9.5 or SP 12.5 asphaltic concrete as depicted on the Contract Drawings and as specified in Sections 320, 330, and 334 of the FDOT Standard Specifications. Paving asphalt shall comply with the requirements of AASHTO M 226 (ASTM D 3381).

2.07 PAVEMENT MARKING PAINT

1. Pavement marking paint shall be a product specifically formulated for use on asphalt

concrete pavement and shall have a proven record of performance and durability. Products shall conform to Sections 710 (Painted Pavement Markings), 711 (Thermoplastic Pavement Markings) and 971 (Pavement Marking Materials) of the FDOT Standard Specifications. Temporary pavement marking shall be required until asphalt had cured per the FDOT standard specifications.

2.08 REFLECTIVE PAVEMENT MARKERS

1. Reflective pavement markers (RPM's) shall conform to Section 706 of the FDOT Standard Specifications. Materials requirements shall conform to Section 970 of the FDOT Standard Specifications. Reflective pavement markers shall be as follows, unless otherwise indicated on the Drawings:

   A. 4-lane road: Permanent: RPM Type B, 2 way reflective, color: white/red (W/R).

   B. At potable water fire hydrant assemblies: Permanent: RPM Type B, two way reflective, color: blue/blue (B/B). Do not provide RPMs at irrigation water hydrant assemblies.

PART 3 -- EXECUTION

3.01 SUBGRADE PREPARATION

1. The subgrade shall be prepared as specified in the Section 02200, "Earthwork" as applicable to roadways and embankments and FDOT Standard Specification Section 160. The surface of the subgrade after compaction shall be hard, uniform, smooth and true to grade and cross- section. Subgrade for base material shall not vary more than 0.04-foot from the specified grade and cross section.

3.02 BASE

1. Base shall be provided where shown and to the thickness shown. Construction of the base course shall be as specified in Section 200, 204, and/or 234 of the FDOT Standard Specifications. Imported bases shall be delivered to the job site as uniform mixtures and each layer shall be spread in one operation. Segregation shall be avoided and the base shall be free of pockets of coarse or fine material. Where the required thickness is 6 inches or less, the base materials may be spread and compacted in one layer. Where the required thickness is more than 6 inches the base material shall be spread and compacted in two or more layers of approximately equal thickness and the maximum compacted thickness of any one layer shall not exceed 6 inches. The relative compaction of each layer of base shall not be less than the maximum density shown on the Contract Drawings. The compacted surface of the finished aggregate shall be hard, uniform, smooth and at any point shall not vary more than 0.02 foot from the specified grade or cross-section

3.03 PRIME COAT

1. Prior to placing of pavement, a prime coat shall be applied to the compacted base at a rate of 0.10 gal/sq yd in accordance with FDOT Standard Specification Section 300.

3.04 TACK COAT

1. A tack coat shall be applied to existing paved surfaces where new asphalt concrete is to be placed on existing pavement and in accordance with FDOT Standard Specification Section 300-8. It shall also be applied to the contact surfaces of all cold pavement joints, curbs, gutters, manholes and the like immediately before the adjoining asphalt pavement is placed. Care shall be taken to prevent the application of tack coat material to surfaces that will not be in contact with the new asphalt concrete pavement. Undiluted emulsified asphalt shall be applied at the rate of 0.025 to 0.075 gal/sq yd.

3.05 ASPHALT CONCRETE

1. Asphalt Concrete shall be in accordance with FDOT Standard Specifications Section 320 (Hot Mix Asphalt – Plant Methods and Equipment), FDOT Standard Specifications Section 327 (Milling of Existing Asphalt Pavement), FDOT Standard Specifications Section 330 (Hot Mix Asphalt – General Construction Requirements) and FDOT Standard Specifications Section 334 (Superpave Asphalt Concrete).

2. Paving cannot be conducted until after all pipelines are satisfactorily pressure tested.

3. At the time of delivery to the WORK site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather.

4. Asphalt concrete shall not be placed when the atmospheric temperature is below 40 degrees F, when the roadway is wet or during unsuitable weather. Any materials that are in transit prior to the starting of inclement weather may be placed at Contractor's risk.

5. The asphalt concrete shall be evenly spread upon the base to such a depth that, after rolling, it will be of the specified cross section and grade of the course being constructed.

6. The depositing, distributing, and spreading of the asphalt concrete shall be accomplished in a single, continuous operation for the entire width of roadway of the proposed paving by means of a self-propelled mechanical spreading and finishing machine designed especially for that purpose. The machine shall be equipped with a screed or strike-off assembly capable of being accurately regulated and adjusted to distribute a layer of the material to a definite pre- determined thickness. When paving is of a size or in a location that use of a self-propelled machine is impractical the self- propelled requirement shall be waived.

7. Spreading, once commenced, must be continued without interruption.

8. The mix shall be compacted immediately after placing. Initial rolling with a steel-wheeled tandem roller, steel three-wheeled roller, or vibratory roller shall follow the paver as closely as possible. If needed, intermediate rolling with a pneumatic-tired roller shall be done immediately behind the initial rolling. Final rolling shall eliminate marks from previous rolling. In areas too small for the roller a vibrating plate compactor or a hand tamper shall be used to achieve thorough compaction.

9. Upon completion the pavement shall be true to grade and cross-section. When a 15-ft straightedge is laid on the finished surface parallel to the center of the roadway, the surface shall not vary from the edge of the straightedge more than 3/16-in except at intersections or changes of grade. Acceptance testing shall be in accordance with FDOT Standard Specifications Section 330-9 (Surface Requirements) using the above noted tolerances. Contractor shall provide a calibrated rolling straight edge as required by the city. Overlay of existing roadways will not be subject to the surface tolerances as specified above.

10. The relative density after compaction shall be in accordance with FDOT Standard Specification Section 330-9. A properly calibrated nuclear asphalt testing device shall be used for determining the field density of compacted asphalt concrete, or slabs or cores may be laboratory tested in accordance with ASTM D 1188.

3.06 CUTTING AND RESTORING EXISTING PAVEMENT

1. Where street surfacing is damaged or destroyed in connection with performing the WORK it shall be replaced with the same kind or better surface in accordance with the latest specifications, rules, and regulations, and subject to the inspection of the agency having jurisdiction. If a strip of existing pavement less than 4 feet wide is left between a trench and the pavement edge, it shall be removed and new pavement shall be placed. In cutting or breaking up street surfacing, do not use equipment which will damage the adjacent pavement. Asphaltic- concrete pavement shall be saw cut to clean straight lines and removed.

3.07 RESURFACING PREPARATION

1. Level areas of uneven surface to within 1/4 inch using a 15-foot straightedge. Area requiring leveling includes the intersection with existing pavement.

2. Repair of paving shall consist of removal of existing deteriorated asphalt patches and lime rock, replacement and compaction of lime rock to 12-inch depth as depicted on the Contract Drawings and leveling courses to meet requirements of Paragraph A above.

3. Deteriorated paving or inadequate base shall be saw cut and removed, and restored per these Specifications prior to resurfacing.

4. Resurfacing shall be 1-inch minimum thickness with leveling courses as required with 1.5-inch maximum thickness per Type S-III surface course.

5. Where asphaltic overlay terminates at existing paving or curbing, the existing paving shall be milled a minimum of 1-inch depth at the tie-in point to provide a smooth transition / tie-in of the existing pavement or curbing to the new asphalt roadway. Reimbursement shall be included in the applicable overlay pay items.

3.08 REFLECTIVE PAVEMENT MARKER PLACEMENT

1. Placement of reflective pavement markers shall be in accordance with Section 706 of the FDOT Standard Specifications.

3.09 PAVEMENT MARKING

1. Pavement marking paint shall be applied only when the pavement surface is dry and clear, and when the air temperature is above 40 degrees F. All equipment used in the application of pavement marking shall produce stripes and markings of uniform quality with clean and well-defined edges that conform to Sections 710, 711, and/or 971 of the FDOT Standard Specifications. Drips, overspray, improper markings and paint material tracked by traffic shall be immediately removed from the pavement surface.

2. Disturbed existing paving markings shall be replaced in kind at no additional cost to the City.

3.10 FOUR LANE ROADWAY ADDITIONAL REQUIREMENTS

1. Contractor shall provide automatic level controls on the final lift of all four lane roadways.

2. The final lift of pavement on all four lane roadways shall be installed as close to substantial completion as possible and is a requirement of substantial completion.

END OF SECTION

SECTION 02590

STORM DRAIN PIPE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide storm drain pipelines for use in gravity flow applications and all appurtenant Work, complete in place, in accordance with the Contract Documents.

2. Provide storm drain pipelines with integral bell joints fabricated out of either corrugated High Density Polyethylene (HDPE) pipe, corrugated PVC Pipe, elliptical and round Reinforced Concrete Pipe, or Fiber Reinforced Concrete Pipe.

1.02 CONTRACTOR SUBMITTALS

1. Catalog data submittals shall be made in accordance with Section 01300 – Contractor Submittals.

PART 2 -- PRODUCTS

2.01 CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) PIPE

1. All corrugated high-density polyethylene pipes shall conform to FDOT Standard Specifications Section 948.2.3. Corrugated HDPE pipe for storm drain shall conform to AASHTO M294 with the following exception: corrugations may only be annular. Pipe shall also conform to the minimum cell classification 435400C as specified in ASTM D 3350.

2. Pipe and fittings shall be joined by the use of integral bell joints with a gasket compressed between the spigot and belled ends of the pipe. Elastomeric gaskets shall comply with the requirements of ASTM F 477. All joints and fittings shall be watertight. No thermal butt fusion type joints shall be provided for HDPE pipe for use in storm drainage.

3. Manufacturer's, or City approved equal

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 CORRUGATED POLYVINYL CHLORIDE (PVC) PIPE

1. All corrugated polyvinyl chloride pipe shall conform to FDOT Standard Specifications Section 948.1.7. Corrugated PVC pipe for storm drain shall conform to ASTM F949 and ASTM F794 manufacturing and testing requirements. Pipe shall also conform to the minimum cell classification 12454 as specified in ASTM D 1784.

2. Pipe and fittings shall be joined by the use of integral bell joints with a gasket compressed between the spigot and belled ends of the pipe. Elastomeric gaskets shall comply with the requirements of ASTM F 477. All joints and fittings shall be water tight.

3. Manufacturer's, or City approved equal

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.03 ELLIPTICAL REINFORCED CONCRETE PIPE (ERCP) AND ROUND REINFORCED CONCRETE PIPE

1. Reinforced concrete pipe shall be used at all driveway culverts as shown on the Drawings.

2. Elliptical reinforced concrete pipe shall conform to the requirements of ASTM designation C 507 for Class HE-III and FDOT Standard Specifications Section 430/449.

3. Round reinforced concrete pipe shall conform to applicable requirements of ASTM C76 and as specified in FDOT Standard Specifications Section 430/449. Pipes shall be Class III, Wall B or C.

4. All joints shall have a tongue and groove joint designed to be self-centering with a gasket compressed between tongue and groove. Gaskets shall meet all the requirements set forth in ASTM C 443 and FDOT Standard Specifications Section 942. All joints and gaskets shall be water tight.

5. Joints for elliptical reinforced concrete pipe shall be of a cold adhesive preformed plastic gasket material conforming to FDOT Standard Specifications Section 942 or a continuous rubber gasket type, **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

6. Joints for circular reinforced concrete pipe shall be of the rubber gasket type, and shall conform to FDOT Standard Specifications Section 942.

7. Manufacturer's, or City approved equal

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

PART 3 -- EXECUTION

3.01 GENERAL

1. All laying, jointing, testing for defects and for leakage, shall be performed in the presence of the City, and shall be subject to its approval before acceptance. All material found to have defects will be rejected and the Contractor shall promptly remove such defective material from the Site.

3.02 HANDLING AND STORAGE

1. Handling: Pipe, fittings, and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.

2. Storage: After unloading and before installation, pipe shall be stored on flat, level ground with no rocks, timbers or other objects under the pipe. The maximum stacking height for various diameters of pipe is:

15- to 21-inch diameter	4 rows
24- to 30-inch diameter	3 rows
33- to 48-inch diameter	2 rows
54-inch and larger	1 row

3. Pipe shall be transported, stored, and handled with care. It shall not be rolled or dragged over gravel or rock, and during placement, shall be prevented from striking rock or other hard objects. Damaged, bent, out-of-round, or otherwise defective pipe shall be removed from the Site and the Contractor shall replace it as part of the Work.

3.03 INSTALLATION OF HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

1. Installation shall conform to the requirements of ASTM D 2321 and the applicable requirements of Section 02200 - Earthwork, instructions furnished by the pipe manufacturer, and to the requirements herein. Wherever the requirements are in conflict, the more stringent shall apply.

3.04 INSTALLATION OF POLYVINYL CHLORIDE (PVC) PIPE

1. Installation shall conform to the requirements of ASTM F794 and ASTM F949 and the applicable requirements of Section 02200 - Earthwork, instructions furnished by the pipe manufacturer, and to the requirements herein. Wherever the requirements are in conflict, the more stringent shall apply.

3.05 INSTALLATION OF ELLIPTICAL AND ROUND REINFORCED CONCRETE PIPE

1. Installation shall conform to the requirements of ASTM C 1478 and C 1479, and the applicable requirements of Section 02200-Earthwork, instructions furnished by the pipe manufacturer, and to the requirements herein. Wherever the requirements are in conflict, the more stringent shall apply.

2. All reinforced concrete pipe laying shall begin at the downstream end of the line and proceed upstream. Pipe shall be laid carefully and true to line and grade. All reinforced concrete pipe joints shall be wrapped with a filter fabric jacket per FDOT Standard Specifications Section 430/449 to prevent infiltration.

3.06 GENERAL INSTALLATION GUIDELINES FOR HDPE, PVC, ELLIPTICAL AND ROUND REINFORCED CONCRETE PIPES

1. Contractor’s attention is called for pipelines to be installed in accordance with manufacturer’s recommendations for proper installation.

2. Bell-and-spigot pipe shall be laid with the bell end pointing in the direction of laying from downstream to upstream. Pipe shall be graded in straight lines, taking care to avoid

the formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable. At the end of each day's work, open ends of pipe shall be closed temporarily with watertight plugs or bulkheads.

3. Pipe shall be supported at its proper elevation and grade; care being taken to secure firm and uniform support. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the pipe bed, with recessed excavation to accommodate bells, joints, and couplings. Anchors and supports shall be provided where necessary and where indicated.

4. Where unstable trench walls or trench bottom is encountered, such as may be found by excavation below ground water, this condition shall be stabilized before laying the pipe. Depending on the severity of the condition, the Contractor may elect to use tight sheeting, stay bracing, a trench box, well points, an under drain, removal of the unstable soil and replacement with a suitable foundation material, or a combination of methods.

5. With the gasket properly placed in the spigot groove, the gasket shall be stress-relieved by passing a screwdriver under the gasket and then around the circumference of the spigot.

6. The pipe ends shall be wiped clean and a thin coat of lubricant applied to both the outside surface of the spigot end with the gasket in place, and the inside surface of the bell end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall then be forced into the bell end of the adjoining pipe. A backhoe bucket or a cable winch may be used, but the force shall be steady, not an impact force, and shall be evenly distributed so as not to damage the pipe end.

7. The pipe shall not be deflected either vertically or horizontally in excess of 80% of the manufacturer's recommended allowable deflection

8. Pipe trench backfill and bedding shall be in accordance with the requirements of Section 02200– Earthwork, with minimum backfill compaction in the pipe zone as specified.

END OF SECTION

SECTION 02594

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall furnish and install all high-density polyethylene (HDPE) pipeline, complete in place, in accordance with the Contract Documents.

2. The requirements for pipe materials are indicated on the Drawings.

1.02 CONTRACTOR SUBMITTALS

1. Submittals shall be in accordance with Section 01300 - Contractor Submittals.

2. The Contractor shall provide manufacturer data for all pipe, fittings, and appurtenances.

3. Contractor shall provide welding technician qualifications.

PART 2 – PRODUCTS

2.01 GENERAL

1. All high-density polyethylene pipe shall be Ductile Iron Pipe Size (DIPS), SDR 11 rating.

2. Pipe shall be continuously and permanently marked with the manufacturer's name, pipe size, and SDR rating or minimum pipe stiffness in psi. Pipe shall be marked with a one-inch-wide stripe of continuous color (green-sewer, blue-water, and purple-irrigation).

3. Pipe shall be marked by manufacturer with extrusion code on the pipe. Records shall be maintained by the manufacturer for 2 years, covering date of extrusion, quality control tests, raw material batch number and other information deemed necessary by the manufacturer.

4. Polyethylene pressure pipe shall conform to the applicable requirements of ANSI/AWWA C 906 and shall be subject to additional requirements specified herein.

5. Material Requirements: Pipe shall be high molecular weight, high density polyethylene pipe. The material shall have a standard PE code designation of PE 3408 and have a cell classification of 345464C as described in ASTM D 3350. The pipe shall contain no recycled compound except that generated in the manufacturer’s own plant from resin of the same specification from the same raw material.

6. The pipe shall be homogenous throughout and free of visible cracks, bubbles, holes, foreign inclusions or other injurious defects. It shall be uniform in color, capacity, density, and other physical properties. Any pipe not meeting these criteria shall be rejected.

7. Joints: All joints for the buried polyethylene pipe shall be of the thermal butt fusion or electrofusion type unless otherwise specified. Flanged adapters may be butt welded or electrofusion welded. Mechanical joints to PVC, other materials, equipment, valves, and appurtenances will not be considered. For transitions between PVC and HDPE pipelines, HDPE molded flanges with 316 American made stainless steel backup rings shall be used. HDPE pipe for storm drain use shall not be welded (Ref. Section 02590 – Storm Drain).

2.02 FITTINGS

1. Polyethylene fittings shall conform to Section 2.3 of AWWA C 906. Molded fittings shall conform to ASTM D3261 for butt-type fittings or ASTM F1055 for electrofusion-type fittings.

2. All fittings shall be close radius molded fabrication. No miter joints allowed.

3. Each fitting shall be clearly labeled by manufacturer identifying its size and dimension ratio.

4. All pipe and fittings shall be Ductile Iron Pipe Size (DIPS).

2.03 MANUFACTURERS, OR CITY APPROVED EQUAL:

1. HDPE PIPE MANUFACTURERS **(SEE CITY OF CAPE CORAL QUALIFIED PRODUCTS LIST)**

2. HDPE FITTING MANUFACTURERS **(SEE CITY OF CAPE CORAL QUALIFIED PRODUCTS LIST)**

PART 3 – EXECUTION

3.01 GENERAL

1. Any material found to have defects during the progress of the project shall be immediately removed from the site by the Contractor at no additional cost.

3.02 HANDLING AND STORAGE

1. Handling: Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.

2. Storage: Pipe shall be stored at the job site in unit packages provided by the manufacturer. Pipe shall be stored in such a way as to prevent sagging or bending.

3.03 TRENCHING AND BACKFILL

1. Trench excavation shall conform to the requirements for utility pipeline construction as

specified in Section 02200 - Earthwork.

3.04 INSTALLATION

1. Installation shall conform to the pipe manufacturer recommendations, and the applicable requirements of Section 02347 - Horizontal Directional Drilling, supplementary requirements or modifications specified herein. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.05 JOINT WELDING

1. Sections of high-density polyethylene pipe shall be joined into continuous lengths on the job site above ground. The joining method shall be the thermal butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. Fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure.

2. Butt fusion shall conform to ASTM D 2657 and pipe manufacturer's criteria for the type of joining. Joint strength shall be equal to that of the adjacent pipe.

3. Fusion equipment shall be operated by technicians who have been certified the fusion equipment suppliers, and must have sufficient experience fusion welding pipelines with diameters that are found in the project that the operator will be undertaking.

4. Storm drain pipe joints shall be as specified in Section 02590 – Storm Drain.

3.06 FIELD TESTING AND DISINFECTION

1. Field testing and disinfection of water mains shall conform to the requirements of Section 02666 - Pressure Pipeline Testing and Disinfection.

END OF SECTION

SECTION 02595

POLYETHYLENE PIPE FOR SERVICE CONNECTIONS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. Furnish and install polyethylene (PE) pipe and fittings for service connections complete in place, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. Submittals shall be in accordance with Section 01300 - Contractor Submittals.

2. The Contractor shall provide manufacturer data for all pipe, fittings, and appurtenances.

PART 2 – PRODUCTS

2.01 GENERAL

1. PE pipe two inches or less in size shall meet AWWA C-901, ASTM D-3350 cell classification of 334434C and be permanently marked with the type/size/use of the pipe. PE pipe two and one half (2 ½) inches or three (3) inches in size shall meet AWW C-901, ASTM D-3350 cell classification of 334434C and be permanently marked with the type/size/use of the pipe and shall only be permitted by specific written approval by the City. The minimum radius of curvature shall be thirty (30) pipe diameters and bending shall not cause kinking. The potable water pipe shall be blue in color, and the reclaimed water pipe shall be lavender in color.

2. Brass Compression Coupling Fittings: Brass compression coupling fittings shall be permitted as approved by the City.

3. HDPE Compression Coupling Fittings: PE piping with HDPE compression and molded fittings shall be permitted with prior written approval by the City of Cape Coral. PE piping with the HDPE 4710 molded fittings does not require stainless steel stiffeners.

4. Mechanical Coupling Fittings: The mechanical coupling fittings shall meet and/or exceed the maximum design pressure requirements of the piping system. The couplings shall prevent the entry of dust, dirt, and moisture. Mechanical coupling fittings shall not be permitted unless specifically approved in writing by the City.

5. PVC Compression Coupling Fittings: PE piping with PVC compression fittings shall not be permitted unless specifically approved in writing by the City.

2.02 FITTINGS MANUFACTURERS OR CITY APPROVED EQUAL:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

1. For additional information on fittings used on service connection please see Section

15001 – Saddles, Stops, and Small Valves.

2.03 PIPE MANUFACTURERS

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

PART 3 -- EXECUTION

3.01 GENERAL

1. Any material found to have defects during the progress of the project shall be immediately removed from the site by the Contractor at no additional cost.

3.02 HANDLING AND STORAGE

1. Handling: Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.

2. Storage: Pipe shall be stored at the job site in unit packages provided by the manufacturer. Pipe shall be stored in such a way as to prevent sagging or bending.

3.03 TRENCHING AND BACKFILL

1. Trench excavation shall conform to the requirements for utility pipeline construction as specified in Section 02200 - Earthwork.

3.04 INSTALLATION

1. Installation shall conform to the pipe manufacturer recommendations. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.05 FIELD TESTING AND DISINFECTION

1. Field testing and disinfection of water piping shall conform to the requirements of Section 02666 - Pressure Pipeline Testing and Disinfection.

END OF SECTION

SECTION 02599

IRRIGATION WATER PIPE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The CONTRACTOR shall provide polyvinyl chloride (PVC) or Ductile Iron Pipe (DIP) pressure pipe, complete in place, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. Submittals shall be in accordance with Section 01300 - Contractor Submittals.

2. The CONTRACTOR shall provide manufacturing data for all pipe, fittings, and appurtenances.

PART 2 -- PRODUCTS

2.01 PVC PIPE

1. Irrigation water mains below ground shall conform to the applicable requirements of ANSI/AWWA C 900, DR 18.

2. The pipe shall be of the diameter and pressure class specified, shall be furnished complete with rubber gaskets, and all specials and fittings as required in the Contract Documents.

3. Pipe shall be continuously and permanently marked with the manufacturer's name, pipe size and DR rating or pressure rating. Pipe shall be lavender.

4. Additives and Fillers: Unless otherwise allowed in alternate qualification procedures of PPI-TR3, compounds shall have a Hydrostatic Design Basis (HDB) of 4000 psi at 73.4 degrees F.

5. Joints: Joints for the buried PVC pipe shall be an integral bell manufactured on the pipe employing a rubber ring joint in accordance with ASTM C 477. The bell shall be the same or greater thickness as the pipe barrel.

6. Pipe Manufacturers, or City approved equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

7. Restrained joints for PVC pipe shall properly fit the pipe being installed and shall manufactured by the following, or City approved equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

8. Bell restrained harnesses shall be used where in-line PVC restrained joints are required. Bell restrained harnesses for PVC pipe shall be manufactured by the following,

or City approved equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 DIP PIPE

1. Ductile iron pipe below ground shall conform to ANSI/AWWA C 151, C 150, C 104, and C 105 subject to additional requirements herein. Ductile iron pipe wall thickness shall meet the requirements of Pressure Class 250 with cement mortar lining. If ductile iron pipe is stamped with the Special Class rating in lieu of the Pressure Class rating, a letter is to be supplied by the vendor stating that the particular Special Class meets the specified Pressure Rating for each size of pipe.

2. Above ground piping, flanged, and/or fully restrained, shall be Ductile Iron Pipe conforming to ANSI/AWWA C 151, C 150, C 104, and C 105. Ductile iron pipe wall thickness shall meet the requirements of Pressure Class 250 with cement mortar lining. If Ductile Iron Pipe is stamped with the Special Class rating in lieu of the Pressure Class rating, a letter is to be supplied by the vendor stating that the particular Special Class meets the specified Pressure Rating for each size of pipe.

3. Pipe shall be continuously and permanently marked with the manufacturer's name, pipe size and pressure rating.

4. The CONTRACTOR shall also require the manufacturer to mark the extrusion or manufacturing code on the pipe. This coding shall be done in conjunction with records to be held by the manufacturer for 2 years, covering date of manufacture, quality control tests, raw material batch number and other information deemed necessary by the manufacturer.

5. Finish: The pipe shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing and roughness. Lining and coating shall be in accordance with the requirements of Section 2.04 and Section 2.05.

6. Polyethylene Sleeve: Material for the polyethylene sleeve shall conform to the requirements of ANSI/AWWA C 105.

7. Pipe Manufacturers, or City approved equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

8. Joint Design: Ductile iron pipe and fittings shall be furnished with mechanical joints, push-on joints, flanged joints, and restrained joints as required.

   A. Mechanical and push-on joints shall conform to ANSI/AWWA C 111/A21.11.

   B. Flanged joints shall conform to ANSI/AWWA C 115/A21.15. Special ductile iron flanges to match up to 250 psi valve and equipment flanges shall meet ANSI/AWWA C110 and be specially drilled to ANSI/ASME B16.1 class 250 standard dimensions with raised face.

C. Restrained joints shall be as manufactured by the following, or City approved equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

D. For bell-and-spigot ends with rubber gaskets, the clearance between the bells and spigots shall be such that when combined with the gasket groove configuration and the gasket itself, will provide watertight joints under all operating conditions when properly installed. Gaskets shall conform to ASTM C 477.

2.03 FITTINGS

1. Ductile iron fittings shall be used with both PVC pipe and DIP pipe and shall conform to the requirements of ANSI/AWWA C 153/A21.53 or ANSI/AWWA C 110/A21.10 for diameters 3-inch through 48-inch and shall have a minimum pressure rating of 250 psi.

2. All fittings shall be lined and coated in accordance with the requirements of Section 2.04 and Section 2.05.

3. Each fitting shall be clearly labeled to identify its size and pressure class.

4. Manufacturers, or City approved equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.04 CEMENT-MORTAR LINING FOR IRRIGATION WATER LINES

1. Cement-Mortar Lining for Shop Application: Except as otherwise provided herein, interior surfaces of all ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with ANSI/AWWA C 104. During the lining operation and thereafter, the pipe shall be maintained in a round condition by suitable bracing or strutting. The lining machines shall be of a type that has been used successfully for similar work. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at the delivery site, the damaged or unsatisfactory portions shall be replaced with lining conforming to these Specifications.

2. The minimum lining thickness shall be as follows:

Nominal Pipe Diameter (in)	Minimum Lining Thickness (in)
4-12	1/8
16-24	3/16
30-54	1/4

3. Protection of Pipe Lining/Interior: All shop-applied cement mortar lining shall be given a seal coat of asphaltic material in conformance with ANSI/AWWA C104.

2.05 EXTERIOR COATING OF DIP PIPE

1. All irrigation water pipes above ground shall be painted lavender conforming to the requirements in Section 09800 - Protective Coating.
2. Exterior Coating of Exposed Piping: The exterior surfaces of pipe which will be exposed to the atmosphere inside structures or above ground shall be abrasive blasted to a minimum commercial Grade SSPC-SP-6, NACE 3 and given a high solids epoxy primer coat, **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.** If intermediate coating is required as per Section 09800 – Protective Coating, it shall be applied in the factory. The finish coat shall be applied after installation in accordance with Section 09800 -Protective Coating.

3. Polyethylene Encasing: Buried ductile iron pipe shall be shop coated as required with manufacturer's standard coating. Where directed in the field, the coated pipe shall be encased with 8-mil polyethylene material in accordance with the requirements of ANSI/AWWA C 105/A21.5.

4. Shop-applied interior linings and exterior coatings shall be held back from the ends of the pipe as recommended by the manufacturer.

2.06 IDENTIFICATION AND LOCATING DEVICES

1. All irrigation water pipes and services shall be an electronic marking system caution tape, 6- inches wide. The tape shall be as manufactured by SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST and shall be colored coded Lavender.

2. All irrigation water piping shall be marked with an Electronic Marker System (EMS), SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST. Markers shall be installed at all fittings; casing pipe ends and changes in direction.

2.07 LUBRICANT

1. Lubricant for irrigation water pipe shall conform to the manufacturer's requirements.

2.08 BEDDING MATERIAL

1. Unless otherwise indicated, pipe bedding shall conform to Section 02200 - Earthwork.

PART 3 -- EXECUTION

3.01 GENERAL

1. Material found to have defects shall be immediately removed from the site by the CONTRACTOR.

2. PVC pipe installation shall conform to the requirements of AWWA M23, instructions furnished by the pipe manufacturer, and to the supplementary requirements herein. DIP pipe installation shall conform to the requirements of ANSI/AWWA C 600. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3. All transitions between dissimilar pipe materials (i.e., Ductile Iron Pipe to PVC, PVC to

Ductile Iron Pipe, etc.) shall be accomplished with an appropriately sized approved mechanical joint. No bell to spigot transitions will be allowed on dissimilar pipe materials. All transitions between dissimilar pipes shall be inspected and approved by the City.

3.02 HANDLING AND STORAGE

1. Handling: Pipe, fittings, and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the CONTRACTOR.

2. The DIP pipe shall be handled by devices designed and constructed to prevent damage to the pipe coating/exterior. DIP shall not be installed where the lining or coating show defects that may be harmful as determined by the CITY OF CAPE CORAL. Such damaged lining or coating shall be repaired, or a new undamaged pipe shall be furnished and installed.

3. Storage: Pipe shall be stored, if possible, at the site in unit packages provided by the manufacturer. Pipe shall be stored in a manner to prevent exposure to sunlight (UV) until such time as it is installed. Caution shall be exercised to avoid compression damage or deformation to the pipe. PVC pipe shall be stored in such a way as to prevent sagging or bending. Pipe more than two years old, may be approved by the city depending on the state of the pipe and gaskets. Contractor shall receive written approval from the City of Cape Coral prior to use of any pipe which is more than two years old. Gaskets shall be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons. Stockpiled pipe shall be suitably supported and shall be secured to prevent accidental rolling. The city may reject excessively faded or dirty pipe.

3.03 INSTALLATION

1. Bell-and-spigot pipe shall be laid with the bell end pointing in the direction of laying. Pipe shall be graded in straight lines, taking care to avoid the formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable. At the end of each day's work, open ends of pipe shall be closed temporarily with plugs.

2. Pipe shall be supported at its proper elevation and grade; care being taken to secure firm and uniform support. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the pipe bed, with recessed excavation to accommodate bells, joints, and couplings. Anchors and supports shall be provided where indicated and where necessary for fastening work into place. Fittings shall be independently supported.

3. Joints shall be installed according to manufacturer's recommendations. Contractor shall take precautions to prevent "over homing" of the pipe. The indication line marked on the spigot of the pipe shall in all cases remain visible after joining of the pipe, in accordance with the manufacturer's recommendations. Trenches shall be kept free of

water until joints have been properly made.

4. Deflection at the joint shall not exceed 80% of the deflection recommended by the manufacturer. No deflection of the joint shall be allowed for joints that are over-belled or not belled to the stop mark.

5. In laying pipe, it shall be laid to the setline and grade, within approximately one inch plus or minus.

6. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the CONTRACTOR may change the alignment and/or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection noted above. No joint shall be misfit by any amount that will be detrimental to the strength and water tightness of the finished joint.

7. Pipe and Specials Protection: The openings of all pipe and specials shall be protected with suitable plugs or bulkheads to prevent unauthorized access by persons, animals, water or any undesirable substance. At all times, the pipe shall be prevented from floating.

8. Pipe Cleanup: As pipe laying progresses, the CONTRACTOR shall keep the pipe interior free of all debris. The CONTRACTOR shall completely clean the interior of the pipe of all sand, dirt, and any other debris following completion of pipe laying, and perform any necessary repairs prior to testing the completed pipeline.

9. Field Cutting: Pipe shall be cut by means of saws, power driven abrasive wheels, or pipe cutters, which will produce a square cut, or per the manufacturer's written procedure. No wedge- type roller cutters will be permitted. After cutting, the end of the pipe shall be beveled using a beveling tool, sander, or abrasive disc.

3.04 ELECTRONIC MARKING SYSTEM TAPE AND MARKERS

1. All irrigation mains shall have an electronic marking system caution tape, 6-inches wide installed continuously along the alignment. The tape shall be installed during backfilling 12 to 18 inches directly above the pipe at a uniform elevation.

2. Locating markers shall be installed at all fittings, casing pipe and changes in direction. Locating markers shall not be installed more than four (4) feet deep. Locating markers shall not be placed within 12-inches of the fittings.

3.05 CONNECTIONS TO EXISTING IRRIGATION WATER MAINS

1. The CONTRACTOR shall locate all underground improvements and install the pipelines to the depths indicated. Where the new work is to be connected to existing pipelines, the CONTRACTOR shall make arrangements with the serving utility through the CITY OF CAPE CORAL well in advance of the connections, to allow adequate time for draining of the existing line, if necessary, and shall expedite the work to minimize water outages to the users. Where sections of existing distribution mains are taken permanently out of service and abandoned in place, the pipe shall be drained first and then the cut ends shall be sealed with a Mega lugged Plug.

3.06 RUBBER GASKETED JOINTS

1. Rubber Gasketed Joints: Immediately before jointing pipe, the bell end of the pipe shall be thoroughly cleaned, and a clean rubber gasket lubricated with a lubricant recommended by the pipe manufacturer shall be placed in the bell groove. The spigot end of the pipe shall be carefully cleaned and lubricated with the same lubricant. The spigot end of the pipe shall then be inserted into the bell of the previously laid joint and pushed into its proper position. Tilting of the pipe to insert the spigot into the bell will not be permitted.

3.07 INSTALLATION OF PIPE APPURTENANCES

1. Protection of Appurtenances: Where pipe is encased in polyethylene sleeves, buried appurtenances shall also be encased in polyethylene.

2. Installation of Valves: All valves shall be handled in a manner to prevent any injury or damage to any part of the valve. All joints shall be thoroughly cleaned and prepared prior to installation. The CONTRACTOR shall adjust all stem packing and operate each valve prior to installation to ensure proper operation.

3. All valves shall be installed so that the valve stems are plumb and, in the location, shown.

3.08 SERVICE CONNECTIONS

1. DIP Pipe Service Connections: No direct tapping of ductile iron pipe will be permitted. Double strap ductile iron service saddles anchored by a minimum of four bolts shall be used for service connections on ductile iron pipe. Service saddles shall be sized to fit the pipe outside diameter and shall have a bearing area of sufficient width along the axis of the pipe, so that the pipe will not be distorted when the saddle is made tight. Sealing gaskets shall be BUNA-N rubber and straps shall be corrosion resistant alloy steel. Maximum outlet size permitted with service saddles is 2 inches. Refer to Section 15001 – Saddles, Stops and Small Valves for additional requirements.

2. PVC Pipe Service Connections: Direct tapping will not be permitted. Brass service saddles shall be used on mains up to six inches (6”) in diameter. Double strap ductile iron saddles shall be used on mains 8 inches (8”) and larger. Double strap ductile iron service saddles anchored by a minimum of four (4) bolts shall be used for all service connections. Service saddles shall be sized exactly to the pipe outside diameter and shall have a bearing area of sufficient width along the axis of the pipe, so that the pipe will not be distorted when the saddle is made tight. Sealing gaskets shall be BUNA-N rubber and straps shall be corrosion resistant alloy steel. An internal shell cutter shall be used to drill through the corporation stop to minimize PVC shavings, retain the coupon, and reduce stress. Single fluted shell cutters or twist drills are not acceptable. Shell cutter shall have sufficient throat depth to handle the heavy wall PVC pipe. Maximum outlet size permitted with service clamps or saddles is 2 inches.

3. Tapping sleeves and valves for full body fittings shall be used for all outlet sizes greater than 2 inches in diameter. Tapping sleeves shall be assembled and installed in accordance with the manufacturer’s recommendations.

4. Where existing irrigation water services are present in an area, the entire existing long and short side irrigation water service including curb stop are to be located, removed and replaced by the CONTRACTOR. Existing irrigation meter boxes are to be maintained. The CONTRACTOR, at his option, may either convert the existing corporation stop from a HDPE tubing connector to a Schedule 80 PVC connector or to hot tap the existing irrigation main and provide a new corporation stop. If a hot tap is provided the original corporation stop is to be turned off and the outlet is to be plugged. The CONTRACTOR is to perform the replacement of the existing irrigation services in a timely manner to minimize the outage to the Homeowner. The CONTRACTOR shall provide all necessary notifications to the Homeowner.

3.09 FIELD TESTING

1. Field-testing of irrigation water mains shall conform to the requirements of Section 02666 – Pressure Pipeline Testing and Disinfection.

3.10 FIELD ADJUSTMENT OF EXISTING IRRIGATION MAINS

1. The CONTRACTOR shall notify the CITY OF CAPE CORAL when conflicts with new improvements and existing irrigation mains are found. When directed by the CITY OF CAPE CORAL, the CONTRACTOR will field adjust the existing irrigation mains as required to provide adequate separation. The existing irrigation mains shall be restrained in accordance with the Restrained Joint Schedule as shown in the Drawings. Field adjusted existing irrigation piping shall be visually inspected under normal line pressure before backfilling. Pressure test of the field adjusted irrigation piping will not be required.

END OF SECTION

SECTION 02666

PRESSURE PIPELINE TESTING AND DISINFECTION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall perform flushing and testing of all potable water, irrigation water, gravity sewer and wastewater force main pipelines and appurtenant piping, and disinfection of all potable water pipelines and appurtenant piping, complete, including conveyance of test water from CITY designated source to point of use and all disposal thereof, all in accordance with the requirements of the Contract Documents.

2. Flushing Plan: Flushing Plan shall include marked up Master Plans for each testing area indicating the limits of the areas to be flushed, valves to be operated to achieve a flushing velocity of 2.5 ft/second, volume of water required, proposed water source, and flushing water disposal method.

3. Hydrostatic Test Plan: Hydrostatic Test Plan shall include marked up Master Plans for each testing area indicating the limits of the areas to be tested, valves to be opened and closed during the test, volume of pipeline being tested, allowable leakage calculation per paragraph 3.04.8 and 9, and points used for bleed down after testing.

4. Positive Service Identification Plan: Positive Service Identification shall include marked up Master Plans for each testing area indicating the limits of the areas to be tested, and valves to be closed during the test.

1.02 CONTRACTOR SUBMITTALS

1. Flushing Plan, Hydrostatic Test Plan, and Positive Service Identification Plan shall be provided to the City, a minimum of 7 days before testing is to start.

PART 2 -- PRODUCTS

2.01 MATERIALS REQUIREMENTS

1. Temporary valves, plugs, bulkheads, and other air pressure testing and water control equipment and materials shall be provided by the Contractor subject to the City's review. No materials shall be used which would be injurious to pipeline structure and future function. Air test gages shall be laboratory-calibrated test gages and shall be recalibrated by a certified laboratory at the Contractor's expense prior to the leakage test, if required by the City. Pressure test pump assemblies must be fabricated using threaded iron or brass fittings only. PVC assemblies are not allowed. Contractor shall demonstrate to the City that the assemblies are free from defects, corrosion or other hazards prior to attachment to the system.

2. The Contractor will provide potable water jumper assemblies and backflow preventers

for temporary use on the Project. The jumper assemblies and backflow preventers may be available by the CITY. The Contractor shall provide a $1,000 refundable deposit to use the CITY supplied jumper assembly if available. All other test equipment, chemicals for chlorination, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor. No materials shall be used which would be injurious to the construction or its future function.

3. Chlorine for disinfection shall be in the form of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.

4. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300. If granules or tablets are used, they must be dissolved in water in a separate container (55-gallon drum) and introduced as a liquid into the pipe.

PART 3 -- EXECUTION

3.01 GENERAL

1. Unless otherwise provided herein, water for testing and flushing all pressure rated lines and disinfecting potable water pipelines will be furnished by the CITY; however, the Contractor shall make all necessary provisions for conveying the water from the CITY designated source to the points of use.

2. All pressure pipelines shall be hydrostatically tested and leak tested. Disinfection of all potable water lines shall be accomplished by chlorination.

3. Disinfection shall be scheduled by the Contractor as directed by the City so as to assure the maximum degree of sterility of the facilities at the time the WORK is accepted. Bacteriological testing shall be performed by a certified testing laboratory approved by the CITY and at the expense of the Contractor. Results of the bacteriological testing shall be satisfactory with the State Department of Health or another appropriate regulatory agency. Contractor shall dispose of test water at location and by methods approved by City or other governing body. Contractor shall be responsible to periodically flush the line to maintain the minimal chlorine residual required by the Health Department until final acceptance. Bacteriological test results and clearance shall be received before the pipelines are considered substantially complete.

4. The Contractor shall provide 48 hours' notice to the ENGINEER and the City prior to all pressure testing. All pressure testing must be done in the presence of the ENGINEER or City of Cape Coral Representative.

5. Only potable water shall be used for the flushing of potable water mains. Irrigation mains and force mains may be flushed with the use of irrigation water.

3.02 FLUSHING (PRESSURE MAINS 4" TO 12" DIAMETER)

1. Pipelines shall be cleaned and flushed to remove all sand and other foreign matter. Water used for flushing shall achieve a minimum velocity of 2.5 feet per second in every section

of the pipe and the flow shall be maintained for sufficient duration to assure a complete change of the volume of water within the pipe.

2. The Contractor shall be responsible for developing a flushing plan to be submitted to the City for approval prior to flushing. The Contractor shall dispose of all water used for flushing without causing a nuisance or property damage. Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.

3. Pressure mains larger than 12" diameter may be flushed with written approval of the City.

3.03 PIGGING (PRESSURE MAINS GREATER THAN 12" DIAMETER)

1. The Contractor shall clean the system thoroughly by pigging to remove sand, grit, gravel, stones, fluids, construction waste, and all material which would not be found in a properly cleaned pipeline. Pigging shall obtain a smooth interior pipe surface free from any material or fluid not used in cleaning.

2. Pigging shall be defined as passage of a sufficient number of pigs through the pipeline to achieve the clean conditions above. Flushing will not be acceptable as a substitute for pigging.

3. Provision for pig access and egress points and disposal of water and materials shall be the Contractor's responsibility. Pigging shall be performed through butterfly valves for water and irrigation mains or plug valves for force mains. Pigging stations shall be placed at locations between valves.

4. Pigs shall be individually marked, and their location shall be controlled and monitored so that no pigs remain in the system after cleaning.

5. Pigging may be done in conjunction with initial filling for the hydrostatic test.

3.04 HYDROSTATIC TESTING OF PIPELINES

1. Prior to hydrostatic testing, all potable water, and irrigation water pipelines and force mains less than or equal to 12 inches shall be flushed at a minimum of 2.5 ft/second. The Contractor shall test all completed pipelines in accordance with the approved test plan. Complete installation shall include all water services, blow-offs, air release valves, and other appurtenances in their final position. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary plugs in the pipe and filling the line slowly with water. The Contractor shall be responsible for ascertaining that all test plugs are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Any unharnessed sleeve- type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. The Contractor shall provide sufficient temporary air tapping's in the pipelines to allow for evacuation of all entrapped air in each pipe segment to be tested. After completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air vents are open during filling.

2. The pressure gauge utilized for pressure testing shall be less than one (1) year old or calibrated within the past year. The pressure gauge will be liquid filled with a range of 0 to 200 psi. The City and an authorized CITY representative must approve the pressure gauge being used. The Contractor will perform hydrostatic testing of all distribution areas and will conduct the tests in the presence of the city and the CITY representative, with 7-days advance notice provided.

3. The pressure system should be filled slowly with a flow velocity less than 2 feet per second (fps). The drinking water systems will be filled using a potable water source and the irrigation and force main systems will be filled using the CITY irrigation water or another approved source.

4. All the air must be expelled from the systems prior to pressure testing. It is recommended the Contractor use services, hydrants, air release valves, blow-offs, and temporary taps to expel the air.

5. After the pipeline or section has been filled, flushed or pigged, and most of the air has been expelled, the system shall be pumped up to 60 psi (approximately 5 psi over the existing pressure). Then the system shall be allowed to stand for at least 24 hours. This will allow the remaining air to escape and the pressure to stabilize. During this period, bulkheads, valves, services, hydrants, blow-offs, and connections shall be examined for leaks. If leaks are found, corrective measures shall be taken. After the above process has been completed, re-pump the system to the test pressure specified: 150 psi for the potable water and irrigation mains and 100 psi for the force mains. The pressure shall be maintained for one hour prior to the final pressure test.

6. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 2 hours. The test pressure shall be measured at the lowest point of the pipeline section being tested. All visible leaks shall be repaired.

7. If during the two-hour period the pressure gauge drops more than 5 psi, re-pump the system back to the specified test pressure and measure the volume of water required in gallons. At the end of the two-hour test period re-pump the system to the specified test pressure and measure the volume of water required in gallons. The leakage volume of the pipe is the sum of the volume of water required to maintain the specified test pressure during the 2-hour hydrostatic test and the water required at the end of the hydraulic test to re-pump the system to the specified pressure.

8. The maximum allowable leakage for distribution and transmission pipelines shall be computed on the basis of AWWA Standard C600 or the applicable formula for other than 20-foot lengths. In the case of pipelines that fail to pass the prescribed leakage test, the Contractor shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines. Per AWWA C600: No pipe installation will be accepted if leakage is greater than that determined by the following formula:

In inch-pound units, Where:

$$L = \frac{SD\sqrt{P}}{148{,}200}$$

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet (maximum of 2,000 feet, see I. below)

D = nominal diameter of the pipe, in inches (the smallest pipe diameter along the pipe length tested – see I. below)

P = average test pressure in pounds per square inch (gauge)

Note: For 20-foot pipe lengths, use factor of 148,200, as shown in formula above. For 18-foot pipe lengths, use factor of 133,200 instead of 148,200.

9. The Contractor shall test pressure pipeline systems between consecutive valves (valve to valve). In areas with valves in close proximity, consideration will be given by the city on a case-by-case basis to extend this test length. The Contractor may elect to test pipe lengths greater than the segments as defined above, however the allowable leakage (L) shall not exceed the amount calculated using a 2,000-foot length of pipeline (S) and the smallest diameter pipe (D) in the test segment. If the Contractor chooses to test a pipe section greater than 2,000 linear feet that could be isolated into a smaller test length, the allowable leakage shall be calculated using the actual length of the smallest pipe first, then using the next larger size pipe and successive larger pipe sizes until the 2,000 linear feet of pipe length is calculated, i.e., if there was 500 linear feet of 4-inch pipe, 500 linear feet of 6-inch pipe, and 12,000 linear feet of 8- inch pipe, the allowable leakage would be calculated as follows: 500 linear feet at 4-inch, 500 linear feet at 6-inch, and 1,000 linear feet at 8- inch.

10. The system will be bled down to zero psi after it has passed the test by bleeding off the pressure at the ends of the pressure system using hydrants, blow-offs, services, and any other appropriate appurtenances. One person should monitor the pressure gauge while another, in contact with the first, will supervise the bleed down process. This will verify that the pressure gauge is working properly and that the entire system has been tested. If the system being bled down has more than one tie-in (connection point), bleed off enough pressure from each area of the system to make the gauge show a drop for each area. If after all pressure has been released and the gauge reads zero psi, the test will be deemed acceptable.

11. The Contractor shall fill in any washouts and repair any damaged pipe or appurtenances caused by the test.

12. Final paving cannot be installed until after all pipelines are satisfactorily pressure tested. If the pavement is to be placed in two lifts, testing must be completed prior to installation of the final layer of asphalt.

3.05 DISINFECTING PIPELINES

1. General: All potable water pipelines shall be disinfected in accordance with the requirements of ANSI/AWWA C651 using the Continuous-Feed Method as modified herein.

2. Chlorination: A chlorine-water mixture shall be uniformly introduced into the potable water pipeline by means of a solution-feed chlorinating device. The chlorine solution shall be introduced at one end of the pipeline through a tap in such a manner that as the pipeline is filled with water; the dosage applied to the water entering the pipe shall be approximately 50 mg/l. Care shall be taken to prevent the strong chlorine solution in the line being disinfected from flowing back into the line supplying the water.

3. Retention Period: Chlorinated water shall be retained in the pipeline long enough to destroy all non-spore-forming bacteria. This period shall be at least 24 hours. After the chlorine-treated water has been retained for the required time, the free chlorine residual at the pipeline extremities and at other representative points shall be at least 25 mg/l.

4. Chlorinating Valves: During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily chlorinated water.

5. Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for domestic use. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to thoroughly neutralize the chlorine residual remaining in the water. The Contractor shall discharge water to a location and by methods approved by City. Care shall be taken to prevent chlorinated water from being discharged into storm sewer systems.

6. Bacteriological Testing: After final flushing and before the pipeline is placed in service, samples shall be collected at the sample points determined by the Health Department and shall be tested for bacteriological quality in accordance with the requirements of the State Department of Health or another appropriate regulatory agency. For this purpose, the pipe shall be re-filled with fresh potable water and left for a period of 24 hours before any sample is collected. Should the initial disinfection treatment fail to produce satisfactory bacteriological test results, the disinfection procedure shall be repeated until acceptable results are obtained. The City shall notify the Contractor of the test results.

3.06 CONNECTIONS TO EXISTING SYSTEM

1. The city will notify the Contractor when a Letter of Clearance is received from the Health Department. At this time the Contractor will be allowed to schedule the connection of the new line to the existing system. The Contractor shall notify the CITY Utility Department and schedule a time for connection to the existing system. Where connections are to be made to an existing water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a one percent

hypochlorite solution before they are installed. Thorough flushing shall be started as soon as the connection is completed and shall be continued until discolored water is eliminated. Additional sampling after connection shall be performed as required by the Health Department.

2. It will be not necessary to pressure test services that are installed on existing mains. These services are to be visually inspected at the existing line pressure.

3.07 TESTING OF WATER AND IRRIGATION SERVICES

1. Once service boxes have been installed in a test plan area, the Contractor shall demonstrate flow through every potable water and irrigation water service by opening the curb stop. The Contractor shall then isolate the irrigation main in the area and bleed the pressure to 0 psi. After bleeding the irrigation main to 0 pressure, the Contractor shall open every potable water and irrigation curb stop to demonstrate flow in the potable water service and no flow in the irrigation water service. The Contractor shall provide all necessary personnel to perform the Positive Service Identification and will be required to endorse the test results. The City's Inspector shall witness and endorse all Testing of Water and Irrigation Services.

END OF SECTION

SECTION 02822

SOLID
SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work

A. Furnish all labor, materials, equipment and incidentals required to prepare lawn bed and install sodding as specified.

B. All sodded areas disturbed by Contractor activities shall be replaced with like kind.

2. Related Work Described Elsewhere

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

B. Earthwork: Section 02200.

1.02 QUALITY ASSURANCE (NOT APPLICABLE)

1.03 SUBMITTALS

1. Provide technical data as required in Section 01340 regarding all materials or installation procedures required under this Section.

2. Submit representative topsoil samples for analysis by a private laboratory to determine nutrient deficiencies and outline a proper fertilization program.

PART 2 - PRODUCTS

2.01 GENERAL

1. 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 acid 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

1. Fertilizer:

A. 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.

B. Fertilizer shall be 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.

C. 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 or a City of Cape Coral Representative. Store fertilizer in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.

2. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 20 available phosphoric acid.

3. Lime shall be ground limestone.

2.03 SOD

1. Sod shall match existing kind and be of firm texture having a compacted growth and good root development as approved.

2. 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.

3. 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 PREPARATION

1. Areas to be sodded shall be cleared of all rough grass, weeds, and debris, and ground brought to an even grade as approved.

2. The soil shall then be thoroughly tilled to a minimum 8-inch depth.

3. Loam shall be placed to a minimum depth of 4 inches and shall be lightly compacted. No loam shall be spread in water.

4. Lime shall be applied at a rate necessary to achieve a pH of 6 to 7.

5. Apply superphosphate at a rate of 5 pounds per 1,000 square feet and apply fertilizer at a rate of 16 pounds per 1,000 square feet.

6. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over 1-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 INSTALLATION

1. 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 protected so as not to be damaged by sweating or excessive heat and moisture.

2. 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.

3. 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 or City.

3.03 MAINTENANCE

1. 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 and during the warranty period. 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. The Contractor shall also mow lawn areas once per week until final completion of the Project.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

1. 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.

END OF SECTION

SECTION 02830

CHAIN-LINK FENCES AND GATES

PART 1 – GENERAL

1.01 SCOPE

1. Furnish and install galvanized steel chain-link fence, nominally 6 feet high as shown on the Drawings. Provide gate(s) at the site as shown on the Drawings.

1.02 QUALITY ASSURANCE

1. Erection Qualifications: The fencing erector must be a firm experienced in the erection of fencing and accessories of the types specified. The erector must be approved by the manufacturer of the fencing and gates.

2. Design Criteria: Comply with the standards of the Chain-link Fence Manufacturer's Institute for Galvanized Steel Chain-link Fence Fabric, Federal Specification RR-F-191/1A, unless otherwise shown or specified.

3. 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. The cantilever gate and motor operator shall be manufactured by Hoover Fence Company or approved equal.

4. Suppliers Qualifications: The design, equipment, installation and installation supervision furnished under this section shall be provided by a motorized gate manufacturer who has been engaged in the business of supplying these types of equipment for at least 5 years.

5. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

A. ASTM A-120, Specifications for Pipe, Steel, and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless for Ordinary Uses.

B. ASTM A-90, Test Method for Weight of Coating on Zinc-Coated (galvanized) Iron or Steel Articles.

C. ASTM A-491, Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.

D. Chain-link Fence Manufacturers Institute, Galvanized Steel Chain-Link Fence Fabric.

E. Federal Specifications, RR-F-191/1A, Fencing and Wire and Post, and Metal (Chain-Link Fence Fabric).

F. Underwriters Laboratory Gate Operator Requirements (UL 325).

G. ASTM F 1184 Standard Specification for Industrial and Commercial Horizontal Slide Gates,

Type II, Class 2.

1.03 SUBMITTALS

1. Shop Drawings: Submit shop drawings in accordance with Section 01340.

A. 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.

B. Chain link cantilever gate and motorized gate operator, if specified on the drawings, including complete wiring diagrams; assembly and installation drawings; detailed specifications; and data covering the materials used and the parts, devices, and other accessories. Include the following:

1) A complete description of all components, including certification of listing by UL.

2) Complete sequence of operation for all functions.

3) Complete wiring diagram for all components and interfaces to equipment supplied.

4) Location drawings for all components.

5) A listing of the manufacturer's representatives responsible for installation and servicing.

6) Conduit and cabling to all equipment locations.

7) Layout and details illustrating height, location and sizes of posts, rails, braces, gate, footings, hardware list and erection procedures.

8) Descriptive literature of materials to be provided to determine compliance with the Specifications.

2. Operation, Maintenance and Instruction Manuals for Motorized Gate: Operation, Maintenance and Instruction Manuals for the equipment and systems shall be furnished.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

1. Delivery of materials shall be in manufacturer's original packaging with all tags and labels intact and legible.

2. Handle and store materials in such a manner as to avoid damage and prevent rust.

PART 2 – PRODUCTS

2.01 MATERIALS

1. Fabric: The fabric shall be galvanized steel chain link with No. 9 gauge wire woven in a 2-inch mesh.

Top and Bottom selvage shall be barbed. The fabric shall conform to the requirements of ASTM Designation A-491. The fabric shall have a minimum tensile strength of 75,000 psi. The weight of the coating shall be determined by the strip test as defined in ASTM Designation A428.

2. 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 A120.

3. Top Rail: The top rail shall be provided with couplings approximately every 20 feet. Couplings shall be the outside sleeve type, at least 6 inches long.

4. Swing Gates: Swing gates shall be as indicated on the Drawings and hinged to swing through 180 degrees from closed to open and shall be complete with latches, locking devices, stop keeper, hinges, fabric, and braces. Gates shall be the same height as the fence and the gate fabric shall be the same as the fence fabric. Gate frames shall be constructed of round tubular members continuously welded at all corners or assembled with fittings. Welds shall be painted with aluminum or zinc-based paint prior to application of pre-coating. Gate fabric shall be attached securely to the gate frames with No. 9 tie wires at intervals not exceeding 12 inches. Hinges shall be of adequate strength for the gate and with large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gates shall be easily operable by one person. Latches, stops, and keepers for all gates, along with 3/8-inch-thick stainless-steel chain and padlock shall be provided with each swing gate.

5. Electric Motorized Cantilever Gate: The gate system at site entrance shall be furnished as a complete package by the Motorized Gate Supplier consisting of a vehicular motorized slide gate as shown on the Drawings and as specified herein. The gate system shall include the slide gate, automatic gate operator, and all required structural and safety equipment.

   A. Slide Gate: Cantilevered slide gate shall be for 30-foot-wide clear opening as indicated on the Drawings, and shall be complete with latches, stops, keepers, rollers, and roller tracks. Gates shall be the same height as the fence. Gate shall ride on a double wheel carrier. Gate shall be as manufactured by Hoover Fence Company or approved equal.

   B. The slide gate operator shall be designed open and close a 30 feet clear opening cantilever chain-link gate (39 feet total) as shown on the Drawings. The operator shall function with digital keypads, detector loops and radio control. The operator shall utilize 208 Volt AC single phase. Control voltage shall be 24 Volt DC. Gate operator shall be as manufactured by Lift Master Elite Series SL3000UL1HP with 1 HP capacity or approved equal.

6. Concrete: Concrete shall have a minimum compressive strength of 3,000 psi at 28 days.

7. 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 galvanized except ties and clips may be of aluminum.

PART 3 – EXECUTION

3.01 ARRANGEMENT

1. Posts: All posts shall be uniformly spaced. Post spacing shall not exceed 10 feet. 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.

2. Braces: Braces shall be provided at each gate, corner, pull and end post.

3. Top Rails: 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.

4. Bottom Tension Wire: 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.

5. Stretcher Bars: Each stretcher bar 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) for each corner and pull post.

6. Ties and Clips: Fabric shall be fastened to all intermediate posts with 9-gauge tie wires, with spacing not to exceed 12 inches apart. Fabric shall be tied to top rail with 9-gauge tie wires, with spacing not to exceed 14 inches on centers.

3.02 INSTALLATION

1. Post Setting: Line posts shall be set in holes 12 inches in diameter, 42 inches deep with 36-inch post embedment. Terminal posts shall be set in holes 18 inches diameter, 42 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.

2. 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 and a galvanized 3/8-inch steel truss rod used as a tension member.

3. Fabric: Fence fabric shall not be stretched until concrete footings have cured a minimum of three (3) 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 MINIMUM

WALL THICKNESSES

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

SECTION 02900

PUMP STATION LANDSCAPING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide landscaping and appurtenant work, complete and in place, in accordance with the Contract Documents and the Land Use and Development Regulations as required by the City of Cape Coral Department of Community Development.

2. All landscaping around pump stations shall be outside of the pump station easement and maintained by the developer, HOA, or other responsible party. Any landscaping within the pump station easement must be pre-approved by the City of Cape Coral. Requests for landscaping within the pump station easement shall be accompanied by a planting plan for review and approval by the City of Cape Coral.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be furnished in accordance with Section 01300 – Contractor Submittals.

1.03 QUALITY ASSURANCE

1. General: All plants shall be true to type or name as indicated in the Contract Documents and shall be tagged in accordance with the standard practice recommended by the Agricultural Code of the State of Florida, however, determination of plant species or variety will be made by the City.

2. All plants shall comply with Federal and State laws requiring inspection for plant diseases and infestations.

3. The Contractor shall obtain clearance from the County Agricultural Commissioner, as required by law, before planting plants delivered from outside the County in which they are to be planted. Evidence that such clearance has been obtained shall be filed with the City.

4. Inspections will be made by the city or its representative during preliminary WORK, planting, finish grading, final WORK, prior and after maintenance period. The Contractor shall request inspection at least 24 hours in advance of the time inspection is required.

5. Rejected plants shall be identified as such in an obvious manner, shall be immediately removed from the Site, and be replaced with acceptable plants.

6. Plants shall have been grown in nurseries in accordance with accepted horticultural practices, which have been inspected by the governing authorities. Inspection of plant materials required by City, County, State, or Federal authorities shall be the responsibility

of the Contractor, who shall have secured permits or certificates prior to delivery of plants to Site.

7. Invasive plant species, including but not limited to, Ficus, melaleuca, Brazilian pepper, etc. shall not be planted.

8. The Contractor shall utilize 'Florida Friendly Plants' and draught tolerant landscaping as much as possible when furnishing the landscape.

1.04 CLEANUP

1. Upon completion of all planting operations, the portion of the Site used for WORK or storage area by the Contractor shall be cleaned of all debris, superfluous materials, and equipment. All such materials and equipment shall be entirely removed from the Site.

2. All walks or pavement shall be swept or washed clean upon completion of the WORK of this Section.

1.05 MAINTENANCE OF LANDSCAPING PLANTING PRIOR TO ACCEPTANCE OF PROJECT

1. General: The Contractor shall be responsible for protecting, watering, and maintaining all planting and irrigation systems until final acceptance of all WORK under the Contract.

2. Maintenance shall begin immediately after planting. Trees, shrubs and sod shall be maintained, or replaced if deemed unacceptable by the City, during the 3-year warranty period.

3. Trees, shrubs and sod shall be maintained by mowing, pruning, cultivating and weeding as required for healthy growth. Stakes, guy supports, and wrappings shall be tightened and replaced; trees and shrubs shall be reset to proper grades or vertical position and shall be sprayed to keep them free of insects and disease. Sprinkler lines broken or disrupted shall be replaced to proper working order prior to completion of the WORK under this Contract and shall be acceptable to the City.

4. Protection: The Contractor shall provide adequate protection to all newly seeded areas including erosion control, until Final Completion.

5. The Contractor shall replace any materials or equipment which are damaged.

6. Partial utilization of the project shall not relieve the Contractor of any of the requirements contained in the Contract Documents.

1.06 FINAL INSPECTION AND GUARANTEE

1. Inspection of lawns and planting will be part of final inspection under the Contract.

2. Written notice requesting inspection shall be submitted to the City at least 10 days prior to the anticipated inspection date.

3. Final acceptance prior to start of the guarantee period of the Contract will be on written approval by the City, on the satisfactory completion of all WORK, including maintenance, but exclusive of the replacement of plant material.

4. Any delay in the completion of any item of WORK in the planting operation which extends the planting into more than one season shall extend the correction period in accordance with the date of completion given above.

5. The Contractor shall replace within three days, all dead plants and all plants not in a vigorous, thriving condition, which are noted at the end of the three-year warranty period.

6. Plants used for replacement shall be of the same size and variety as shown on the drawings. Replacement plants shall be furnished, planted, staked, and mulched as indicated for new plants.

7. All WORK under this Section shall be left in good order to the satisfaction of the City and the City, and the Contractor shall, without additional expense to the City, replace any trees, shrubs, etc., which develop defects or die during the three-year warranty period.

1.07 MAINTENANCE AND GUARANTEE FOLLOWING ACCEPTANCE OF PROJECT

1. General: The Contractor shall be responsible for maintenance until Final Completion.

2. The inspection of lawn areas is independent of the final inspection and maintenance period. After the lawn has been accepted, the responsibility for mowing and irrigation will be turned over to the city.

3. All plant materials shall be in a condition acceptable to the City or its representative at the end of the three-year warranty period.

4. The Contractor shall make adjustments necessary to the automatic sprinkler system and shall replace any dead or diseased plants during the three-year warranty period.

5. Final Inspection: The City and Contractor shall make a final inspection at the end of the three-year warranty period. Any plants and materials found defective at time of final inspection shall be replaced within 3 days.

PART 2 -- PRODUCTS

2.01 GENERAL

1. All landscaping materials for soil conditioning, weed abatement, or planting shall be first-grade, commercial quality. A list of the materials used, together with typical certificates of each material, shall be submitted to the City prior to final acceptance.

2.02 TOPSOIL

1. Topsoil shall be fertile, friable loam suitable for plant growth. Topsoil shall be subject

to inspection and approval upon delivery.

2.03 FERTILIZER AND ADDITIVES

1. Fertilizer shall be furnished in bags or other standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. Fertilizers shall comply with the state fertilizer laws.

2. Chemical fertilizers shall be a mixed commercial fertilizer with percentages of nitrogen, phosphoric acid, and potash at 16-4-8. At least 50% of the phosphoric acid shall be from normal super phosphate or an equivalent source that will provide a minimum of 2 units sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or container. Fertilizers shall be uniform in composition, dry, and free flowing. Contractor shall observe requirements for seasonal fertilizing and use appropriate fertilizer mixes at all times.

2.04 MULCH

1. Mulch shall be fresh cypress mulch. The rate of application shall correspond to depth not less than 3-in. according to texture and moisture content of mulch material.

2. Straw mulch or native hay for a soil/seed stabilizer shall be clean hay or straw, consisting of oat, rye, or wheat straw, or of pangola, peanut, coastal Bermuda or bahia grass, hay or compost; and shall be free from noxious weeds and plants. Mulch shall not contain large sticks, stones, or other foreign materials that will prevent the eventual decay of the mulch necessary for its complete effectiveness. Mulch shall be applied at a rate of 3 tons per acre. Mulch is to be crimped into soil with a mulch crimper. Only undeteriorated mulch shall be used.

3. All fertilizers shall be of an organic source and shall be compatible with the type of plant that they are applied.

2.05 PLANT MATERIALS

1. Plants shall meet requirements of the Contract Documents and shall be in accordance with the botanical names and applicable standards of quality, size, condition, and type. Plants shall be true to name, genera, species, and variety in accordance with reference publications.

2. Plant names are defined in "Standardized Plant Names" and "Bailey's Encyclopedia of Horticulture." When a name is not found in either reference, the accepted name used in the nursery trade shall apply.

3. Plants shall be marked legibly for identification for delivery to the Site.

4. All plant material furnished by the Contractor shall be nursery grown in accordance with acceptable horticultural practices. Unless otherwise specified, all plant material shall be Florida No. 1 or better in accordance with Grades and Standards for Nursery

Plants, State Plant Board of Florida. The City reserves all rights to determine acceptability of plant material submitted for planting. Trees and palms must meet specification contained herein but need not necessarily be nursery grown stock.

5. Plants shall be of sound health, vigorous, and free from plant disease and shall be well branched, shall have full foliage when in leaf, and shall have a healthy well-developed normal root system.
6. All trees must have a fully developed fibrous root system, be heavily branched, or in the case of palms, heavily fronded, free from all insects, fungus, and other diseases. All trees and palms except cabbage palms shall be balled and burlapped (unless otherwise specified).

7. Shrubs and vines shall be heavily caned and leafed with foliage to base and shall be free from insects, diseases and mutilations of any nature.

8. All ground covers shall have a sturdy fibrous root system; unless unrooted cuttings are called for on the plans shall be heavily leafed and must be free of all insects, diseases and injuries.

2.06 STAKING MATERIALS

1. Stakes and Guys: Stakes and deadmen shall be of sound new hardwood, or treated softwood, free of knot holes and other defects. Wire ties and guys of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 ga shall be provided. New 2-ply garden hose not less than 1/2-inch hose size, cut to required lengths to protect tree trunks from damage by wires shall be provided. All guys shall be flagged.

2.07 MISCELLANEOUS MATERIALS

1. Wrapping material for trees, 2-inch diameter or larger, shall be 2 thicknesses of crinkled paper cemented together with bituminous material in strips 4-inch wide. Twine for tying shall be medium or coarse sisal yarn with a light impregnation of oil condensate from asphalt or tar.

2. All stone shall be FDOT #57 stone. Setting bed shall be 4 inches below grade with Mirafi filter fabric under the stone.

3. Continuous decorative concrete curbing shall be required at the master pump station as shown on the drawings.

4. HDPE bulb type plastic edging required at each duplex station as shown on the Drawings shall be at least 6 inches wide.

2.08 WATER

1. It is the Contractor's responsibility to supply all water to the site during sodding and planting operations and through the maintenance period and until the WORK is accepted. The Contractor shall arrange for adequate supply of water needed for HIS WORK. The Contractor shall also furnish all necessary equipment and accessories for the adequate

irrigation of lawns and planted areas. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 -- EXECUTION

3.01 GENERAL

1. The landscape WORK shall not be performed at any time when it may be subject to damage by climatic conditions.

2. The Contractor shall carefully scale or otherwise verify all dimensions in the Contract Documents. Dimensions and plant locations shall be coordinated with City and final location shall be Site-oriented by the planter and City. Any discrepancies or inconsistencies shall be brought to the attention of the City.

3. Substitutions for the indicated plant materials may be considered pursuant to the Contract Documents.

4. The Contractor shall remove and/or relocate landscape items such as trees, shrubs, grass, other vegetation, improvements, and obstructions as required.

5. Waste materials shall be removed and disposed of off the Site, unless otherwise indicated.

6. The Contractor is responsible for obtaining information regarding utilities in the area of WORK and shall protect them as necessary.

7. Burning of combustible materials on the Site shall not be permitted.

8. The Contractor shall provide temporary fencing, barricades, covering, or other protections to protect the adjacent properties and other structures from damage. The Contractor shall protect structures, sidewalks, pavements, and other facilities which are subject to damage during landscape WORK. All excavations shall be backfilled at the end of the day.

3.02 SOIL PREPARATION

1. The landscape WORK shall not begin until all other trades have repaired all areas of settlement, erosion, rutting, etc., and the soils have been re-established, recompacted, and refinished to finish grades. The City shall be notified of all areas which prevent the landscape WORK from being executed.

2. Areas requiring grading by the landscaper including adjacent transition areas shall be uniformly level or sloping between finish elevations to within 0.10-ft above or below required finish elevations.

3. The landscape WORK shall not proceed until after walks, curbs, paving, edging, and irrigation systems are in place.

4. During grading, waste materials in the planting areas such as weeds, rocks 2 inches and larger, building materials, rubble, wires, cans, glass, lumber, sticks, etc., shall be removed from the Site. Weeds shall be dug out by the roots. After removal of waste materials, the planting area subgrade shall be scarified and pulverized to a depth of not less than 6 inches, and all surface irregularities below the cover of topsoil shall be removed.

5. Fertilizers, additives, peat, etc. subject to moisture damage shall be kept dry in a weatherproof storage place.

6. Finish grading shall consist of:

7. Final contouring of the planting areas.

8. Placing all soil additives and fertilizers.

9. Tilling of planting areas and bringing areas to uniform grades by floating and/or hand raking.

10. Making minor adjustment of finish grades as directed by the city.

11. Removing waste materials, raking, disking, dragging, and smoothing soil ready for planting.

12. Finish grade of all planting areas shall be 1-1/2 inches below finish grade of adjacent pavement of any kind.

13. Topsoil shall be uniformly distributed over all areas where required. Subgrade and topsoil shall be damp.

14. Surface drainage shall be provided as indicated by shaping the surfaces to facilitate the natural run-off of water. Low spots and pockets shall be filled with topsoil and graded to drain properly.

3.03 DELIVERY, STORAGE, AND HANDLING OF PLANT MATERIALS

1. Plants shall be planted no later than 2 days after delivery.

2. All balled and burlapped plants which cannot be planted immediately after delivery shall be set on the ground and be well protected with soil, wet moss, or other acceptable material. Bundles of plants shall be opened and the plants separated before the roots are covered. Care shall be taken to prevent air pockets among the roots.

3. During planting operations, bare roots shall be covered with canvas, wet straw, or other suitable materials. No plants shall be bound with wire or rope at any time so as to damage the bark or break branches.

4. Plants shall not be picked up or moved by stem or branches but shall be lifted and handled from the sides of the containers. Plants with balls cracked or broken before or

during planting operations will not be accepted and shall be immediately removed from the Site.

3.04 TREE AND PLANT LOCATIONS

1. The Contractor shall locate and stake all tree and shrub locations and have the locations

2. approved by the City before starting excavation for same. The plant locations shall be observed, and their locations shall be adjusted as directed by City before final approval.

3. No trees shall be located closer than 72 inches to structures unless otherwise indicated. Ground covers and shrubs may be planted up to structures or curbs.

3.05 PLANT PITS

1. Plant pits, centered on location stakes, shall be excavated circular pits with vertical sides and flat or saucer shape bottom in accordance with the following sizes unless indicated otherwise:

2. Tree pits shall be at least 2 feet greater in diameter than the specific diameter of ball or spread of roots and at least 6 inches below depth of ball or roots. A 3-inch layer of manure shall be worked thoroughly to a depth of 6 inches below the pit bottom.

3. Shrubs shall be planted in pits or holes of soil 24 inches deep below finished grade, or deeper as necessary to properly set the plant at finished grade with a minimum of 6 inches of planting soil under balls of all plants. Shrubs with balls shall be planted in pits that are at least 24 inches greater in diameter than the bottom of ball. Bare root shrubs shall be planted in pits at least 12 inches below the roots of the plant.

3.06 PREPARED BACKFILL

1. Topsoil for use in preparing soil for backfilling plant pits shall be a fertile, friable, natural topsoil of loamy character, without mixture of subsoil materials, and obtained from a well-drained, arable site. It shall be free from heavy clay, coarse sand, stones, lime, lumps, plants, roots, obnoxious grasses (such as Bermuda or nut grass) and weeds. It shall not be excessively acid or alkaline nor contain toxic substances which may be harmful to plant growth.

3.07 ROCKS OR UNDERGROUND OBSTRUCTIONS

1. In the event that rock or underground obstructions are encountered in the excavation of plant pits, alternative locations will be selected by the City. Moving of trees to alternative locations shall not entail additional costs to the City.

3.08 SETTING PLANT MATERIALS

1. A layer of planting soil shall be placed and compacted in the bottom of the excavation.

2. Balled stock shall be placed in the excavation with the top of the ball to match adjacent finished grade. Soil shall be added as required under the ball to achieve plumbness.

3. Backfill shall be placed in 2- to 3-inch-thick layers. Each layer shall be worked by hand to complete backfill and eliminate voids. Trees shall be kept plumb during backfilling. When excavation is approximately 2/3 full, backfill hole shall be filled with water. Watering shall be repeated until no more water can be absorbed. Remainder of backfill shall be placed and compacted and watered again.

4. Container-Grown plants shall be placed and backfilled as specified for Balled and Burlapped stock, and the bottom of the container removed immediately before placing.

5. The top of the backfill shall be dished to allow for mulching and an earthen berm constructed around the rim of the original excavation to hold six inches of water.

3.09 STAKING

1. Staking of trees shall be done immediately after planting. Plants shall stand plumb after staking. Staking shall be as required.

2. No balled and burlapped specimen "tree-like" shrubs shall be staked.

3. Trees of 2-inch caliper and larger shall be guyed at points of branching with 3 wires spaced equally around and outside the perimeter of the ball. Guy wires shall be covered with rubber hose at the bark at points of contact. Each guy shall be positioned below crotches and fastened to a 4-inch diameter by 18-inch wood deadman, driven 12 inches into ground. Stakes will be removed by the city.

4. Trees less than 2-inch caliper shall be supported by 2 takes placed diametrically opposite at perimeter line of ball and to sufficient depth to hold tree rigid. Stakes shall be driven vertically and not twisted or pulled. Trees shall be wired to each stake as indicated on staking details. Trees shall be protected with rubber hose over wires at points of contact. Stakes will be removed by the city.

3.10 PRUNING AND MULCHING

1. Each tree and shrub shall be pruned in accordance with standard horticultural practice to preserve the natural character of the plant in the manner fitting its use in the landscape design, as approved by the City.

2. All dead wood or suckers and all broken or badly bruised branches shall be removed by thinning out and shortening branches. Deciduous bare-rooted plants shall have not less than 1/3 of their respective leaf surfaces removed. All cuts shall be made just above a healthy bud. Pruning shall be done with clean, sharp tools.

3. Cuts over 3/4-inch diameter shall be painted with approved tree paint. Paint shall cover all exposed cambium as well as other living tissue. Paint shall be waterproof, adhesive, and

elastic antiseptic; shall be free from kerosene, coal tar, creosote, or other materials injurious to the life of the tree; and shall be approved before it is used.

4. Plants shall be mulched after planting and cultivating have been completed. A layer of mulch materials shall be spread on finished landscaping grade within all planting areas to a depth of 3 inches. All shrub and ground cover beds shall be completely covered with the mulch.

3.11 SODDING

1. Preparation of sub-grade grading shall be per the paragraphs entitled "General" and "Soil Preparation" above.

2. Finish grading shall be per the paragraph entitled "Soil Preparation" above. The soil additives shall be provided as recommended by manufacturer's instructions and the fertilizer for finish grading shall be spread at a rate of 20 lb/1000 ft^2 or as recommended by the manufacturer.

3. Sod shall be laid within 24 hours from the time of stripping. Dormant sod shall not be laid.

4. Sod shall be laid to form a solid mass with tightly fitted joints. Ends and sides of sod strips shall abut without overlap. Strips shall be staggered to offset joints in adjacent courses. Sod shall be tamped or rolled lightly to ensure contact with subgrade. Sifted soil shall be worked into minor cracks between pieces of sod with excess removed to avoid smothering of adjacent grass.

5. Sod shall be watered thoroughly with a fine spray immediately after planting.

3.12 MISCELLANEOUS ITEMS

1. After all edging, plants, and sprinkler emitters are in place, and the existing grass in all wood mulch, cobble, and gravel areas has been removed to a depth of 4 inches, place filter fabric over the entire area to receive wood mulch, cobble, or gravel.

2. Cypress chip mulch shall be placed in all shrub areas were indicated to a minimum depth of 3 inches over planted areas.

3. Gravel shall be placed as indicated on the Drawings to a minimum depth of 4 inches over the entire area.

END OF SECTION

SECTION 02920

RESTORATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall perform all restoration Work indicated and required in accordance with the Contract Documents. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform the Work.

2. The Contractor shall examine the site and identify items that require restoration during construction and prior to completion and shall coordinate the restoration of such items with the City and the landowner as needed.

1.02 QUALITY CONTROL

1. The City shall perform quality control to confirm and document that all restoration Work performed by the Contractor has been completed to the satisfaction of the City and/or the landowner.

1.03 CONTRACTOR SUBMITTALS

1. The Contractor shall perform Work in accordance with the requirements in Section 01300 - Contractor Submittals.

PART 2 -- PRODUCTS

2.01 REQUIREMENTS

1. General: Materials for use shall be as indicated in this Section, unless specified otherwise. For earthwork restoration, the soil materials shall be as specified in Section 02200 – Earthwork.

2. Contractor shall notify the property owner of any landscape, trees, bushes, decorative fencing, etc. located within the right-of-way conflicting with construction 60 days prior to commencing construction activities. Property owner will have 60 days to remove any landscape, trees, bushes, decorative fencing, etc. located within the right-of-way during that 60-day period. Contractor shall be required to remove and dispose of any landscape, trees, bushes, decorative fencing, etc. left within the right-of-way after 60 days.

PART 3 -- EXECUTION

3.01 REQUIREMENTS

1. General: Restoration WORK shall be performed as indicated in this Section. For restoration Work related to earthwork, the execution shall be as specified in Section 02200 – Earthwork. Restoration shall begin as soon as practical after the utility has been

installed. Mailboxes shall be replaced daily unless other provisions have been made. All practical efforts shall be made to complete roadway restoration including the prime coat within 60 days of beginning Work in an area. Contractor shall properly restore roadway access at the end of each workday, unless otherwise approved by the City. Asphalt paving shall be completed within 90 days of the application of the prime coat. Prime coat shall be maintained until such time as the asphalt installation is complete. Driveways, finish grading, seeding, sodding, and other final restoration shall be started in an area within 14 days of the installation of the asphalt paving. Final restoration must be completed within 60 days of the installation of the asphalt paving. All areas disturbed by construction activities shall be restored, including lots used for access to Work, lay- down, storage, excess earth stock piles, etc., to a condition equal to or better than existing prior to construction.

3.02 LAWN AREAS

1. Driveways, lawns and landscaping areas shall be restored and property such as mailboxes shall be replaced. Mailboxes shall be replaced in accordance with FDOT 2013 Design Standards Index No. 532. Where excavation occurs in lawn areas, the Contractor shall re-sod the lawn to match the existing type of grass after completion of the Work. All lots with homes or businesses shall be re-sodded in accordance with Section 02822 – Solid Sodding.

2. Right-Of-Way areas at lots without houses or businesses shall be seeded and mulched in accordance with FDOT Standard Specifications 2013 Section 981. All lots without houses or businesses shall be seeded and mulched or shall be hydro-mulch seeded in accordance with Florida Department of Transportation Section 981 and shall be green mulch mix. If seed and mulch is used for restoration, a strip of sod with a minimum width of 12" minimum shall be placed along the street side of the excavation to provide erosion protection along the pavement edge. Seed shall conform to the requirements of the Florida Department of Agriculture and Consumer Services and all applicable State laws. The seed shall have been harvested from the previous year's crop. All seed bags shall have a label attached stating the date of harvest, LOT number, percent purity, percent germination, noxious weed certification and date of test. Seed, which has become wet, moldy, or otherwise damaged prior to use, will not be accepted.

3. Each of the species or varieties of seed shall be furnished and delivered in separate labeled bags. During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents, or other causes.

4. All quantities of seed specified shall be for pure live seed. It is the responsibility of the Contractor to calculate and apply the actual pure live seed poundage based on the label attached to each bag of seed. Shipping tickets shall indicate both pure live seed weight and bulk weight for each species.

5. Grass seed shall be fresh, clean, new-crop seed, composed of the varieties listed below mixed in the proportions by weight. Purity and germination percentage shall be the results of testing. Germination rate of all seed shall not be less than 80% and no seed with an excess of 5% weed shall be used.

6. A Bahia/millet seed mixture will be utilized between March 1 and November 1. A rye/Bahia mixture will be utilized between November 1 to March 1. The seed mixture will be spread uniformly on the prepared soil. Hay mulch will then be spread uniformly upon the seeded area to provide erosion control until the seeds germinate. The hay mulch will then be cut into the soil and crimped with specialized equipment ensuring further soil stability. Lots without houses or businesses may also be hydro-mulch seeded in accordance with Florida Department of Transportation Section 981 and shall be green mulch mix.

7. The existing sod may be carefully removed, dampened, and stockpiled to preserve it for replacement or new sod may be provided. Contractor must provide new sod if stockpiled sod has not been placed within 72 hours of cutting. Excavated material may be placed on the lawn provided that a drop cloth, plywood, or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling, the sod shall be replaced and lightly rolled in a manner so as to restore the lawn to a condition, which meets or improves the original condition.

3.03 LANDSCAPING AND TREES

1. Only trees that directly impede construction activities shall be removed. City must approve any and all tree removal. Trees removed under such conditions may be required to be replaced. All trees that interfere with Work improvements and proper storm drainage flow shall be removed at no additional cost to the City, at the City's direction.

3.04 SOD FOR STABILIZATION

1. At all locations where the excavated area is within 4 feet of the street pavement and where no natural stand of grass exists, two (2) strips of sod of at least 2-foot 8 inches in width shall be planted along the edge of the pavement as a means of erosion stabilization and pavement protection. The sod strips, or blocks, shall be placed with staggered transverse joints. This shall include all areas to be seeded as the basic means of stabilization and restoration. Provide two (2) strips of sod around all meter boxes installed on vacant lots. All sod shall be properly rolled when installed.

3.05 RESTORATION OF SIDEWALKS OR PRIVATE DRIVEWAYS

1. Wherever sidewalks or private driveways have been removed for purposes of construction, the Contractor shall place suitable temporary sidewalks or driveways promptly after backfilling and shall maintain them in satisfactory condition until the replacement sidewalk or driveway is constructed.

2. Private driveways shall be provided with temporary access within a maximum time of 12 hours after removal for construction. The Contractor shall provide a minimum of 48 hours' notice to all affected parties prior to removing private driveways. The final restoration of the driveway shall be completed within 14 days after paving the local street.

3. The Contractor shall maintain temporary sidewalks or driveways until the final restoration has been made. The concrete shall have a minimum cure time of 3 days. During this time period the concrete must be protected from rain, traffic and all other elements that could cause damage by the Contractor at no additional cost to the city.

4. In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw cut and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of driveway. Damaged edges of driveways along excavations and elsewhere shall be trimmed by saw cutting in straight lines. Incidental driveway repair (driveways that new pressure pipe mains are not installed under) shall be full width and to a minimum length of three feet. Construction/control joints shall be at least three feet apart. Driveway replaced due to the installation of new pressure pipe mains shall be replaced from the roadway to the nearest construction or control joint or the Right-Of-Way line. All driveway restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed driveway and pavement.

5. All driveways shall be restored to preexisting conditions.

6. At Contractor's option, he may bore and jack under existing driveways and sidewalks in lieu of open cut pipe installation, utilizing ductile iron pipe with restrained joints. See Section 02340 – Boring and Jacking.

3.06 WATERING

1. Upon completion of the erosion control seeding, sodding, and other trees and plantings, the entire area shall be soaked to saturation by a fine spray. The new plantings shall be adequately watered during dry weather to establish and maintain a healthy stand of grass and viability of all plants. At no time shall the plantings be allowed to dry out. Care shall be taken to avoid excessive washing or pooling on the surface and any such damage caused thereby shall be repaired by the Contractor.

3.07 MAINTENANCE PRIOR TO FINAL ACCEPTANCE

1. The Contractor shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include the filling, leveling, and repairing of any washed or eroded areas, as may be necessary, and sufficient watering to maintain the plant materials in a healthy condition. The City may require replanting of any areas in which the establishment of the vegetative ground cover does not appear to be developing satisfactorily. Contractor shall mow sod at inlets on undeveloped lots and four lane medians prior to substantial completion.

3.08 MISCELLANEOUS ITEMS

1. Improvements to the land such as fences, walls, outbuilding, mail boxes, and other structures that of necessity must be removed, shall be replaced with equal or better-quality materials and workmanship. The Contractor shall provide the homeowner the opportunity to retain any mailbox, fence, wall, outbuilding, etc. prior to removal. Mailboxes shall be replaced to match the originals at the locations encountered prior to

commencement of the Work. The mailbox shall be replaced in accordance with FDOT Design Standards 2013 Index. No. 532 with the face located at least 2 feet from the edge of payment and the bottom 42" from the top of pavement.

2. Disturbed swales shall be regraded to provide positive drainage.

3. Any commercial signs, disturbed or removed, shall be restored to their original condition within 24 hours.

4. Special Items- Decorative rocks, yards signs, and other landscaping items shall be replaced in kind at the original locations.

END OF SECTION

SECTION 03111

CONCRETE FORMWORK (ADDED)

PART 1 - GENERAL

1.01 DESCRIPTION

1. This section describes materials and installation of concrete forms.

1.02 SUBMITTALS

1. Submit shop drawings in accordance with the General Conditions and Section 01340: Shop Drawings, Working Drawings and Samples.

2. Submit manufacturer's literature for form ties, spreaders, corner formers, form coatings, and bond breakers.

3. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

4. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

PART 2 - PRODUCTS

2.01 FORM CONSTRUCTION AND DESIGN

1. Design formwork in conformance with methodology of ACI 347R for anticipated loads, lateral pressures, depth of concrete placement and rate of concrete placement.

2. Locate bracing and shoring to maintain form stability and comply with finish tolerances specified.

3. Provide temporary openings in wall and column forms to facilitate cleaning, inspection and concrete placement.

4. Provide drop chutes and/or drop pipes to prevent accumulation of hardened concrete on forms and reinforcement above fresh concrete and to prevent concrete segregation.

5. Construct forms with regard for construction and expansion joint locations and architectural lines.

6. Use panels as large as practical to minimize form seam lines.

7. Construct forms to minimize fines leakage during concrete placement at construction joints, bulkheads, base of wall/slab intersections and other areas where fines may migrate from the concrete surface during placement. The level of acceptable fine leakage from the formed surface shall be determined by the Engineer as evidenced by the lack of rock

pockets formed during placement of the concrete.

8. Provide form windows or stage forms to allow visual observation at all times of the concrete being placed and vibrated. Provide a formwork design and placement schedule that will limit free fall of concrete in walls 8 inches or less in thickness to 4 feet and for walls thicker than 8 inches, limit this fall to 6 feet. Total vertical lift made in a single pass shall not exceed 2 feet in height.

9. Notify the Owner's Representative prior to concrete placement (48 hours minimum).

10. Steel forms shall be minimum 24 gauge, with tongue-and-groove joints, complete with steel stakes and splice plates.

11. Provide material for forms that is not reactive with concrete. Formwork of aluminum is not acceptable.

12. Expandable metal mesh shall not be used in formwork.

2.02 CLASSES OF FORMS

1. Class I Forms: Use steel forms, ply form, or smooth-surface plywood 3/4-inch minimum thickness for straight surfaces and 1/2-inch minimum thickness for curved surfaces.

2. Class II Forms: Use plywood in good condition, metal, or smooth-planed boards free from large or loose knots with tongue-and-groove or ship-lap joints.

3. Class II forms may be used for exterior concrete surfaces that are 1 foot or more below finished grade. Use Class I forms for all other surfaces.

2.03 FORM MATERIAL

1. Use plywood, lumber, and steel of sufficient strength and surface smoothness to produce the specified finish.

2. Lumber used in form construction shall be Southern Yellow Pine, No. 2, S4S, Standard Grade Rules Southern Pine Inspection Bureau. Boards shall be 6 inches or more in width.

3. Plywood used in form construction shall be Grade B-B, Class 1 plyform, mill-oiled, and sanded on both sides in conformance with U.S. Product Standard PS-1.

2.04 FORM TIES

1. Locate form ties on exposed surfaces in a uniform pattern or as indicated in the drawings. Place form ties so they remain embedded in the concrete except for a removable portion at each end and do not leave an open hole through the concrete. Form ties shall have conical or spherical type inserts with a maximum diameter of 1 inch. Construct form ties so that no metal is within 1 inch of the concrete surface when the forms, inserts, and tie ends are removed. Do not use wire ties. Ties shall withstand all pressures and maintain forms within acceptable deflection limits.

2. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1 inch and sufficient dimensions to permit patching of the tie hole.

3. Ties for water-holding structures or dry structures with access, such as basements or pipe galleries, that are below finish grade shall have an integral steel water stop that is tightly and continuously welded to the tie. The water stop shall be at least two times larger in area than the tie cross-sectional area and shall be oriented perpendicular to the tie and symmetrical about the center of the tie. Construct the ties to provide a positive means of preventing rotation or disturbance of the center portion of the tie during removal of the ends.

4. Tapered form ties shall be tapered through-bolts at least 1 inch in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of the same minimum size.

2.05 BOND BREAKER

1. Bond breaker shall be a V.O.C.-compliant nonstaining type that will provide a positive bond prevention, such as Clean Lift 90 W.B. as manufactured by Edoco Burke; Silcoseal 97EC as manufactured by Nox-Crete, Inc.; or equal.

2. Bond breaker shall be certified as meeting the requirements of ANSI/NSF 61 for contact with potable water.

2.06 FORM RELEASE AGENT

1. Form releasing agents shall be certified as meeting the requirements of ANSI/NSF 61 for contact with potable water.

2. Form release agent shall effectively prevent absorption of moisture by the form and prevent bond with the concrete. Agent shall be nonstaining, V.O.C.-compliant, leave concrete with a coatable surface, and be nontoxic after 30 days.

3. For steel forms, release agent shall prevent discoloration of the concrete due to rust.

PART 3 - EXECUTION

3.01 FORM TOLERANCES

1. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum Tolerance (inch)
Sleeves and inserts	+1/4 –1/4
Projected ends of anchors	+1/4 –0.0
Anchor bolt setting	+1/4 –1/4
Finished concrete, all locations	+1/4 -1/4 in 10 feet
	Max ±1-inch in total length

2. The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and inserts:	Centerline of sleeve or insert.
Projected ends of anchors:	Plane perpendicular to the end of the anchor as located in the drawings.
Anchor bolt setting:	Centerline of anchor bolt.
Finish concrete:	The concrete surface as defined in the drawings.

3. Where equipment is to be installed, comply with manufacturer's tolerances if more restrictive than above.

4. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner.

3.02 FORM SURFACE PREPARATION

1. Clean form surfaces to be in contact with concrete of foreign material prior to installation. Tape, gasket, plug, and/or caulk joints, gaps, and apertures in forms so that the joint will remain watertight and withstand placing pressures without bulging outward or creating surface irregularities.

2. Coat form surfaces in contact with concrete with a form release agent prior to form installation.

3. Keep form coatings off steel reinforcement, items to be embedded, and the previously placed concrete.

4. Coat face and edges of Class I forms with a two-coat system of one-component polyurethane coating applied by roller at the rate of 500 square feet per gallon.

3.03 BEVELED EDGES (CHAMFER)

1. Form 3/4-inch beveled edges on exposed concrete edges and corners, beam soffit corners, and were indicated in the drawings. Reentrant corners in concrete members shall not have fillets, unless otherwise shown in the drawings. The top edges of slabs, walkways, beams, and walls may be beveled with an edging trowel in lieu of using chamfer strips.

3.04 FORM PLACEMENT

1. Provide means for holding adjacent edges and ends of form panels tight and in accurate alignment to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Forms shall be tight and shall prevent the loss of mortar and fines during placing and vibration of concrete.

2. Provide one cleanout and inspection opening (12 inches wide by 18 inches high) every 7

feet at the bottom of each lift of forms.

3. Provide exterior corners in concrete members with bevels as specified.

4. Provide means for removing forms without injury to the surface of finished concrete.

5. Do not embed any form-tying device or part thereof other than metal in the concrete.

6. Locate large end of taper tie on the "wet" side of the wall.

7. Use only form or form-tying methods that do not cause spalling of the concrete upon form stripping or tie removal.

8. Form surfaces of concrete members except where placement of the concrete against the ground is shown in the drawings or as indicated below. The dimensions of concrete members shown in the drawings apply to formed surfaces, except where otherwise indicated. Add 2 inches of concrete where concrete is placed against trimmed undisturbed ground in lieu of forms. Placement of concrete against the ground shall be limited to footings and other nonexposed concrete and only where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing.

3.05 FORM REUSE

1. Reuse only forms that provide a uniform surface texture on exposed concrete surfaces. Apply light sanding or other surface treatment between uses for uniform texture. Plug unused tie rod holes with corks, shave flush, and sand the concrete surface side. Do not patch forms other than filling tie rod holes, except in the case of Class II forms. Do not use metal patching discs on Class I forms.

3.06 REMOVAL OF FORMS

1. Forms and shoring for elevated structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and reshore. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed:

Sides of footings and encasements	24 hours
Walls, vertical sides of beams, girders, columns, and similar members not supporting loads	48 hours
Slabs, beams, and girders	10 days (forms only)
Shoring for slabs, beams, and girders	Until concrete strength reaches specified 28-day strength
Wall bracing	Until top or roof slab concrete reaches specified 28-day strength

2. Do not remove forms from concrete that has been placed with outside air temperature

below 50°F without first determining if the concrete has properly set without regard for time. Do not apply heavy loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

3.07 FORMED OPENINGS

1. Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure watertightness. Provide openings with continuous keyways and water stops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.

3.08 EMBEDDED ITEMS

1. Set anchor bolts and other embedded items accurately before placing concrete and hold securely in position until the concrete is placed and set. Check special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after placing concrete. Check nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to placing concrete.

3.09 ALUMINUM SURFACES IN CONTACT WITH CONCRETE

1. Coat aluminum surfaces that will be in contact with concrete per Section 09900, System No. 18.

3.10 PIPES AND WALL SPOOLS CAST IN CONCRETE

1. Install wall spools, wall flanges, and wall anchors before placing concrete. Do not weld, tie, or otherwise connect the wall spools or anchors to the reinforcing steel.

2. Support pipe and fabricated fittings to be encased in concrete-on-concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will occur during construction.

3. Pipes or spools located below operating water level shall have water stop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast. Pipes fitted with thrust rings shall be cast in place.

END OF SECTION

SECTION 03151

CONCRETE JOINTS, WATER STOPS, AND SEALANTS (ADDED)

PART 1 - GENERAL

1.01 DESCRIPTION

1. This section describes materials, testing, and installation of construction and expansion joints, PVC water stops, premolded joint filler, joint sealant, bond breaker tape, preformed control joints, backing rod, and steel expansion joint dowels.

1.02 SUBMITTALS

1. Submit shop drawings in accordance with the General Conditions and Section 01340 Shop Drawings, Working Drawings and samples.

2. Submit manufacturer's literature, catalog data, and statement of compliance with referenced standards and specifications for materials specified herein.

3. Submit material samples of PVC water stops.

4. Provide technical data sheets for the Contractor's personnel and the Owner covering joint preparation, priming, and sealant materials application.

5. Submit layouts for construction joints.

1.03 MANUFACTURER'S SERVICES

1. Prior to joint preparation for joints receiving sealant materials, the Contractor shall require joint manufacturer's technical representative to demonstrate at the site joint preparation, priming, and sealant materials application for the Contractor's personnel performing joint work.

PART 2 - PRODUCTS

2.01 WATER STOP SHALL BE:

1. Water stops shall be extruded from a PVC compound and shall be lock-rib, center-bulb, retro-fit or flat-strip type as manufactured by Greenstreak, Durajoint, Kirkhill Rubber Company, Vinylex, or equal. Water stop shall comply with Corps of Engineers Specification CRD-C-572-74.

2. PVC waterstop for construction joints shall be flat ribbed type, 6 inches wide unless otherwise noted on the drawings, with a minimum thickness at any point of 3/8 inches. PVC waterstop shall be Model 732 by Greenstreak or approved equal.

3. PVC waterstop for control joints shall be ribbed with a center bulb, 6 inches wide with a

minimum thickness at any point of 3/8 inches. The center bulb shall have an O.D. not less than 1-3/8 inches. PVC waterstop shall be Model 732 by Greenstreak or approved equal.

4. PVC waterstop for expansion joints shall be ribbed with a center bulb, 9 inches wide with a minimum thickness at any point of 3/8 inches. The center bulb shall have an O.D. not less than 1-3/8 inches. PVC waterstop shall be Model 738 by Greenstreak or approved equal.

5. PVC waterstops for sealing existing concrete structures and new concrete placement shall be retro-fit type, 6 inches wide and 3-3/16 inches height with a minimum thickness at any point of 3/8 inches. The waterstop shall be attached to the existing concrete using 1/4" X 2-1/4" SS sleeve exp. Bolt with SS batten bars. PVC waterstop shall be Model 609 by Greenstreak or approved equal.

6. All PVC waterstops shall have an integral fastening system consisting of hog rings and grommets.

7. Extruded from virgin elastomeric PVC compound.

8. Provide factory-made crosses, tees and ells fabricated by the waterstop manufactured using thermostatically controlled electric heat source.

9. Resistant to chemical action with portland cement, alkalies, acids, and not affected by mildew or fungi. It shall show no effect when immersed for 10 days in a 10% solution of sulfuric or hydrochloric acid, saturated lime solution or salt water. Water stops shall be such that any cross section will be dense, homogeneous, and free from porosity and other imperfections. They shall be symmetrical in shape. When tested in accordance with Federal Standard No. 601, the material shall meet the following minimum requirements:

Requirement	ASTM Spec.
Tensile strength, 2,000 psi	D638
Hardness, Shore durometer, 60-70	D2240
Elongation, ultimate, 280%	D638
Water absorption, dry weight, maximum (48 hours) 0.32%	D570
Specific gravity, 1.3	D792
Stiffness in flexure, 920 psi	D747
Cold brittleness, -35°F	D746
Tear resistance, 290 lbs./inch	D624

2.02 JOINT SEALANT FOR CONCRETE STRUCTURES

1. Joint sealant shall be a multipart, gray, nonstaining, nonsagging, gun grade polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant

2. rubber. Sealant shall comply with ASTM C920, Type M, Grade P, Class 25 for horizontal joints and Grade NS, Class 25 for vertical joints and be recommended by the manufacturer for continuous immersion in water.

Characteristic or Parameter	Technical Requirements
Pot life	1 to 3 hours
Hardness	35 Shore A, ±5
Elongation	650%, ASTM D412
Tensile strength	200 psi, ASTM D412
Peel strength on concrete	No adhesion loss at 25 pounds
Temperature service range	40°F to 167°F
Immersion in water	Continuous

3. Sealant shall be Tremco Vulkem 227 or Sikaflex-2CNS (for Grade NS, Class 25), Sikaflex-2CSL of Sika Corporation or Vulkem 245 (for Type M, Grade P, Class 25), or equal. Troweling of sealants into joints will not be permitted.

4. For wastewater applications, use multi-component chemical resistant polysulfide sealant conforming to ASTM C 920, Type M, Grade NS, Class 25 such as Sonolastic Two- part, Sonneborn, Minneapolis, MN, Hornflex-L, Tamms, Beltsville, MD, or Cormax PSC, DuPont, or approved equal.

2.03 BACKING ROD FOR EXPANSION JOINTS

1. Backing rod shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware, or equal. The rod shall be 1/4 inch larger in diameter than the joint width. Where possible, provide full-length sections for the joint; minimize splices. Apply backup rod and bond breaker tape in expansion joints.

2.04 BOND BREAKER TAPE

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape that will adhere to the premolded joint material or concrete surface. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.

2.05 PREFORMED CONTROL JOINT

1. Preformed control joint shall be a one-piece, flexible, PVC joint former, such as Kold-Seal Zip-Per Strip KSF-150-50-50, manufactured by Vinylex Corp., Knoxville, Tennessee, or a one-piece steel strip with preformed groove, such as Keyed Kold Retained Kap, manufactured by Burke Concrete Accessories, Inc., San Mateo, California, or equal. Provide the preformed control joint material in full-length unspliced pieces.

2.06 PREMOLDED JOINT FILLER FOR PAVEMENTS AND SLABS

1. Joint filler shall be performed, no extruded type constructed of closed-cell neoprene conforming to ASTM D1752, Type I, as manufactured by W. R. Grace Company of Cambridge, Massachusetts; W. R. Meadows, Inc., Elgin, Illinois; or equal or bituminous-type preformed expansion joint filler conforming to ASTM D994.

2.07 PREMOLDED JOINT FILLER FOR HYDRAULIC STRUCTURES

1. Sponge rubber per ASTM D1752, Type I or self-expanding cork per ASTM D1752, Type III.

2.08 STEEL EXPANSION JOINT DOWELS

1. Steel expansion joint dowels shall conform to the following:

   A. Stainless steel bar dowels conforming to ASTM A276, Type 316.

2. Expansion joint shall be thoroughly greased prior to placing adjoining wall or slab concrete.

2.09 STYROFOAM FILLER BLOCK

1. Styrofoam filler blocks for future construction and expansion joints shall be Styrofoam SM brand as manufactured by Dow Chemical Company or equal.

PART 3 - EXECUTION

3.01 PVC WATER STOPS

1. Water stops shall be heat spliced at ends and intersections to ensure continuity. Bend water stops up from footing and slab joints and splice to wall water stop to result in a watertight structure. Construct forms for construction joints in such a manner as to prevent injury to water stops. Hold water stops securely in position in the construction joints by wire ties, continuous bars, and rings as indicated. Install water stops in construction and expansion joints in hydraulic structures or were shown in the drawings.

2. Make field splices with a thermostatically controlled heating iron in conformance with the manufacturer's current recommendations. Allow at least 10 minutes before pulling or straining the new splice in any way. The finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80% of the unspliced materials.

3.02 CONSTRUCTION JOINTS

1. Layout of construction joints shall be as shown in the drawings and according to the following guidelines:

   A. Provide horizontal construction joints at top of foundation members and slabs on grade and at the soffit of supported slabs and beams.

   B. Space horizontal construction joints at least 8 inches below bottom of slabs.

2. For slabs-on-grade that are not subject to hydraulic loading, use formed construction joints. Maximum size of pour shall be 30 feet each way. Allow 24 hours between pours of adjacent slabs. Provide joints as specified or shown. Set continuous expansion joint strips between slabs and abutting vertical surfaces as indicated in the drawings.

3. Place expansion joint fillers every 30 feet in straight runs of walks, at right-angle turns, and wherever concrete walks butt into vertical surfaces.

4. For control joints of nonstructural slabs, provide partial depth plastic strips set flush with finished surface or 1/8-inch-wide joints cut with a diamond saw. Use control joints one-quarter to one-third the depth of the slab unless otherwise indicated.

5. Construction joints shall be keyed, unless otherwise detailed. Form keyways by beveled strips or boards placed at right angles to the formed face. Except where otherwise shown in the drawings or specified, keyways shall be at least 1-1/2 inches in depth over at least 25% of the width of the section.

6. After the pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material, and expose clean aggregate by sandblasting the surface of construction joints before placing the new concrete. Cover horizontal construction joints with mortar. Spread uniformly and work thoroughly into all irregularities of the surface. The water-cement ratio of the mortar in place shall not exceed that of the concrete to be placed, and the consistency of the mortar shall be suitable for placing and working.

7. In case of emergency, place additional construction joints. (An interval of 45 minutes between two consecutive batches of concrete shall constitute cause for an emergency construction joint.)

3.03 EXPANSION JOINTS

1. Provide expansion joints with continuous edge reservoirs, which shall be filled with a joint sealant. Leave the material used for forming the reservoirs in place until immediately before the grooves are cleaned and filled with joint sealant. After removing edge forms from the reservoir, remove grout, loose concrete, and fins; then sandblast the slots. Allow the reservoirs to become thoroughly dry; then blow out the reservoirs and immediately prime and fill with the expansion joint sealant and backup materials. The primer used shall be supplied by the manufacturer of the joint sealant.

3.04 INSTALLATION OF PREMOLDED JOINT FILLER

1. Install in joint accurately as shown. Attach to concrete with a bonding agent recommended by the joint sealant and joint filler manufacturer for compatibility.

3.05 INSTALLATION OF JOINT SEALANTS

1. Immediately before installing the joint sealant, clean the joint cavity by sandblasting or power wire brushing. Install bond breaker tape per manufacturer's instructions.

2. Apply masking tape along the edges of the exposed surface of the exposed joints.

3. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.

4. After the joints have been prepared as described above, apply the joint sealant. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer.

5. Trowel the joints smooth with a tuck-pointing tool wiped with a solvent recommended by the sealant manufacturer.

6. After the sealant has been applied, remove the masking tape and any sealant spillage.

3.06 INSTALLATION OF STEEL EXPANSION JOINT DOWELS

1. Align dowels as indicated in the drawings. Secure tightly in forms with rigid ties. Orient dowels to permit joint movement.

3.07 CRACKING

1. Saw joints in slabs before the formation of uncontrolled cracking (i.e., cracking that occurs at locations other than construction, control, or contraction joints) and as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing. Saw joints both during the day and night as required.

2. If concrete cracks at locations other than construction, control, or contraction joints, the Contractor may be required to remove and replace the defective work (cracked concrete) in accordance with the provisions of this section, at no additional cost to the Owner.

END OF SECTION

SECTION 03210

CONCRETE REINFORCEMENT (ADDED)

PART 1 - GENERAL

1.01 DESCRIPTION

1. This section describes materials, testing, and installation of reinforcing steel in concrete.

1.02 SUBMITTALS

1. Submit shop drawings in accordance with the General Conditions and Section 01340: Shop Drawings, Working Drawings, and Samples.

2. Submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove conformance with the specified ASTM standard.

3. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings (mechanical, electrical, equipment, and architectural) including additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings indicated in the typical detail and structural drawings. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, deck, floor, or roof slabs) including dowels and corner bars. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown in the drawings and as specified. Placing drawings shall be prepared by the Contractor and shall not incorporate photocopies of the contract drawings.

4. Do not begin fabrication of reinforcing steel until after shop drawings have been reviewed and approved by engineer.

PART 2 - PRODUCTS

2.01 REINFORCING STEEL

1. Reinforcement shall conform to ASTM A615 or A706, Grade 60.

2. Fabricate reinforcing in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Bend reinforcing steel cold.

3. Deliver reinforcing steel to the site bundled and with identifying tags.

2.02 WELDED WIRE REINFORCEMENT

1. Welded wire reinforcement shall conform to ASTM A1064. Provide wire size, spacing, and type as shown on drawings. Furnish in flat sheets only.

2.03 TIE WIRE

1. Tie wire shall be 16 gauge minimum, black, soft annealed.

2.04 BAR SUPPORTS

1. Bar supports in beams and slabs exposed to view after form stripping shall be galvanized and plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

2.05 BAR COUPLERS

1. Reinforcing steel bar splicing couplers shall be a mechanical type as manufactured by Dayton Barsplice Inc., DYWIDAG, or equal. Use couplers which develop 125% of the specified yield strength of the reinforcing bars. Make field demonstrations and sample splicing prior to splicing bars being included into the work.

PART 3 - EXECUTION

3.01 PLACING

1. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.

2. Place reinforcing in accordance with the following, unless otherwise indicated:

   A. Reinforcement indicated in the drawings is continuous through the structure to the farthest extent possible. Terminate bars 2 inches clear from faces of concrete.

   B. Splices may be used to provide continuity due to bar length limitations. Minimum length of bars spliced for this reason is 30 feet. Do not splice reinforcement that is detailed to be continuous in the drawings.

3. Reinforcing steel, before being positioned and just prior to placing concrete, shall be free from loose mill and rust scale and from any coatings that may destroy or reduce the bond. Clean reinforcing steel by sandblasting or wire brushing and remove mortar, oil, paint, or dirt to remove materials that may reduce the bond.

4. Do not straighten or rebind reinforcing steel in the field. Do not use reinforcing with bends not shown in the drawings.

5. Position reinforcing steel in accordance with the drawings and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms to provide the specified concrete coverage. Bars additional to those shown in the drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position, shall be provided by the Contractor at his own expense.

6. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.

7. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.

8. Roll wire mesh used for reinforcement flat before placing concrete. Support and tie wire mesh to prevent movement during concrete placement.

9. Position dowels for masonry walls to occur at reinforced block cells.

3.02 SPLICES

1. Splices shall be as indicated in the drawings. Unless otherwise shown, stagger splices in adjacent horizontal bars 48 bar diameters.

3.03 ADDITIONAL REINFORCEMENT AROUND OPENINGS

1. Place additional reinforcement around pipe or openings as indicated in the drawings.

3.04 WELDING REINFORCEMENT

1. Do not weld reinforcing steel unless specifically noted. Welding of reinforcing steel shall be in accordance with AWS D1.4.

3.05 PLACING WELDED WIRE FABRIC

1. Extend fabric to within 2 inches of the edges of the slab and lap splices at least 1-1/2 courses of the fabric and a minimum of 6 inches. Tie laps and splices securely at ends and at least every 24 inches with 16-gauge black annealed steel wire. Pull fabric into position as the concrete is placed by means of hooks, and work concrete under the steel to ensure that it is placed at the proper distance above the bottom of the slab.

END OF SECTION

SECTION 03300

CONCRETE (ADDED)

PART 1 - GENERAL

1.01 DESCRIPTION

1. This section describes materials, mixing, testing, and placing of concrete and grout.

1.02 SUBMITTALS

1. Submit shop drawings in accordance with the General Conditions and Section 01340 Shop Drawings, Working Drawings and Samples.

2. Prepare concrete and mortar mix designs and laboratory 7-day and 28-day compressive tests, or submit test reports of 7- and 28-day compressive tests of the mix where the same mix has been used on two previous projects. Prepare mix designs in accordance with ACI 318, Chapters 4 and 5, except as modified herein. Submit mix design in writing for review by the Owner at least 15 days before placing of any concrete.

3. Provide certificate that cement used complies with ASTM C150 and these specifications.

4. Provide certificates that aggregates comply with ASTM C33 and contain less than 1% asbestos by weight or volume. State weathering region limits of coarse aggregates: severe, moderate, or negligible. State basis of determining that potential reactivity is negligible. Identify certifications and tests to actual materials to be used in the work. Provide additional tests and certifications for each change in material source. Provide an alternate material source of aggregate if tests indicate that aggregates are reactive or possess severe weathering potential. Submit gradation analysis with concrete mix designs.

5. Provide delivery tickets for ready-mix concrete or weighmasters certificate per ASTM C94, including weights of cement and each size aggregate and amount of water added at the plant and record of pours. Record the amount of water added on the job on the delivery ticket. Water added at the plant shall account for moisture in both coarse and fine aggregate.

6. Provide certificate of compliance with these specifications from the manufacturer of the concrete admixtures.

7. Provide epoxy bonding compound manufacturer's specific instructions for use. Provide manufacturer's certifications as to suitability of product to meet job requirements with regard to surface, pot life, set time, vertical or horizontal application, and forming restrictions.

8. Provide no shrink grout manufacturer's certificate of compliance with these specifications and specific instructions for use.

9. Submit six copies of a report from a testing laboratory verifying that aggregate and gravel material contains less than 1% asbestos by weight or volume and conforms to the specified gradations and characteristics.

10. Plant Qualification: Submit certification from the National Ready Mixed Concrete Association or FDOT indicating compliance with the specified qualification requirements.

11. For potable water, provide certification that all materials used in grout, concrete, or the curing and repair of concrete, meet the requirements of ANSI/NSF 61 for contact with potable water.

12. Material Certificate: Vapor Barrier

1.03 PLANT QUALIFICATION

1. Meet requirements of the Check List for Certification of Ready Mixed Concrete Production facilities of the National Ready Mixed Concrete Association and ASTM C94.

1.04 STANDARDS

1. Unless otherwise indicated, materials, workmanship, and practices shall conform to the following standards:

   A. FBC (Latest Edition).

   B. ACI 301, "Structural Concrete for Buildings."

   C. ACI 318, "Building Code Requirements for Reinforced Concrete."

   D. ANSI/NSF 61: “Drinking Water System Components-Health Effects."

2. Where provisions of pertinent codes and standards conflict with this specification, the more stringent provisions govern.

PART 2 - PRODUCTS

2.01 NONDOMESTIC CEMENT AND ADDITIVES

1. The use of nondomestic cement and additives in concrete may be permitted only after review of a written request to use such materials. The request to use nondomestic materials shall include a chemical analysis that indicates the material meets the project specifications. Certifications that state the nondomestic materials meet the project requirements will not be accepted.

2. Test reports for concrete materials shall be current to within three months of inclusion into the project and shall be identifiable to the materials supplied.

2.02 CEMENT

1. Unless nondomestic cement has been approved, use domestic portland cement that conforms to ASTM C150 and C595, Type IPMS or, in lieu of Type IPMS, provide a mixture of 80% Type II portland cement and 20% pozzolan fly ash II/V or 20% Class F fly ash. Use Type III cement for high early strength concrete only for special locations and only when reviewed in advance by the Resident Project Representative. Use Type I cement for tremie concrete. Pozzolan or fly ash content of Type IPMS cement shall not exceed 20% of the total weight.

2. Use only one brand of cement in any individual structure. Use no cement that has become damaged, partially set, lumpy, or caked. Reject the entire contents of the sack or container that contains such cement. Use no salvaged or reclaimed cement.

3. Maximum tricalcium aluminate shall not exceed 8%. The maximum percent alkalies shall not exceed 0.6%.

2.03 AGGREGATES

1. Aggregates shall be natural rock, sand, or crushed natural rock and shall comply with ASTM C33, and shall contain less than 1% asbestos by weight or volume. Aggregates shall be free from any substances that will react with the cement alkalies, as determined by Appendix X-1 of ASTM C33.

2.04 WATER AND ICE

1. Use water and ice that is clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities that might reduce the strength, durability, or otherwise adversely affect the quality of the concrete. Water shall not contain more than 500 mg/L of chlorides nor more than 500 mg/L of sulfate.

2.05 COLOR ADDITIVE FOR EXTERIOR ELECTRICAL DUCT ENCASEMENT

1. For exterior electrical duct concrete encasements, use a color additive for identification purposes: brick red "Colorfull" as manufactured by Owl Manufacturing Company, Arcadia, California; coral red "Chromix C-22" as manufactured by L. M. Scofield Company, Los Angeles, California; or equal. Add the color additive while the concrete is being mixed using the quantity per cubic yard of concrete recommended by the manufacturer for the class of concrete indicated.

2.06 CONCRETE ADMIXTURES

1. Class A concrete shall contain an air-entraining admixture conforming to ASTM C260. Admixtures shall be Master Builders MB-AE 90, Sika AER, or equal.

2. Class A concrete shall contain a water-reducing admixture conforming to ASTM C494, Type A or D. It shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations.

Admixtures shall be Master Builders Pozzolith polymer-type normal setting, Plastocrete 161 or Plastiment, Sika Chemical Corporation, or equal.

3. Do not use any admixture that contains chlorides or other corrosive elements in any concrete. Admixtures shall be nontoxic after 30 days.

2.07 FLY ASH:

1. Provide fly ash conforming to the following requirements:

A. Class F fly ash conforming to ASTM C 618 for chemical and physical properties. Flyash shall be produced from a single know and consistent source.

B. The amount of flyash used shall be between 20 and 25% by weight of the specified cement weight.

C. Supplemental requirements in percent:

1) Maximum carbon content: 3%

2) Maximum sulfur trioxide (SO_3) content: 4%

3) Maximum loss on ignition: 3%

4) Maximum water requirement (as a percent of control): 100%

5) Fineness, maximum retained on No. 325 sieve: 25%

2.08 SUPERPLASTICIZER

1. Comply with ASTM C1017, Type 1 or 2.

2.09 NONSHRINK GROUT

1. Nonshrink grout shall conform to the Corps of Engineers Specification for Nonshrink Grout, CRD- 621-83, and to these specifications. Use a nongas-liberating type, cement base, premixed product requiring only the addition of water for the required consistency. Grout shall be UPCON High Flow, Master Flow 713, or equal. Components shall be inorganic.

2.10 ORDINARY TYPE GROUT (DRY PACK)

1. One-part portland cement to two parts sand (100% passing a No. 8 sieve). Add sufficient water to form a damp formable consistency.

2.11 EXPANSIVE GROUT

1. Premixed, cementitious mixture with a minimum 28-day strength of 3,500 psi. Provide air- entraining admixture as recommended by the manufacturer.

2.12 EPOXY GROUT

1. Mix the two components of epoxy bonding compound in compliance with the manufacturer's instructions.

2. Use sand that is oven dry and meets the following graduation requirements for epoxy grout.

Sieve Size	No. 8	No. 50	No. 100
% Passing	100	30 ±15	5 ±5

2.13 EPOXY GROUT FOR MACHINERY BASEPLATE INSTALLATION

1. Epoxy grouts shall meet the following minimum requirements:

   A. Creep shall be less than 0.005 in./in. when tested per ASTM C1181. The tests shall be at 70°F and 140°F with a load of 400 psi.

   B. Linear shrinkage shall be less than 0.080% and thermal expansion less than 17x10-6 in./in./°F when tested per ASTM C531.

   C. Compressive strength shall be a minimum of 12,000 psi after seven days when tested per ASTM C579, Method B.

   D. Bond strength to portland cement concrete shall be greater than 2,000 psi when tested per ASTM C882.

   E. Epoxy grout shall pass the thermal compatibility test per ASTM C884 when overlayed on portland cement concrete.

   F. Determine tensile strength and modulus of elasticity per ASTM D638. The tensile strength shall not be less than 1,700 psi and the modulus of elasticity shall not be less than 1.8x106 psi.

   G. Determine gel time and peak exothermic temperature per ASTM D2471. Peak exothermic temperature shall not exceed 110°F when a specimen 6 inches in diameter by 12 inches high is used. Gel time shall be at least 150 minutes.

   H. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperature as high as 150°F, with a load of 1,200 psi.

   I. Products: Escoweld 7505E, with 7530 aggregate, or equal.

2. Epoxy primer shall be a lead free, chrome free, rust inhibitive, two-component epoxy primer specifically designed for use on metal substrates and in conjunction with epoxy grout products. Products: Escoweld 1014E Rust Inhibitive Epoxy Primer or equal.

3. Nonbonding Filler for Anchor Bolt Sleeves: Escoweld 7506 or equal.

4. Epoxy Grout Liquid: Escoweld 7502E or 7507E or equal.

2.14 JOINT MORTAR BED

1. Mortar or grout placed on horizontal construction joints shall be a mixture of cement, sand, and water in the same proportions used in the concrete but with coarse aggregate omitted.

2.15 EPOXY BONDING COMPOUND

1. Bonding compound shall be Sikadur 32 Hi-Mod, Sika Chemical Corporation, Lyndhurst, New Jersey; Concresive by BASF; Euco Epoxy 452 by Euclid Chemical Company; or equal.

2.16 NONEPOXY BONDING COMPOUND

1. Use Weldcrete by Larsen Products Corp., Link by Sta-Dry Manufacturing Corp., Euco Weld by Euclid Chemical Co., or equivalent. The compound shall be rewettable for up to two weeks.

2.17 CONCRETE MIX DESIGN

1. Conform to ASTM C94, except as modified by these specifications.

2. Air content as determined by ASTM C231 shall be 2% ±1%.

3. Provide concrete with the following compressive strengths at 28 days and proportion it for strength and quality requirements in accordance with ACI 318, "Proportioning on the Basis of Field Experience," to achieve 28-day compressive strength as follows:

Class	Type of Work	28-Day Minimum Compressive Strength (in psi)	W/C Ratio (Max)	Cement Content (min) (in lbs. per C.Y.)
A	Concrete for all structures and concrete not otherwise specified. Concrete fill at structure foundations, cradle, supports across pipe trenches.	4,000	0.45	620
B	Pavement	3,000	0.54	500
C	Floor grout, miscellaneous unreinforced concrete.	3,000	-	376
D	Precast concrete	5,000	0.40	630

4. Measure slump in accordance with ASTM C143. Slump shall be as follows:

   A. Slab on grade or heavy sections wider (in plain view) than 3 feet: 4 inches maximum.
   B. Footings, walls, suspended slabs, beams, and columns: 4 inches maximum.

   C. Pavement: 2 inches maximum.

   D. Floor grout: 4 inches maximum.

   E. Proportion and produce the concrete to have a maximum slump as shown; slump is prior to addition of superplasticizer. A tolerance of up to 1 inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

5. Aggregate size shall be 3/4 inch maximum for slabs and sections 8 inches thick and less. Aggregate size shall be 1 inch maximum for sections greater than 8 inches and less than 17 inches. Aggregate size shall be 1-1/2 inches maximum for all larger slabs and sections. Aggregate size for floor grout shall be maximum 3/8 inch.

6. Combined aggregate grading shall be as shown in the following table:

	Maximum Aggregate Size			
	1-	1"	3/4	3/8
Aggregate Grade per ASTM C33	467	57	67	8

7. Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void content of the coarse aggregate.

2.18 GRANULAR BASE

1. Use structural backfill material as specified in Section 02200 Excavation, Backfilling, and Compaction.

2.19 TRIAL BATCH AND LABORATORY TESTS

1. Before placing any concrete, a testing laboratory designated by the Contractor shall prepare a trial batch of Class A concrete, based on the preliminary concrete mixes submitted. Concrete shall conform to the requirements of this section. Prepare the trial batch using the aggregates, cement, and admixture proposed for the project. The cost of laboratory trial batch tests will be borne by the Contractor. Perform trial batch testing at no additional cost to the Owner.

2.20 SHRINKAGE LIMITATION

1. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age, shall be 0.036% or 0.042%, respectively. Use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to Class A concrete.

2. If the trial batch specimens do not meet the shrinkage requirements, revise the mix design and/or materials and retest.

2.21 WORKABILITY

1. Concrete shall be of such consistency and composition that it can be worked readily into the forms and around the reinforcement without excessive vibrating and without permitting the materials to segregate or free water to collect on the surface.

2. The proportions shall be adjusted to secure a plastic, cohesive mixture, and one that is within the specified slump range.

3. To avoid unnecessary changes in consistency, obtain the aggregate from a source with uniform quality, moisture content, and grading. Handle materials to minimize variations in moisture content that would interfere with production of concrete of the established degree of uniformity and slump.

2.22 VAPOR BARRIER

1. Vapor Barrier: Water-vapor transmission rate (permeance) less than 0.015 perms (gr/ft2/hr/in-Hg), in accordance with ASTM E 1745. The product must meet water-vapor transmission rate (0.01 perms) requirement for both the new material and the ASTM E 1745 mandatory conditioning test (ASTM E 1745; paragraph 7.12 through 7.15.) Provide all manufacturers' accessories required for complete installation including mastic and seam tape. Seam tape to be provided with a water-vapor transmission rate of 0.3 perms or lower.

   A. Products: Subject to compliance with requirements, provide one of the following:

      1) Layfield Construction Materials; VaporFlex 15.

      2) Reef Industries, Inc.; Griffolyn Vaproguard.

      3) Stego Industries, LLC; Stego Wrap 15 mil Class A.

PART 3 - EXECUTION

3.01 SITE-MIXED CONCRETE

1. Conform to ACI 304 as modified by these specifications.

2. Use a batch-type mixer capable of combining the aggregates, cement, and water within the

specified time into a thoroughly mixed and uniform mass and capable of discharging the mixture without segregation.

3. Use equipment that can accurately proportion cement, coarse and fine aggregates, admixtures, and water. Proportion cement and aggregate by weight.

4. Discharge each entire batch before recharging. Do not allow any batch to exceed the manufacturer's rated capacity of the mixer.

5. Mixing time shall be as follows:

   A. For mixer of a capacity of 1 cubic yard or less, one and one-half minutes after batching is completed.

   B. For mixers of capacities larger than 1 cubic yard, one and one-half minutes plus one-half minute for each additional 1/2-cubic-yard capacity or fraction thereof in excess of 1 cubic yard.

   C. The mixer shall revolve at a uniform rate as specified by the manufacturer for the mixing equipment.

3.02 READY-MIXED CONCRETE

1. Provide ready-mixed concrete conforming to ASTM C94 as modified by these specifications.

2. Convey concrete from the truck to the place of final deposit as rapidly as practicable by methods that will prevent segregation or loss of ingredients to maintain the quality of the concrete. Place no concrete more than 90 minutes after mixing has begun for that particular batch. If it is necessary to add water to obtain the specified slump, add water per ASTM C94, but do not exceed the water content of the reviewed design mix.

3. Use dry-batched concrete or jobsite mix only when haul time is excessive. Do not retemper partially hardened concrete.

4. Keep a record showing time and place of each pour of concrete, together with transit-mix delivery slips certifying the contents of the pour.

3.03 PRIOR TO PLACING CONCRETE

1. Subgrade: Compact the subgrade and/or bedding. Saturate the subgrade approximately eight hours before placement and sprinkle ahead of the placement of concrete in areas where vapor barrier is not used. Remove all standing water, mud, and foreign matter before concrete is deposited.

2. Contractor has the option to provide mud slabs to obtain a dry and stable working platform for placement of slabs.

3. Granular Base: When indicated in the drawings, install a granular base beneath the slab on

grade or a structural foundation. Place the granular material on a compacted subgrade and compact the granular base to the same density as the subgrade.

3.04 PLACING CONCRETE

1. Placement shall conform to ACI 304 as modified by these specifications.

2. Coordinate in advance of concrete placement the sequence of placement to assure that construction joints will occur only as designed. Provide Owner's Representative with a copy of the sequence of placement in advance of placement.

3. Alternate sections of concrete walls and slabs may be cast simultaneously. Do not place adjacent sections of walls and slabs until seven days after placement of first placed concrete.

4. Notify the Owner's Representative of readiness, not just intention, to place concrete in any portion of the work. This notification shall be such time in advance of the operation as the Owner's Representative deems necessary to allow observation of the work at the location of the proposed concrete placing. Failure of sufficient advance notification will be cause for delay in placing until observations can be completed. Forms, steel, screeds, anchors, ties, inserts, and other embedded items shall be in place before the Contractor's notification of readiness is given.

5. Schedule sufficient equipment for continuous concrete placing. Provide for backup equipment and procedures to be taken in case of an interruption in placing. Provide backup concrete vibrators at the project site. Test concrete vibrators the day before placing concrete.

6. Do not place concrete until all free water has been removed or has been diverted by pipes or other means and carried out of the forms, clear of the work. Do not deposit concrete underwater, and do not allow free water to rise on any concrete until the concrete has attained its initial set. Do not permit free or storm water to flow over surfaces of concrete so as to injure the quality or surface finish.

7. Where a vapor barrier is installed, do not puncture the vapor barrier by stakes or any other concrete accessory. Repair any holes in the vapor barrier by patching before placing concrete.

8. Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing. Do not deposit concrete in large quantities in one place to be worked along the forms with a vibrator.

9. Use mechanical vibration in placing concrete to eliminate rock pockets and voids, to consolidate each layer with that previously placed, to completely embed reinforcing bars and fixtures, and to bring just enough fine material to exposed surfaces to produce a smooth, dense, and even texture. Vibrators shall be of the high-frequency internal type, and the number in use shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least two vibrators

shall be available at the site. Use external vibrators for consolidating concrete when the concrete is otherwise inaccessible for adequate consolidating. Construct forms with sufficient strength to resist displacement or damage when external vibrators are used.

10. Do not place concrete during rainstorms. Protect concrete placed immediately before rainstorms to prevent rainwater from coming in contact with freshly placed or uncured concrete. Keep sufficient protective covering ready at all times for this purpose.

11. Elephant Trunks: Use hoppers and elephant trunks or drop chutes to prevent the free fall of concrete that results in separation of coarse particles.

12. Chutes: Use metal or metal-lined chutes with a slope not exceeding one vertical to two horizontal and not less than one vertical to three horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirement may be used only if they discharge into a hopper before distribution.

13. Deposit concrete continuously and in level layers of such thickness (not exceeding 2 feet in depth) so that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams, planes of weakness, or cold joints.

3.05 TIME BETWEEN POURS

1. At least two hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system, unless otherwise indicated in the drawings.

3.06 MAXIMUM HEIGHT OF CONCRETE POURS AND FREE FALL

1. Do not drop concrete freely into place from a height greater than 6 feet in unexposed work and 4 feet in exposed work. Use tremies or pumps where the drop exceeds these limits. See Section 03111: Concrete Form Work also.

3.07 PUMPING CONCRETE

1. Conform to the recommendations of ACI 304.2R except as modified herein.

2. Base pump size on rate of concrete placement, length of delivery pipe or hose, aggregate size, mix proportions, vertical lift, and slump of concrete.

3. Minimum inside diameter of pipe or hose shall be based on the maximum aggregate size as follows:

   A. 3/4-inch-maximum aggregate: 2 inches minimum inside diameter.

   B. 1-1/2-inch-maximum aggregate: 4 inches minimum inside diameter.

4. Do not use aluminum pipes for delivery of concrete to the forms.

5. Before pumping is started, prime the delivery pipe or hose by pumping mortar through the line using 5 gallons of mortar for each 50 feet of delivery line. Do not deposit mortar in the forms.

3.08 HOT WEATHER REQUIREMENTS

1. During hot weather, give proper attention to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation in accordance with ACI 301, ASTM C94, and the following.

2. When the weather is such that the temperature of the concrete as placed would exceed 90°F, use ice or other means of cooling the concrete during mixing and transportation so that the temperature of the concrete as placed will not exceed 95°F.

3. Take precautions when placing concrete during hot, dry weather to eliminate early setting of concrete. This includes protection of reinforcing from direct sunlight to prevent heating of reinforcing, placing concrete during cooler hours of the day, and the proper and timely application of specified curing methods.

4. There will be no additional reimbursement to the Contractor for costs incurred for placing concrete in hot weather.

3.09 COLD WEATHER REQUIREMENTS

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather in accordance with ACI 306 and the following.

2. When the temperature of the surrounding atmosphere is 40°F or is likely to fall below this temperature, use heated mixing water not to exceed 140°F. Do not allow the heated water to come in contact with the cement before the cement is added to the batch.

3. When placed in the forms during cold weather, maintain concrete temperature at not less than 55°F. All materials shall be free from ice, snow, and frozen lumps before entering the mixer.

4. Maintain the air and the forms in contact with the concrete at temperatures above 40°F for the first five days after placing, and above 35°F for the remainder of the curing period. Provide thermometers to indicate the ambient temperature and the temperature 2 inches inside the concrete surface.

5. There will be no additional reimbursement made to the Contractor for costs incurred for placing concrete during cold weather.

3.10 BONDING TO OLD CONCRETE

1. Coat the contact surfaces with epoxy bonding compound. The method of preparation and application of the bonding compound shall conform to the manufacturer's printed instructions and recommendations for specific application for this project.

3.11 GROUTING MACHINERY FOUNDATIONS

1. Block out the original concrete or finish off a sufficient distance below the bottom of the machinery base to provide for the thickness of grout shown on the drawings. After the machinery has been set in position and placed at the proper elevation by steel wedges, the space between the bottom of the machinery base and the original pour of concrete shall be filled with a pourable nonshrink grout. Grout and grouting procedure shall be in accordance with API 686, Chapter 4, paragraphs 3.6 and 3.7, and Chapter 5.

3.12 BACKFILL AGAINST WALLS

1. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.

2. Do not backfill the walls of structures 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.

3.13 CONCRETE TESTS

1. Concrete quality testing will be performed on the concrete by the Contractor per Section 01410, Testing and Testing Laboratory Services and as follows:

   A. Frequency of Sampling: Cast four concrete test cylinders from each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day. Sampling and curing of cylinders shall conform to ASTM C31.

   B. Strength Testing: Test cylinders in accordance with ASTM C39. Test one cylinder at 7 days for information; test two cylinders at 28 days for acceptance; and hold one cylinder for verification. Strength acceptance will be based on the average of the strengths of the two cylinders tested at 28 days. If one cylinder of a 28- day test manifests evidence of improper sampling, molding, or testing, other than low strength, discard it and use the fourth cylinder for the test result.

   C. Determine concrete slump by ASTM C143 with each strength test sampling and as required to establish consistency.

   D. Determine air content of the concrete using ASTM C231 to verify the percentage of air in the concrete immediately prior to depositing in forms.

   E. Concrete acceptance shall be based on the requirements of ACI 318.

2. To facilitate concrete sampling and testing, the Contractor shall:

   A. Furnish labor to assist the Owner in obtaining and handling samples at the project site.

B. Advise the Owner in advance of concrete placing operations to allow for scheduling and completion of quality testing.

C. Provide and maintain facilities for safe storage and proper curing of concrete test specimens on the project site, as required by ASTM C31.

END OF SECTION

SECTION 03310

CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide cast-in-place concrete, complete and in place, in accordance with the Contract Documents.

1.02 LIMITATIONS

1. Use of this specification is limited to slabs on grade, footings, driveways, curbs, and equipment pads and support piers for pipes, fittings and valves.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

1. Federal Specifications and Standards

	Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant)
PS 1	Construction and Industrial Plywood
PS 20	American Softwood Lumber Standard

2. Commercial Standards

ACI 214	Evaluation of Strength Test Results of Concrete
ACI 301	Specification for Structural Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
ACI 347	Guide to Formwork for Concrete
ASTM A 82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 185	Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 615	Standard Specification for Deformed and Plain Billet- Steel Bars for Concrete Reinforcement
ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Standard Specification for Concrete Aggregates

ASTM C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	Standard Specification for Ready-Mixed Concrete
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	Standard Specification for Portland Cement
ASTM C 192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete
ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 1752	Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
WRI	Manual of Standard Practice for Welded Wire Fabric

1.04 CONTRACTOR SUBMITTALS

1. General: Furnish submittals in accordance with Section 01300 - Contractor Submittals.

2. Shop Drawings

A. Shop bending diagrams, placing lists, and drawings of all reinforcing steel prior to fabrication. Details of the concrete reinforcing steel and concrete inserts shall be submitted at the earliest possible date after receipt of the Notice to Proceed. Details of reinforcing steel for fabrication and erection shall conform to ACI 315 and the requirements indicated. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The Shop Drawings shall include bar placement diagrams, which clearly indicate the dimensions of each bar splice.

3. Mix Designs: Prior to beginning the Work, submit concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concreteherein. The mix designs shall be checked by an independent testing laboratory acceptable to the City. All costs related to such checking shall be borne by the Contractor.

4. Delivery Tickets: Where ready-mix concrete is used, furnish certified delivery tickets to the city at the time of delivery of each load of concrete. Each ticket shall show the FDOT certified equipment used for measuring, and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate, added at the batching plant, and the amount allowed to be added at the site for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the time when water was added to the batch, when it left the plant, when it arrived at the Site, number of drum revolutions, when unloading began, and when unloading was finished.

1.05 QUALITY ASSURANCE

1. Testing of Reinforcing Steel

   A. If requested by the City, the Contractor shall furnish manufacturer certified test reports and/or samples from each heat number of reinforcing steel in a quantity adequate for testing. Costs of initial tests will be paid by the city. Costs of additional tests of non- compliant steel shall be paid by the Contractor.

2. Testing of Materials

   A. Tests on component materials and for compressive strength of concrete will be performed as indicated herein. Test for determining slump will be in accordance with the requirements of ASTM C 143 – Standard Test Method for Slump of Hydraulic- Cement Concrete. Testing shall be included in the Contract price.

   B. The cost of laboratory tests on cement, aggregates, and concrete, will be paid by the city. However, the Contractor will be charged for the cost of any additional tests and investigations on Work which does not meet the Specifications. The laboratory will meet or exceed the requirements of ASTM C 1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Laboratory Evaluation.

   C. Concrete for testing shall be supplied by the Contractor at no additional cost to the CITY, and the Contractor shall assist the City in obtaining samples and disposal and cleanup of excess material.

3. Field Compression Tests

   A. Compression test specimens will be taken from the first placement of each class of concrete herein and at intervals thereafter as selected by the City to ensure continued compliance. Each set of test specimens will be a minimum of 5 cylinders.

B. Compression test specimens for concrete will be made in accordance with Section 9.2 of ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field. Specimens will be 6-inch diameter by 12-inch high cylinders.

C. Compression tests will be performed in accordance with ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens. One test cylinder will be tested at 7 days and two (2) at 28 days. The remaining cylinders will be held to verify test results, if needed.

4. Evaluation and Acceptance of Concrete

A. Evaluation and acceptance of the compressive strength of concrete will be according to the requirements of ACI 318 – Building Code Requirements for Structural Concrete, Chapter 5 "Concrete Quality," and as indicated herein.

B. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.

C. All concrete that fails to meet the ACI requirements and these Specifications, is subject to removal and replacement at no additional cost.

5. Construction Tolerances: The Contractor shall set and maintain concrete forms and perform finishing operations to ensure that the concrete is within the tolerances herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated. Permissible deviations will be in accordance with ACI 117.

PART 2 -- PRODUCTS

2.01 FORM AND FALSE WORK MATERIALS

1. Except as otherwise specifically accepted by the City, all lumber brought on the Site for use as forms, shoring, or bracing shall be new material.

2.02 REINFORCEMENT STEEL

1. General: Reinforcement steel for cast-in-place reinforced concrete construction shall conform to the following requirements:

A. Bar reinforcement shall conform to the requirements of ASTM A 615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, for Grade 60 Billet Steel Reinforcement, unless otherwise indicated.

B. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement, and the details indicated. Welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either furnished in flat sheets or in rolls with a core diameter of

not less than 10-inches. Welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.

C. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82 - Steel Wire, Plain, for Concrete Reinforcement.

2. Accessories

A. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Slab bolsters shall have gray plastic-coated legs.

B. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength than required for the concrete in which they are located. Where concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface.

2.03 CONCRETE MATERIALS

1. Materials shall be delivered, stored, and handled to prevent damage. Only one brand of cement shall be used and accepted by the City prior to its use. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

2. All materials furnished for the Work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.

3. Storage of materials shall conform to the requirements of Section 205 of ACI 301. D. Materials for concrete shall conform to the following requirements:

A. Cement shall be standard brand Portland cement conforming to ASTM C 150, Type I, II or III.

B. Water shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.

C. Ready-mix concrete shall conform to the requirements of ASTM C 94.

D. Air-entraining agent meeting the requirements of ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete shall be used. Sufficient air- entraining agent shall be used to provide a total air content of 3 to 5 percent. The City reserves the right, at any time, to sample and test the air- entraining agent. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

E. Admixtures: Admixtures may be added at the Contractor's option to control the set, affect water reduction, and increase workability. The addition of an admixture shall be at the Contractor's expense. The use of an admixture shall

be subject to acceptance by the City. If the use of an admixture is producing an inferior end result, the Contractor shall discontinue use of the admixture. Admixtures shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, shall be non- toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air- entraining admixture.

1) Concrete shall not contain more than one water-reducing admixture. Concrete containing an admixture shall be first placed at a location determined by the City.

2) Set controlling admixture may be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as Sika Corporation's Plastiment; Master Builder's Pozzolith 440-N, or City approved equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees, a set accelerating admixture such as Sika Corporation's Plastocrete 161FL; Master Builder's Pozzutec 20; or City approved City equal shall be used.

3) Low range water reducer shall conform to ASTM C 494, Type A. It shall be WRDA by Grace Concrete Products; Pozzolith 322-n by Master Builders; or approved City equal. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.

F. Calcium Chloride: Calcium chloride will not be permitted in concrete.

G. Flyash: Flyash may be used as a substitute to cement. The amount by weight of flyash shall be limited to not more than 20% of the combined weight of flyash plus cement. Slag will not be permitted for use.

2.04 CURING MATERIALS

1. Materials for curing concrete shall conform to the following requirements and ASTM C 309:

A. Curing compounds shall be white pigmented and resin based. Sodium silicate compounds shall not be allowed. Concrete curing compound shall be Kurez by Euclid Chemical Company; Masterkure N-Seal-HS by ChemRex; L&M Cure R; or approved City equal. Water based curing compounds shall be used only where local air quality regulations prohibit the use of a solvent-based compound and when curing compound must be removed for finishes or grouting. Water based curing compounds shall be Aqua- Cure by Euclid Chemical Company; Masterkure-100W

by ChemRex; L&M Cure R-2; or City approved equal.

B. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

C. Evaporation retardant shall be a material such as Confilm by Master Builders; Eucobar by Euclid Chemical Company; or City approved equal.

2.05 JOINT MATERIALS

1. Materials for joints in concrete shall conform to the following requirements:

A. Joint filler material shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 for Type I.

B. Elastomeric joint sealer shall conform to the requirements of Section 07920 - Sealants and Caulking.

C. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth hereinafter, if testing is required by the City.

2.06 MISCELLANEOUS MATERIALS

1. Epoxy adhesives shall be the following products:

A. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur 32 Hi-Mod Epoxy Adhesive, by Sika Corporation; Concresive Liquid (LPL), by Master Builders; BurkEpoxy MV by The Burke Company; or City approved equal.

B. For bonding hardened concrete or masonry to steel, Sikadur 31 Hi-Mod Gel by Sika Corporation; BurkEpoxy NS by The Burke Company; Concresive Paste (LPL) by Master Builders; or City approved equal.

2. Cement Grout

A. Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where

needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 Days shall be 4000 psi.

B. The cement used shall be 1/2 gray and 1/2 white Portland cement, or other proportion as determined by the City. White Portland cement shall be Atlas white,

or City approved equal. No cement from kilns burning metal-rich hazardous waste fuel shall be used.

3. Non-Shrink Grout (cement-based)

A. Cement-based non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas liberating, non-metallic, cement type precision grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used.

B. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout shall be as recommended by the manufacturer for the particular application.

C. Grout shall not contain chlorides or additives that may contribute to corrosion.

D. Grout shall be formulated to be used at any consistency from fluid to plastic.

E. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:

1) Minimum tensile splitting strength of 500 psi per ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

2) Minimum flexural strength of 1000 psi per ASTM C 580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

3) Minimum bond strength (concrete to grout) of 1900 psi per modified ASTM C 882
- Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

4) Grout shall be certified for use in a marine environment where applicable.

F. Non-shrink grout shall have a minimum 28-Day compressive strength of 9000 psi when mixed at a fluid consistency.

G. Non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable, and plastic consistencies.

H. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827 – Test Method for Early Volume Change of Cementitious Mixtures. The grout when tested shall not bleed or segregate at maximum allowed water.

I. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090 - Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.

J. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.

K. Non-Shrink Grout shall be Masterflow 928 by MBT/Degussa Building Systems (for non- marine environment applications only), Sikagrout 328 by Sika Corporation, High-Flow Grout by Euclid Chemical Company, CG200 PC by Hilti, or approved City equal.

2.07 CONCRETE DESIGN REQUIREMENTS

1. General

A. Concrete shall be composed of cement, admixtures, aggregates and water, all of the qualities indicated. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and be smooth. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the CITY. All changes shall be subject to review by the City.

B. The Contractor is cautioned that the limiting parameters specified below are NOT a mix design. Additional cement or water reducing agent may be required to achieve workability demanded by the Contractor's construction methods. The Contractor is responsible for any costs associated with furnishing concrete with the required workability.

2. Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall be not less than the following tabulation.

Class of Concrete Min 28-Day Compressive Strength (psi)	Type of Work	Max Size Aggregate (in)	Min Cement Per cu yd (lbs)	Max W/C Ratio (by weight)
3,000	Sidewalks and Driveways	1	470 (min)	0.50
4,500	Structural Concrete	1	564 to 600	0.45

Note: One sack of cement equals 94 lb.

2.08 CONSISTENCY

1. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slump shall be 3 inches plus 1 inch.

2.09 MEASUREMENT OF CEMENT AND AGGREGATE

1. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the Contractor and acceptable to the City; provided that, where batches are so proportioned as to contain an integral number of conventional sacks of cement, and the cement is delivered at the mixer in the original unbroken sacks, the weight of the cement contained in each sack may be taken without weighing as 94 pounds.

2.10 MEASUREMENT OF WATER

1. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the City and capable of measuring the water in variable amounts within a tolerance of one percent.

2.11 READY-MIXED CONCRETE

1. At the Contractor's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, placing and the supplementary requirements as required herein and in accordance with ASTM C 94.

2. Ready-mixed concrete shall be delivered to the Site, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first. In hot weather, or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

3. Truck mixers shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

4. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

5. Each batch of ready-mixed concrete delivered to the Site shall be accompanied by a certified delivery ticket in accordance with the Paragraph 1.4.D entitled "Delivery Tickets."

6. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the City.

7. The use of hydraulic cement in wet well interiors is prohibited. This includes new construction, all repairs, and patches.

PART 3 -- EXECUTION

3.01 GENERAL FORMWORK REQUIREMENTS

1. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms, and any forms, which are unsafe or inadequate in any respect, shall promptly be removed from the Work and replaced at the Contractor's expense. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, false work, and shoring shall comply with applicable local, state and federal regulations. All design, construction, maintenance, preparation, and removal of forms shall be in accordance with ACI 347 and the requirements herein.

2. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete.

3.02 CONSTRUCTION

1. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is called for on the Drawings. Not less than 1- inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

2. Construction Joints: Concrete construction joints will not be permitted at locations other than those indicated, except as may be acceptable to the CITY OF CAPE CORAL. Pipe stubs and anchor bolts shall be set in the forms where required.

3. Slab Elevations: All concrete slabs shall be poured in place at equal elevations to prevent trip hazards, unless otherwise shown on the drawings. All slabs to include but not limited to: transition slabs between wet well lids and valve vaults, control panel slabs, pipe support slabs, etc. Prior to pouring slabs, Contractor shall ensure that the area to be poured is sufficiently compacted to prevent settling. Any settlement of concrete pads due to lack of subgrade compaction shall be removed and replaced at the sole expense of the Contractor. See specification 02200 for further requirements on excavation, backfilling, and compaction.

4. Concrete Coating: Prior to coating of wet wells, Contractor shall administer a pH test to ensure that the concrete has sufficiently cured. pH testing shall be in the form of a TSW6 test or City approved equal. All concrete must pass pH testing prior to coating.

5. Wet Well Bottoms: Prior to placement of any concrete in wet wells the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting (exposing aggregate) prior to the application of an epoxy bonding agent. Application shall be according to the bonding agent manufacturer's instructions and recommendations.

3.03 REUSE OF FORMS

1. Forms may be reused only if in good condition and only if acceptable to the City.

3.04 REMOVAL OF FORMS

1. Careful procedures for the removal of forms shall be strictly followed, and this Work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. Members, which must support their own weight, shall not have their forms removed until they have attained at least 75 percent of the 28-day strength of the concrete. Forms for all parts of the Work not specifically mentioned herein shall remain in place for periods of time as determined by the City.

3.05 GENERAL REINFORCEMENT REQUIREMENTS

1. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements indicated herein.

2. Reinforcing spliced by mechanical connectors or welding is not permitted.

3.06 FABRICATION

1. General

A. Reinforcement steel shall be accurately formed to the dimensions and shapes required, and the fabricating details shall be prepared in accordance with ACI

315 and ACI 318, except as modified by the Drawings.

B. The Contractor shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings. Said drawings, diagrams, and lists shall be prepared by the Contractor.

C. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.

2. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will injure the material. No bars with kinks or bends not required shall be used. All bars shall be bent cold, unless otherwise permitted by the City. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the City.

3.07 PLACING

1. Reinforcement steel shall be accurately positioned and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers, which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. For concrete on formwork, the Contractor shall provide concrete, metal, plastic, or other acceptable bar chairs and spacers.

2. The portions of all accessories in contact with the formwork shall be made of concrete, plastic, or steel coated with a 1/8-inch minimum thickness of plastic which extends at least ½-inch from the concrete surface. Plastic shall be gray in color.

3. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.

4. Bars additional to those indicated which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at its own expense.

5. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.

6. The minimum spacing requirements of ACI 318 shall be followed for all reinforcing steel.

7. Unless specific permission is granted by the City prior to each occurrence, no concrete shall be delivered to the job site before 7:00am or after 5:00pm.

3.08 SPLICING

1. General: Reinforcement bar splices shall be used as required. When it is necessary to splice reinforcement the character of the splice shall be as acceptable to the City.

2. Splices of Reinforcement

   A. The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318, Section 12.15.1 for a Class C splice.

   B. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

3.09 CLEANING AND PROTECTION

1. Reinforcement steel shall at all times be protected from corrosive conditions until concrete is placed around it.

2. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and, if necessary recleaned.

3.10 PROPORTIONING AND MIXING

1. Proportioning: Proportioning of the concrete mix shall conform to the requirements of Chapter 3 “Proportioning” of ACI 301.

2. Mixing: Mixing of concrete shall conform to the requirements of Chapter 7 ACI 301.

3. Slump: Maximum slumps shall be as indicated in Paragraph 2.8 of this Section.

4. Retempering: Retempering of concrete or mortar which has partially hardened will not be permitted.

3.11 PREPARATION OF SURFACES FOR CONCRETING

1. General: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

2. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the City, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete and foreign material. Such cleaning shall be accomplished by hydroblasting. All

pools of water shall be removed from the surface of construction joints before the new concrete is placed.

3. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to achieve an initial set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent Work; provided that construction joints shall be made only where acceptable to the City.

4. Embedded Items

   A. No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the City at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.
   B. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown on the Drawings or by Shop Drawings and shall be accepted by the CITY OF CAPE CORAL before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.

5. Casting New Concrete Against Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting (exposing aggregate) prior to the application of an epoxy bonding agent. Application shall be according to the bonding agent manufacturer's instructions and recommendations.

6. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the city.

7. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete to ensure a minimum of 2 inches for above-grade installations and 3 inches for on-grade installations, clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

8. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.

9. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

10. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.12 HANDLING, TRANSPORTING, AND PLACING

1. General: Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.

2. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced.

3. Notification of Concrete Placement: No concrete shall be placed except in the presence of a duly authorized representative of the City. The Contractor shall notify the City in writing at least 24 hours in advance of placement of any concrete.

4. Conveyor Belts and Chutes: Ends of chutes, hopper gates, and all other points of concrete discharge throughout the Contractor'S conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not segregate. Conveyor belts, if used, shall be of a type acceptable to the City. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the required consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the cement adhering to the belt will be wasted. All conveyor belts and chutes shall be covered. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

5. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees

6. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the required minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the Contractor shall employ effective means, such as precooling of aggregates and mixing water, using ice, or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.

7. Cold Weather Placement

   A. Placement of concrete shall conform to ACI - 306.1 - Cold Weather Concreting, and the following:

      1) Earth foundations shall be free from frost or ice when concrete is placed upon or against them.

      2) Maintain the concrete temperature above 50 degrees F for at least 3 days after placement.

3.13 PUMPING OF CONCRETE

1. General: If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

2. Pumping Equipment

   A. The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the site during pumping.

   B. The minimum diameter of the hose (conduits) shall be 2 inches.

   C. Pumping equipment and hoses (conduits) that are not functioning properly shall be replaced.

   D. Aluminum conduits for conveying the concrete shall not be permitted.

3. Proportioning

   A. Minimum compressive strength, cement content, and maximum size of aggregates shall be as required in this Section.

   B. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.

   C. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.

3.14 TAMPING AND VIBRATING

1. As concrete is placed in the forms or in excavations, it shall be thoroughly compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high-speed power vibrators (8000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.

3.15 FINISHING CONCRETE SURFACES

1. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions indicated are defined as tolerances and are indicated in Part 1 above. These tolerances are to be distinguished from irregularities in finish as described herein.

2. Formed Surfaces: No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects.

3. Unformed Surfaces: After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. The finish specified for unformed concrete surfaces are designated and defined as follows:

   A. Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.

   B. After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed ¼-inch. Joints and edges shall be tooled where indicated or as determined by the City.

   C. After the surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.

   D. Trowel the surface to remove local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise indicated. The resulting surface shall be rough enough to provide a nonskid finish.

3.16 CURING AND DAMPPROOFING

1. General: Concrete shall be cured for not less than 14 days after placing, in accordance with the methods indicated below for the different parts of the Work.

Surface to be Cured or Damp-proofed	Method
Un-stripped forms	1
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4

2. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed

within 14 days of placing the concrete, curing shall be continued in accordance with Method 4.

3. Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

4. Method 3: The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

5. Method 4: The surface shall be sprayed with a liquid curing compound. Curing compound shall not be used on surfaces to receive coatings, tile, additional concrete, etc., where the adhesion of the additional treatments may be affected.

   A. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film, which will seal thoroughly.

   B. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the completion of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

   C. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, curing compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.

   D. Where curing compound is required, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed concrete surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet- sandblasted to remove the curing compound.

   E. Whenever the air temperature exceeds 85 degrees F or the wind speed exceeds 25 mph at the time of placement, the concrete shall be treated as follows. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each Work operation as necessary to prevent drying shrinkage cracks.

   F. During the curing period, no traffic of any nature and no depositing of any materials, temporary or otherwise, shall be permitted on surfaces coated with c u r i n g compound. Foot traffic and the depositing of materials may be allowed

after three days if the surface is covered with 5/8-inch plywood placed over polyethylene sheets.

6. The Contractor may submit alternate methods of curing, which maintain the concrete in a continuously wet condition for acceptance by the City.

3.17 PROTECTION

1. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. The Contractor shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring. Immediately following the first frost in the fall, the Contractor shall be prepared to protect all concrete against freezing. The concrete shall be maintained at a temperature not lower than 50 degrees F for at least 72 hours after it is placed.

2. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed Work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete.

3.18 TREATMENT OF SURFACE DEFECTS

1. As soon as forms are removed, exposed concrete surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the City. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as required herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. Repairs and replacements shall be promptly executed.

2. Defective surfaces to be repaired shall be cut back from true line a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with neat cement so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair shall consist of a mixture of one sack of cement to 3 cubic feet of sand.

3. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave

the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross- section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry- packed cement grout.

4. All repairs shall be built up and shaped in such a manner that the completed Work will conform to the requirements of this Section, using methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

END OF SECTION

SECTION 03350

CONCRETE FINISHING AND CURING (ADDED)

PART 1 - GENERAL

1.01 DESCRIPTION

1. This section describes materials and methods of concrete finishes, curing, repair of defects, and surface protection.

1.02 SUBMITTALS

1. Submit shop drawings in accordance with the General Conditions and Section 01340 Shop Drawings, Working Drawings and Samples.

2. Submit curing compound manufacturer's statement of compliance with these specifications and recommended coverage to meet or exceed the specified tests. Submit manufacturer's application instructions.

PART 2 - MATERIALS

2.01 EPOXY BONDING COMPOUND

1. **See Section 03300**.

2.02 CURING COMPOUND

1. Curing compound shall conform to ASTM C309, Type 1-D, Class A.

2. Curing compound shall be compatible with required finishes and coatings.

2.03 MORTAR FOR REPAIR OF CONCRETE

1. Mortar used for repair of concrete shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.

2.04 CLEAR FLOOR HARDENER (SURFACE APPLIED)

1. Floor hardener shall be a colorless, aqueous solution of zinc and/or magnesium fluosilicate. Each gallon of the fluosilicate solution shall contain not less than 2 pounds of crystals. Hardener shall be Mastertop CST, a product of Master Builders Company, Cleveland, Ohio; Burke-O-Lith, a product of Edoco Burke Company; or equal. The solution shall be delivered ready for use in the manufacturer's original sealed containers.

2.05 BURLAP MATS

1. Conform to AASHTO M182.

2.06 SISAL-KRAFT PAPER AND POLYETHYLENE SHEETS FOR CURING

1. Conform to ASTM C171.

2.07 DUSTPROOF/SEALER (DPS):

1. Manufacturers:

A. Armorseal Rexthane 1 manufactured by Sherwin Williams.

B. Duraguard 300HS manufactured by ChemMasters.

C. Eucothane manufactured by the Euclid Chemical Company.

D. Or acceptable equivalent product.

2. Provide a high solid, single component, moisture cure urethane with VOC compliance.

3. Provide surface primer in accordance with manufacturer's printed instructions.

4. Colors to be selected by Engineer.

PART 3 - EXECUTION

3.01 CONCRETE FINISHES

1. Finish concrete surfaces in accordance with the following schedule:

Finish Designatio	Area Applied
F-1	Beams, columns, and exterior walls not exposed to water or view.
F-2	Exterior and interior walls, beams, and columns exposed to water, unless such items are to be coated.
F-3	Walls, beams, and columns of structures or buildings exposed to view and to 1 foot below water level or finished grade. Underside of formed floors or slabs. EXCEPTION: surfaces that are to be coated.
F-4	Exterior and interior surfaces to be coated.
S-1	Slabs and floors to be covered with concrete or grout.
S-2	Slabs and floors not water bearing.
S-3	Slab surfaces on which mechanical equipment moves. Slab surfaces to receive hardener.
S-4	Slabs and floors of structures or buildings exposed to view, which are water bearing, or to receive crystalline waterproofing.

S-5	Slabs and floors at slopes greater than 10% and stairs.
E-1	Exposed edges. EXCEPTION: edges normally covered with earth.
E-2	Top of walls, beams, and similar unformed surfaces.

2. Finish F-1: Repair defective concrete, fill depressions deeper than 1/2 inch, and fill tie holes.

3. Finish F-2: Repair defective concrete, remove fins, fill depressions 1/4 inch or deeper, and fill tie holes.

4. Finish F-3: In addition to Finish F-2, fill depressions and airholes with mortar. Dampen surfaces and then spread a slurry consisting of one part cement and one and one-half parts sand by damp loose volume, over the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.

5. Finish F-4: Repair defective concrete, remove fins, fill depressions 1/16 inch or deeper, fill tie holes, remove mortar spatter, and remove bulges higher than 1/16 inch.

6. Finish S-1: Screed to grade without special finish.

7. Finish S-2: Smooth steel trowel finish.

8. Finish S-3: Steel trowel finish free from trowel marks and all irregularities.

9. Finish S-4: Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

10. Finish S-5: Steel trowel finish without local depressions or high points. Apply a stiff bristle broom finish. Leave broom lines parallel to the direction of slope drainage.

11. Finish E-1: Provide chamfer or beveled edges per Section 03111: Concrete Formwork.

12. Finish E-2: Strike smooth and float to an F-3 or F-4 finish.

3.02 FINISHING OF FORMED SURFACES

1. Water cure surfaces until finishing and repairing are completed.

2. Perform finish work as soon as possible after forms are removed. Remove fins and irregularities by grinding or rubbing, fill depressions deeper than specified with mortar, and fill tie holes.

3. Ream tie holes with toothed reamers until surface of hole is rough and clean. Coat surface with epoxy bonding compound and fill with mortar.

4. Finish tapered tie holes as follows:

A. Sandblast tie rod hole and blow clean prior to filling.

B. Drive rubber plug, with one end open, to the center of the hole. Plug size shall be larger in diameter than the diameter of the hole at the center of the wall.

C. Coat entire annular surface of the hole with epoxy prior to filling with mortar. Apply epoxy in accordance with manufacturer's instructions.

D. Fill each side of hole with mortar. Apply mortar to the "wet" side of the wall first. Consolidate mortar solidly into the hole.

E. Notify Owner's Representative of tie rod filling schedule.

3.03 REPAIR OF DEFECTS

1. Do not repair defects until concrete has been reviewed by the Owner's Representative.

2. Surface Defects:

A. Repair surface defects that are smaller than 1 foot across in any direction and are less than 1/2 inch in depth.

B. Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges perpendicular to the surface and at least 3/8 inch deep, thoroughly dampen the surface, work into the surface a bonding grout (one part cement to one-part fine sand), fill the hole with mortar, match the finish on the adjacent concrete, and cure as specified.

3. Severe Defects:

A. Repair severe defects that are larger than surface defects but do not appear to affect the structural integrity of the structure.

B. Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges of the hole perpendicular to the surface, sandblast the surface, coat the sandblasted surface with epoxy bonding compound, place nonshrink grout as specified in Section 03300: Concrete, match the finish on the adjacent concrete, and cure as specified.

4. Major Defects

A. If the defects are serious or affect the structural integrity of the structure or if patching does not satisfactorily restore the quality and appearance to the surface, the Owner's Representative may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section.

3.04 REPAIR OF CRACKS IN CONCRETE

1. Repair concrete cracks in liquid containment structures that are greater than 0.01 inch and

less than 0.1 inch in width by epoxy pressure injection. Epoxy pressure injection shall be Sikadur 52, or equal.

A. Preparation: Insert and anchor a one-way polyethylene valve or pipe nipple in holes drilled into crack. Position them every 6 inches or 18 inches on center depending on the width of the crack. The injecting operation for vertical cracks shall consist of pumping the epoxy grout into the lowest position first and working vertically up in the cracks. Maintain a slow, steady pressure rather than a rapid buildup of pressure. When grouting material reaches the next tube, stop off the present position and follow the same procedure on the next position.

B. Upon completion of the epoxy grouting, remove the epoxy gel used to hold the valve or nipple by applying a direct flame to the epoxy and scraping it off. Fill the holes with the same material as used for patching the surface.

C. While the valves or nipples are installed first, the grouting operation shall not commence until after the patchwork has been completed and has sufficiently cured.

2. Repair cracks in concrete structures that are wider than 1/10 inch by cutting out a square edged and uniformly aligned joint 3/8 inch wide by 3/4 inch deep, preparing exposed surfaces of the joint, priming the joint, and applying polyurethane joint sealant in accordance with Section 03151.

3. If the cracks are serious or affect the structural integrity or function of the element, the Owner's Representative may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section. Where concrete is removed or has spalled, wire brush the exposed rebar, if any, and apply Sika Armatec 110 or equal, before repairing the concrete.

4. After leakage testing dewater the structure, repair leaking concrete cracks from inside the structure, and retest the structure.

3.05 CURING AND PROTECTION

1. Water cure cast-in-place concrete for liquid containment walls, slabs, channels, and footings by Method 1, 2, or 3 for a period of five days (minimum) prior to applying other curing methods. Do not submerge concrete placed in the dry until it has attained sufficient strength to adequately sustain the stress involved and do not subject it to flowing water across its surface until it has cured four days. Start curing of concrete as soon as possible without damaging surface and not later than two hours after placing.

2. Cure concrete surfaces in accordance with the methods specified herein for the different parts of the work and described in the following paragraphs. These methods are considered to be minimum for curing. The conditions that exist in the field during placement and curing may require additional curing procedures and efforts to ensure proper protection and curing of the concrete. Select and implement the appropriate method commensurate with climatic conditions.

Curing Method	Area Permitted
1	All surfaces.
2	All surfaces.
3	Slabs and floors.
4	All surfaces of non-hydraulic structures when maximum ambient temperature will not exceed 80°F and humidity will not drop below 40% on the day of concrete placement and for the three days following.

3. Where wooden forms are used, wet forms immediately before concreting and keep moist by sprinkling until removed. Keep exposed surfaces of formed concrete moist until commencement of curing.

4. Use proper concrete placing and curing methods at all times to limit the amount of crazing and cracking of the structures during initial setting and shrinking of the concrete. Repair cracks and coat with a cementitious crystalline waterproofing system.

5. Cure concrete for not less than 14 days after placing in accordance with one of the following methods.

   A. Method 1, Water Spray Method:

      1) Tightly close off concrete surfaces to be cured by bulkheads or other means or entirely surround by tight enclosures, and keep the concrete surfaces moist by sprinkling, spraying, or other means.

   B. Method 2, Wet-Burlap-Mat Method:

      1) Thoroughly wet and cover concrete surfaces to be cured with wet burlap mats as soon as the forms have been stripped or as soon as the concrete has set sufficiently to avoid marring the surface. Keep entire concrete surface and burlap continuously and completely wet during the entire curing period.

   C. Method 3, Curing Blanket Method:

      1) Thoroughly wet concrete surfaces to be cured and cover with curing blankets as soon as the concrete has set sufficiently to avoid marring the surface. The curing blankets shall be weighted to maintain close contact with the concrete surface during entire curing period. Should the curing blankets become torn or otherwise ineffective, keep surfaces moist and replace damaged sections. The curing blankets shall consist of one of the following two types:

      2) Sheets of heavy waterproof sisal-kraft paper laid with the edges butted together and with the joints between strips sealed with 2-inch-wide strips of

sealing tape or with the edges lapped not less than 3 inches and fastened together with waterproof cement to form continuous watertight joints; or

3) Sheets of clean polyethylene, having a minimum thickness of 4 mils, layed with edges butted together, and with the joints between sheets sealed with 1-inch-wide strips of acetate tape.

4) During the curing period, do not permit traffic of any nature or depositing of objects, temporary or otherwise, on the curing blankets.

D. Method 4, Curing Compound Method:

1) Do not use curing compound on surfaces that are to be coated in accordance with Section 09900: Painting.

2) Spray the surface with two coats of liquid curing compound. Apply in accordance with the manufacturer's instructions to cover the surface with a uniform film that will seal thoroughly. Apply second coat at 90 degrees for the first coat.

3) Apply curing compound immediately after completion of the finish on unformed surfaces and within two hours after removal of forms on formed surfaces. Repair formed surfaces within the said two-hour period; provided, however, that any such repairs which cannot be made within the said two-hour period shall be delayed until after Method 1, 2, or 3 has been applied. When repairs are to be made to an area on which curing compound has been applied, first sandblast the area to remove the compound, then repair.

4) Wherever curing compound may have been applied to surfaces against which concrete subsequently is to be placed and to which it is to adhere, remove the curing compound entirely by sandblasting prior to the placing of new concrete.

5) Where the curing compound method is used, exercise care to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, repair the damaged portions immediately by the application additional curing compound.

E. It is the responsibility of the Contractor to select the appropriate curing method in response to climatical and/or site conditions occurring at the time of concrete placement. Take appropriate measures as described in ACI 305 and 306 for protecting and curing concrete during hot and cold weather.

3.06 CLEAR HARDENER APPLICATION (SURFACE APPLIED)

1. Cure, clean, and keep floors dry to receive hardener. Complete work immediately above floors prior to applying hardener. Apply hardener evenly, using three coats, allowing 24 hours between coats. The first coat shall be one-third strength, second coat one-half

strength, and third coat two-thirds strength. Apply each coat so as to remain wet on the concrete surface for 15 minutes. Apply proprietary hardeners in conformance with the manufacturer's instructions. After the final coat is completed and dry, remove surplus hardener from the surface by scrubbing and mopping with water.

2. Apply hardener to the surfaces designated in the drawings.

3.07 DUSTPROOF/SEALER (DPS):

1. Apply primer in accordance with manufacturer’s printed instructions.

2. Give particular attention to priming of concrete substrate and time laps between coats when more than one conditioning coat is required.

3. Mix colored polyurethane dustproof/sealer surface treatment and apply to sound, fully cured, dry and thoroughly clean concrete slabs in strict accordance with manufacturer's printed instructions.

   A. Total dry film thickness for both primer and topcoat shall be 4 mils.

3.08 CONCRETE SURFACES TO BE COATED

1. See Section 09900: Painting.

END OF SECTION

SECTION 03400

PRECAST CONCRETE

STRUCTURES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide precast concrete wet well structures, manholes, vaults, and storm drain inlets, complete and in place, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. General: Furnish submittals in accordance with Section 01300 - Contractor Submittals.

2. Shop Drawings

A. Show dimensions, locations, lifting inserts, reinforcement, and joints.

B. Structural design calculations for all precast concrete structures shall be signed and sealed by a professional structural engineer licensed and registered in the state of Florida.

1.03 QUALITY ASSURANCE

1. Inspection: After installation, the Contractor shall demonstrate that manholes and vaults have been properly installed, leveled true and plumb with tight joints, at the correct elevations and orientations, and that the backfilling has been carried out in accordance with the Contract Documents.

PART 2 -- PRODUCTS

2.01 MANHOLES

1. The Contractor shall provide precast manhole sections and conical sections conforming to ASTM C 478 and the requirements of this Section. Adjusting rings shall be standard items from the manufacturer of the manhole sections. Minimum wall thickness of adjusting rings shall be as indicated on the Drawings. Bricks are not allowed except for wedges used for final shimming of the ring and cover.

2. Axial length of sections shall be selected to provide the correct total height with the fewest joints.

3. Conical sections shall be designed to support cast iron frames and covers under an H- 20 loading, unless indicated otherwise.

4. Where the manhole barrel diameter is greater than 48-inches, a flat slab-transition, either concentric or eccentric, shall be used to transition to 48-inch diameter riser sections. Underside of the transition shall be at least 7-feet above the top of the bench.

5. A manhole shall be classified as a "drop manhole" when the difference in elevation between the inverts of pipes entering or leaving the manhole is greater than 2.00 feet.

6. Design Criteria: Manhole walls, transitions, conical sections, and bases shall be designed per ASTM C 478 for the depths indicated and the following:

   A. AASHTO H-20 loading applied to the cover.

   B. Unit weight of soil of 120 pcf located above all portions of the manhole.

   C. Lateral soil pressure based on saturated soil producing 100 pcf acting on an empty manhole.

   D. Internal fluid pressure based on unit weight of 63 pcf with manhole filled from invert to cover with no balancing external soil pressure.

   E. Dead load of manhole sections fully supported by the base and transition.

   F. Additional reinforcing steel in walls to transfer stresses at openings.

   G. The minimum clear distance between the edges of any 2 wall penetrations shall be 12- inches or one-half of the diameter of the smaller penetration, whichever is greater, unless otherwise directed by the City.

   H. The minimum structural member thickness for manholes shall be as shown on the Drawings. Cement shall be Type II Portland cement as specified in ASTM C 150. The minimum 28-day concrete compressive strength shall be 4,000 psi. All reinforcing steel shall be embedded in the concrete with a minimum clear cover as recommended by ACI 318.

   I. All precast manholes shall include Xypex C1000-Redadditive in accordance with manufacture specifications. Coal tar on exterior of manholes will not be permitted.

7. Joints shall be sealed with double bitumastic strip seal conforming to ASTM C 443 as shown on Drawings. Seal shall be Ram-nek as manufactured by Henry. All exterior joints and seems in manholes shall also be wrapped in Bidco joint sealing wrap.

8. Concrete for cast-in-place base and invert channel formation shall be 4000 psi concrete conforming to Section 03310 - Cast-In-Place Concrete.

9. Barrel section to sewer pipe connections shall be sealed with resilient connectors complying with ASTM C 923. Mechanical devices shall be American made stainless steel. Flexible Connection Boot shall be. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

10. Manhole Manufacturers or City Approved Equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 FRAMES AND COVERS

1. Castings: Castings for manhole frames and covers shall be non-rocking and shall conform to the requirements of ASTM 48 A, Class 35B. Unless otherwise indicated, cast iron covers and frames shall be heavy traffic type, 24 inches in diameter, with embossed lettering stating "Sanitary Sewer" and "City of Cape Coral." Frame and cover shall be designed for H-20 traffic loading.

2. Castings Manufacturers, or City Approved Equal

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.03 VAULTS AND WET WELLS

1. The Contractor shall provide precast vaults and wet wells designed for the indicated applications and of the sizes indicated.

2. The minimum structural member thickness for vaults and wet wells shall be as shown on the Drawings. Cement shall be Type II Portland cement as specified in ASTM C 150. The minimum 28-day concrete compressive strength shall be 4,000 psi. Precast vault and wetwell structures shall include Xypex C1000 - Red additive in accordance with manufacture specifications. All reinforcing steel shall be embedded in the concrete with a minimum clear cover as recommended by ACI 318.

3. Design Loading: Vaults and wet wells shall be designed for H-20 traffic loading. Lateral loads on vaults and wet wells in all areas shall be calculated from:

	L	=	90 h, plus surcharge of 240 psf in areas of vehicular traffic
Where	L	=	loading in psf
	h	=	depth of fill in feet

4. Where joints are designed in pre-cast concrete vaults and wet wells, such joints shall be interlocking to secure proper alignment between members and prevent migration of soil through the joint. Structural sections at joints shall be sized sufficiently to reinforce the section against localized distress during transportation and handling and against excess contact bearing pressures through the joint.

5. Where openings for access to the vault or wet well are required, the full clear space opening indicated shall be provided, without obstructions from brackets or supports. For large openings where brackets or supports are designed to protrude into the opening for support of required covers, such brackets or supports shall be designed to be easily removed and replaced with a minimum of effort and without cutting or welding.

6. Joints and Lids shall be sealed with double bitumastic strip seal conforming to ASTM C 443 as shown on Drawings. Seal shall be Ram-nek as manufactured by Henry. Exterior portion of joint shall be horizontally wrapped with bitumastic strip seal material as manufactured by Bidco.

7. Concrete for cast-in-place base and invert channel formation shall be 4500 psi concrete or grout conforming to Section 03310 – Cast-in-Place Concrete.

8. Barrel section to sewer pipe connections shall be sealed with resilient connectors complying with ASTM C 923. Mechanical devices shall be American made stainless steel. Flexible Connection Boot shall be SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.

9. Covers for access openings shall be provided. Frames for covers shall be fabricated in accordance with Specification Section – 05530 Aluminum Covers.

10. Where penetrations of the pre-cast concrete vault are required for piping, conduit, or ducts, such penetrations shall be accommodated through pre-cast openings or circular cores performed in the field, as directed by the City of Cape Coral. Thin wall knock-out sections shall not be permitted. All openings for penetrations shall be smooth and free of surface irregularities and without exposed steel reinforcing. Vaults need not be designed to resist thrust from piping passing through the vault. A separate penetration shall be provided for each pipe or conduit entering the pre-cast section. HDPE will be used for all piping entering the valve box, unless otherwise indicated on the Drawings.

2.04 COATINGS AND LININGS

1. The interior of all wet wells, master manholes, valve vaults and specific sanitary manholes as shown on the Drawings shall be coated in accordance with Section 09800-Protective Coating. The exterior of all precast items shall be coated in accordance with Section 09800-Protective Coating.

2.05 STORM DRAIN INLETS

1. All storm drain inlet tops and bottoms shall conform to applicable detail sheets and FDOT Standard Indices 200, 201, and 232.

2. Grates in paved areas: Grates shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**. Inlets (Type C and E) to have concrete top over inlet with opening to fit frame and grate, as shown on the Contract Drawings. Grates in grassed areas: Grates shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** for 'Type C' inlets and **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** for 'Type E' inlets.

3. Storm drain manhole top shall be as depicted on the Design Drawings.

PART 3 -- EXECUTION

3.01 GENERAL

1. Pre-cast concrete sections shall be transported and handled with care in accordance with the manufacturer's written recommendations. Where lifting devices are provided in pre-cast sections, such lifting devices shall be used as intended. Where no lifting devices are provided, the Contractor shall follow the manufacturer's recommendations for lifting procedures to provide proper support during lifting.

2. Buried pre-cast concrete vaults and wet wells shall be assembled and placed in excavations as detailed in the Drawings. Pre-cast concrete vaults and wet wells shall be set to grade and oriented to provide the required dimensions and clearances from pipes and other structures.

3. Prior to backfilling, all cracks and voids in pre-cast concrete vaults and wet wells shall be filled with Type II Portland Cement. Around pipe and conduit penetrations, openings shall be sealed.

4. Eccentric conical sections shall be aligned to place the manhole lid in the quarter points of the roadway.

3.02 STONE BEDDING BENEATH PRECAST CONCRETE STRUCTURES

1. Bed all precast concrete structures with a well graded, compacted layer of FDOT #57 stone. Bedding layer of stone under lift station wet wells shall be a minimum of 12-inches in depth. All other structures shall require a minimum layer of 6-inches in depth. The layer of stone bedding for all structures shall extend a minimum of 12-inches beyond the outside footprint of the precast concrete structure.

3.03 SURFACE DEFECTS

1. All exposed concrete surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the City. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as required herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. Repairs and replacements shall be promptly executed.

END OF SECTION

SECTION 03450

ARCHITECTURAL PRECAST CONCRETE

(ADDED)

PART 1 - GENERAL

1.01 SUMMARY

1. Section includes architectural precast concrete cladding units.

1.02 DEFINITIONS

1. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.03 PREINSTALLATION MEETINGS

1. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

1. Product Data: For each type of product.

2. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

3. Shop Drawings:

A. Detail fabrication and installation of architectural precast concrete units.

B. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.

C. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.

D. Indicate details at building corners.

4. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).

5. Delegated-Design Submittal: For architectural precast concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

1. Welding certificates.

2. Material certificates.

3. Material Test Reports: For aggregates.

4. Field quality-control reports.

1.06 QUALITY ASSURANCE

1. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

   A. Designated as a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units at time of bidding or designated as an APA- certified plant for production of architectural precast concrete products.

   B. Fabricator is located within 500 miles (800 km) of Project site.

2. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

3. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

4. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of two sample panels approximately 16 sq. ft. (1.5 sq. m) in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

1.07 COORDINATION

1. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

1. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400 "Quality Control Requirements," to design architectural precast concrete units.

2. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

3. Calculated Fire-Test-Response Characteristics: Provide architectural precast concrete units with fire-resistance rating indicated as calculated according to ACI 216.1 (ACI 216.1M) and acceptable to authorities having jurisdiction.

4. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding design loads indicated within limits and under conditions indicated.

2.02 REINFORCING MATERIALS

1. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

3. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

4. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from galvanized-steel wire into flat sheets.

5. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

6. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.03 PRESTRESSING TENDONS

1. Prestressing Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, seven-wire, low-relaxation strand.

   A. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.

2.04 CONCRETE MATERIALS

1. Regional Materials: Precast architectural concrete shall be manufactured from aggregates and cement that have been extracted or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

2. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

A. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

3. Supplementary Cementitious Materials:

A. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.

B. Metakaolin: ASTM C 618, Class N.

C. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.

D. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

E. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.

4. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

A. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

1) Gradation: Uniformly graded.

B. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

5. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

6. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

7. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

8. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

2.05 STEEL CONNECTION MATERIALS

1. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

2. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or Type B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

3. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.

4. Malleable Iron Castings: ASTM A 47/A 47M, Grade 32510 or Grade 35028.

5. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).

6. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

7. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.

8. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).

9. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.

10. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or ASTM F 1554, Grade 36 (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.

11. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).

12. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M .

    A. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

13. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop- apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

2.06 GROUT MATERIALS

1. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

2. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less

than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

3. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.07 CONCRETE MIXTURES

1. Prepare design mixtures for each type of precast concrete required.

2. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.

3. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

4. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

5. Normal-Weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

   A. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.

6. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

7. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

8. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.08 FABRICATION

1. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

   A. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

2. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

3. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

4. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

5. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

6. Prestress tendons for architectural precast concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 117.

7. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

8. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

9. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

    A. Place backup concrete mixture to ensure bond with face-mixture concrete.

10. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

    A. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

11. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

12. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.

13. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

14. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.09 FABRICATION TOLERANCES

1. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.10 FINISHES

1. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved mockups and as follows:

   A. Design Reference Sample: Minimum of three (3) 8 inch samples of each specified.

   B. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.

   C. As-Cast Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb.

   D. Textured-Surface Finish: Impart by form liners or inserts.

   E. Bushhammer Finish: Use power or hand tools to remove matrix and fracture coarse aggregates.

   F. Exposed-Aggregate Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.

   G. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.

   H. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attach.

   I. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.

   J. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.

   K. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing.

2. Finish exposed top surfaces of architectural precast concrete units to match face- surface finish.

3. Finish exposed top surfaces of architectural precast concrete units with smooth, steel-trowel finish.

4. Finish unexposed surfaces of architectural precast concrete units with as cast finish.

2.11 SOURCE QUALITY CONTROL

1. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712.

2. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.

PART 3 - EXECUTION

3.01 INSTALLATION

1. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

2. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.

   A. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

   B. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch (19 mm).

3. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

4. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

5. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

6. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.

Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.02 ERECTION TOLERANCES

1. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.03 FIELD QUALITY CONTROL

1. Special Inspections: Engage a qualified special inspector to perform the following special inspections and prepare reports:

   A. Erection of loadbearing precast concrete members.

2. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

3. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

4. Testing agency will report test results promptly and in writing to Contractor and Architect.

5. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

6. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.04 REPAIRS

1. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.

2. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

3. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.

4. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

5. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.05 CLEANING

1. Clean surfaces of precast concrete units exposed to view.

2. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

3. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

   A. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.

   B. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 05500

MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide miscellaneous metalwork and appurtenances, complete and in place, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. Shop Drawings: Shop Drawings of all miscellaneous metalwork shall be submitted in accordance with Section 01300 - Contractor Submittals.

2. Weld Submittals: All weld procedures, welder qualifications and certification shall be submitted to the City by the Contractor prior to welding.

3. All stainless steel to be used on the project must be accompanied by a manufacturer's certificate of origin to evidence that the material is of American manufacture.

1.03 QUALITY ASSURANCE

1. All weld procedures and welder qualifications shall be available for review as required in this Section.

PART 2 -- PRODUCTS

2.01 GENERAL REQUIREMENTS

1. Steel

A.	Plates, Bars, Angles	ASTM A 36
B.	Pipe, Pipe Columns,	ASTM A 53, Type E or S, Grade B standard weight unless noted otherwise
C.	Tubes	ASTM A 500 Grade C
D.	Shapes (W, WT)	ASTM A992
E.	Shapes (S, M, HP, C)	ASTM A36 or ASTM A572 Grade 50

2. Corrosion Protection: All metalwork shall be coated in accordance with Section 09800 - Protective Coating.

3. Stainless Steel: Unless otherwise indicated, stainless steel metalwork and bolts shall be of Type 316 stainless steel and American made. A manufacturer's certificate of origin will be required for all stainless steel to be used.

4. Aluminum: Unless otherwise indicated, aluminum metalwork shall be of Alloy 6061-T6 or 5052. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have contact surfaces coated in accordance with Section 09800.

5. Cast Iron: Unless otherwise indicated, iron castings shall conform to the requirements of ASTM A 48, Class 50B or better.

2.02 CHECKERED PLATE

1. Checkered plate shall have a pattern of raised lugs on one face and shall be smooth on the opposite face. Lugs shall be a minimum of one inch in length and raised a minimum of 0.050 inch above the surface. The lugs shall be located in a pattern in which the lugs are oriented at 90 degrees from the adjacent lugs in two orthogonal directions. The rows of lugs shall be oriented at 45 degrees from the edges of the plates.

2. Where no plate material type is indicated on the Drawings, aluminum shall be provided. Unless indicated otherwise, the minimum plate thickness shall be as required to limit deflection resulting from a live load of 100 psf to 1/4-inch or the span divided by 240, whichever is less.

2.03 IRON CASTINGS

1. Iron castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. They shall be smooth and well cleaned by shot blasting.

2. Covers and grates shall fit together evenly, so that the cover fits flush with the surrounding finished surface and so that the cover does not rock or rattle when loading is applied. Round covers and frames shall have machined bearing surfaces.

3. Unless otherwise indicated on the drawings covers and grates with matching frames shall be designed for AASHTO HS-20 loading unless indicated otherwise.

2.04 BOLTS AND ANCHORS

1. Standard Service (Non-Corrosive Application): Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be steel as indicated herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, steel for bolt material, anchor bolts and cap screws shall be in accordance with the following:

   A. Structural connections: ASTM A 307, Grade A or B, hot-dip galvanized.

   B. Anchor Bolts: ASTM F1554 A 36, hot-dip galvanized.

C. High strength bolts where indicated: ASTM A 325, hot-dip galvanized.

D. Pipe and equipment flange bolts: ASTM A 193, Grade B-7, hot-dip galvanized.

2. Corrosive Service: All bolts, nuts, and washers in the locations listed below shall be type 316 stainless steel and American made as indicated below:

A. All buried locations.

B. All submerged locations.

C. All locations subject to seasonal or occasional flooding.

D. Inside hydraulic structures below the top of the structure.

E. Inside buried vaults, manholes, and structures.

F. All chemical handling areas.

G. Inside trenches, containment walls, and curbed areas.

H. Locations indicated by the Contract Documents or designated by the Contractor to be provided with stainless steel bolts.

I. Unless otherwise indicated

3. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be American made type 316 stainless steel, class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts. All threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless-steel bolts, to meet government specification MIL-A-907E. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

A. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF, organization which develops standards relating to public health safety and the environment.

4. Bolt Requirements

A. The bolt and nut material shall be free-cutting steel.

B. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

C. Bolts and nuts shall be installed with washers fabricated of material matching

the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification. Lock washers fabricated of material matching the bolts shall be installed where indicated.

D. The length of each bolt shall be such that after the joint is made up, the bolt extends through the entire nut with a minimum of two threads protruding from the nut, but in no case more than 1/2-inch beyond the nut.

E. All bolts and nuts shall be cathodically protected from dissimilar metals through the use of nylon washers or other galvanic isolators as applicable.

5. Adhesive Anchors: Unless otherwise indicated, all drilled, concrete or masonry anchors shall be adhesive anchors. Products shall be tested in accordance with ICC A308, and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete. No substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

A. Epoxy adhesive anchors are required for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails, pumps, mechanical equipment, and reinforcing bars. Threaded rod shall be stainless steel Type 316, conforming to ASTM F593 (CW), and American made.

6. Expanding-Type Anchors: Expanding-type anchors if indicated or permitted shall be stainless steel Type 316 and American made. Products shall be single component anchors tested in accordance with ICC AC193, and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete.

2.05 POWDER-DRIVEN PINS

1. Materials: Powder-driven pins for installation in concrete or steel shall be heat-treated steel alloy. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they are to be exposed, they shall be protected in an acceptable manner. Pins shall have capped or threaded heads capable of transmitting the loads to the shanks. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

2.06 IMPACT ANCHOR

1. Impact anchors shall be an expansion type anchor in which a nail type pin is driven to produce the expansive force. The pin shall have a zinc sleeve with a mushroom style head and stainless-steel nail pin. Anchors shall be Metal Hit Anchors, manufactured by Hilti, Inc., Rawl Zamac Nailin, manufactured by the Rawlplug Company; or equal.

PART 3 -- EXECUTION

3.01 FABRICATION AND INSTALLATION REQUIREMENTS

1. Fabrication and Erection: Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."
2. Powder-Driven Pins: Powder-driven pins shall be installed by a craftsperson certified by the manufacturer as being qualified to install the manufacturer's pins. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration. Driven pins shall conform to the following requirements where "D" = pin's shank diameter:

Material Penetrated by Pin	Material Minimum Thickness	Pin Shank Penetration in Supporting Material	Minimum Space From Pin's CL to Edge of Penetrated Material	Minimum Pin Spacing
Concrete	16D	6D minimum	14D	20D
Steel	1/4-inch	Steel thickness	4D	7D

3.02 WELDING

1. Method: Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

2. Quality: In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as indicated by the AWS Code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32- inch on the flat.

3.03 GALVANIZING

1. Structural steel plates, shapes, bars, and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153. Field repairs to galvanizing shall be made using "Galvinox," "Galvo-Weld," or equal.

3.04 DRILLED ANCHORS

1. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dried. Drilled anchors shall not be installed until the concrete has reached the required 28- day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 05530
ALUMINUM COVERS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The CONTRACTOR shall provide aluminum covers, complete and in place, in accordance with the Contract Documents. The covers shall be provided for valve vaults and wet well structures.

1.02 CONTRACTOR SUBMITTALS

1. Furnish submittals in accordance with Section 01300 - Contractor Submittals.

2. Shop Drawings: Include layouts, hinges locations and spacings, cover location, anchors details, construction details, manufacturer's engineering data, installation instructions, and product data.

PART 2 -- PRODUCTS

2.01 SYSTEM DESIGN AND STRUCTURAL PERFORMANCE OF COVER

1. General: All covers and installation shall be in accordance with the manufacturer's published recommendations and specifications.

2. Codes: All codes, as referenced herein, are specified in Section 01090 – Reference Standards.

3. In case of conflict between codes, reference standards, Drawings, and these Specifications, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the CITY OF CAPE CORAL for clarification and directions prior to ordering or providing any materials or labor.

2.02 MATERIALS

1. Cover: Door leaf shall be 1/4-inch-thick aluminum diamond plate reinforced for a AASHTO H- 20 live load as indicated on the drawings. A staple for padlock shall be included for security. The hatch shall be provided with an automatic American made stainless steel hold-open arm with release handle and latch.

2. Frame: The frame shall be extruded aluminum channel section with an integral anchor flange on all four (4) sides. The frame shall include an EPDM odor reduction gasket. A nut rail shall be provided integral to the frame on all sides.

3. Fall Through Prevention Device: The cover shall be equipped with an aluminum grate to prevent fall through incidents (wet well structure cover only). The grate shall be designed for a minimum 300 p.s.f. live load, with hardware components made of 316 American made stainless steel to resist corrosion and lock-open mechanism. The grate

shall operate independent of the cover's reinforcing so that the cover will continue to meet the specified load requirements, even if the grate's leaves are damaged or removed. The leaves of the grate shall pivot on aluminum hinge devices with type 316 American made stainless steel hardware that permit them to rotate upward and automatically lock into position. When open the grate shall act as an additional fall through prevention barrier to the cover opening.

4. Welding Rods: Aluminum welding rods shall be of type recommended by the aluminum manufacturer.

5. Fasteners: Fasteners, screws, and bolts shall be concealed and shall be of 316 American made stainless steel.

6. Miscellaneous Hardware: All hardware, but not limited to all parts of the latch, lifting mechanism assemblies, hold open arms and guides, brackets, hinges and pins shall be 316 stainless steel, and American manufactured. Springs shall be American made stainless steel Type 302, 304, or 316.

2.03 FABRICATION

1. The floor access door shall be equipped with a flush watertight handle that does not protrude above the cover and an American made stainless steel hold open arm with red vinyl grip that automatically locks the cover in the 90-degree open position.
2. The door shall have stainless-steel hinges with stainless steel flat head bolts. All stainless-steel components shall be Type 316 American made alloy.
3. The door shall be manufactured and assembled in the United States. Manufacturer shall guarantee the door against defects in materials and workmanship for a period of ten (10) years.
4. An American made stainless steel slam lock latching device for the cover lid shall be provided to enable full closure of the lid flush with the surrounding slab structure.

2.04 MANUFACTURERS, OR CITY APPROVED EQUAL

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

PART 3 -- EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

1. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken package or container bearing the label of the manufacturer.

2. Storage: All materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

3.02 CRAFTSMANSHIP

1. All WORK shall be performed by craftsmen experienced in the installation of mechanical metal work. Exposed surfaces shall be free from defects or other surface blemishes. Dimensions and conditions shall be verified in the field in advance. Joints, junctions, miters, and butting sections shall be precision-fitted, with no gaps occurring between sections, and all surfaces shall be flush and aligned and without sharp edges.

3.03 INSTALLATION

1. Installation shall be in accordance with the manufacturer's attached instructions and shall be embedded in the precast top at the time of casting. All Aluminum surfaces in contact with concrete shall be coated in accordance with Section 09800 – Protective Coating.

END OF SECTION

SECTION 07920
SEALANTS AND CAULKING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The CONTRACTOR shall provide caulking, sealing, and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be in accordance with Section 01300 - Contractor Submittals.

2. Technical Data: A complete materials list including the manufacturer's technical data and literature, specifications, color sample, joint width, depth tables and installation instructions.

PART 2 -- PRODUCTS

2.01 SEALANTS AND CAULKING MATERIALS

1. General:

A. Manufacturer's Standards: In addition to the standards listed below, the sealants and caulking products and application shall be in accordance with the manufacturer's published recommendations and specifications.

B. Wherever manufacturer's names and products are listed in this Section, "or equal" products will be considered in accordance with Section 01300 - Contractor Submittals.

2. Materials shall conform to the following requirements:

A. Significant Movement Sealants (plus or minus 25% movement capability)

1) For expansion wall joints; masonry and metal curtain wall joints; precast concrete joints and concrete panels; perimeter sealing (windows, doors, and panels); control joints; interior and non-traffic horizontal joints.

a. Two component, non-sag, polyurethane or polysulfide sealant conforming to Federal Specification TT-S-227E, Class A, Type II, and ASTM C 920, Type M, Class 25, Grade NS. Products Silaflex “2c NS”, Dow Corning “983”.

b. One component, non-sag, low modulus, polyurethane or

polysulfide sealant conforming to Federal Specification TT-S230C, Class A, Type II, and ASTM C 920, Type S, Class 25, Grade NS.
Sikaflex “1a” Tremco "Dymonic"

c. One component, non-sag, medium modulus, neutral cure, silicone sealant conforming to Federal Specification TT-S-1543A, Class A, and ASTM C 920, Type S, Class 25, Grade NS.
Pecora “865” Dow Corning "795"

B. Sealants

1) For non-structural applications

a. One component non-sag, medium modulus, neutral cure, silicone sealant conforming to Federal Specification TT-S-1543A, Class A, and ASTM C 920, Type S, Class 25, Grade NS. 2) Pecora “865” Dow Corning 795"

b. One component, non-sag, high modulus, acetoxy cure, silicone sealant conforming to Federal Specification TT-S-1543A, Class A, and ASTM C 920, Type S, Class 25, Grade NS.

C. Interior Sealant and Caulking

1) For general applications

a. One component, acrylic latex caulking conforming to ASTM C 834 Pecora Corp. "AC-20" Tremco “Tremflex 834”

D. Preformed Sealants: Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air, and dust when installed as recommended by the manufacturer. At temperatures from minus 30 to plus 160 degrees F, the sealant shall be non- bleeding and shall have no loss of adhesion.

E. Tape Sealant: Dimensions shall be as required for application conditions. Tape sealants shall be type recommended by tape manufacturer for connecting and bonding to surfaces.

F. Joint backing (backer rod) material shall be resilient, closed-cell polyethylene foam conforming to ASTM D 1752, Type II or III, and/or bond breakers of proper size for joint widths. Joint backing shall be compatible with sealant manufacturer's product and shall not stain the sealant nor the materials to which applied.

G. Primer: Primers shall be as recommended in the manufacturer's printed instructions for caulking and sealants and shall not stain the sealant nor the

materials to which applied. Manufacturer shall be consulted for all surfaces not specifically covered in submittal application instructions. Primer shall be used in accordance with manufacturer's instructions with all primers being applied prior to the installation of any backer rod or bond breaker tape.

H. Cleaning and cleanup solvents, agents, and accessory materials shall be as recommended in the manufacturer's printed instructions for cleaning up.

2.02 COLOR OF SEALANTS

1. Color of sealants that are visible after installation shall match adjacent building finish. If in doubt of color match, obtain color approval from CITY OF CAPE CORAL.

PART 3 -- EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

1. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken packages or containers bearing the manufacturer's label. Packages or containers shall be delivered to the site with seals unbroken.

2. Shelf Life: Materials whose shelf life dates have expired shall not be used in the WORK. Such materials shall be promptly removed from the project site.

3. Storage: All materials shall be carefully stored in accordance with the manufacturer's instructions, in an area that is protected from deleterious elements, and in a manner that will prevent damage to the product. Materials shall be stored at temperatures between 40 and 90 degrees unless otherwise specified by the manufacturer.

3.02 INSTALLATION

1. Manufacturer's Recommendations: All WORK under this Section and all testing, where applicable, shall be performed in accordance with manufacturer's printed recommendations, specifications, and installation instructions except where more stringent requirements are indicated herein; and, except where project conditions require extra precautions or provisions to assure performance of the caulking or sealant system.

2. Authorized Installers: Caulking and sealants shall be complete systems and be installed only by installers authorized and approved by the respective manufacturers.

3. Surface Preparation:

A. General: The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints which will be in contact with the sealant. Ferrous metal surfaces shall be cleaned of all rust, mill scale, and other coatings by wire brush, grinding, or sandblasting. Oil and grease shall be removed by cleaning in accordance with sealant manufacturer's printed recommendations. Protective

coatings shall be removed from all aluminum surfaces against which caulking or sealing compound is to be placed. Bituminous or resinous materials shall be removed from surfaces to receive caulking or sealants.

B. Concrete and Masonry Surfaces: Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence, and loose mortar shall be removed from the joint cavity.

C. Steel Surfaces: Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finishes, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

D. Aluminum Surfaces: Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall not leave a residue, shall be as recommended by the manufacturer of the aluminum and shall be non-staining.

E. Wood Surfaces: Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

4. Joint Types and Sizes: Joint shapes and sizes shall be as indicated or as necessary for job conditions where not indicated. Joints to be caulked or sealed include through- bolt holes, door frames, louver and ventilator frames, joints between openings where items pass through exterior walls, concrete masonry, or combination of these surfaces, and as otherwise indicated or required for water-tightness, weatherproofing, or air- tightness. Use sealing compound at both exterior and interior surfaces of exterior wall penetrations.

3.03 SEALANT FILLED JOINTS

1. Sealant: Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Sealant shall be installed to the required depth without displacing the backing. Unless otherwise indicated or recommended by the manufacturer, the installed sealant shall be tooled so that the surface is uniformly smooth and free of wrinkles and to assure full adhesion to the sides of the joint. Sealants shall be installed free of air pockets, foreign embedded matter, ridges, and sags. Sealer shall be applied over the sealant if recommended by the sealant manufacturer.

2. Sealant Depth: Sealant depth in joints shall be 1/2 the width of joint, but not less than 1/8-inch deep and 1/4-inch wide nor more than 1/2-inch deep and 1-inch wide. All joints shall have a rigid filler material installed to proper depth prior to application of sealant.

3. Masking Tape: Masking tape shall be placed on the finish surface on one or both sides of a

joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

4. Backing: Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

5. Bond-Breaker: Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

6. Primer: Primer shall be used on concrete, concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

7. Applications: A full bead of sealant shall be applied into the joint under sufficient pressure, with the nozzle drawn across sealant, to completely fill the void space and to ensure complete wetting of contact area to obtain uniform adhesion. During application, the tip of the nozzle shall be kept at the bottom of the joint thereby forcing the sealant to fill from the bottom to the top. Sealants shall be tooled immediately after exposure with a caulking tool or soft bristled brush moistened with solvent. The finished sealant-filled joint shall be slightly concave unless otherwise indicated.

3.04 CLEANING

1. After application of sealant and caulking materials, adjacent materials, which have been soiled, shall be cleaned and left in a neat, clean, undamaged, or unstained condition. On porous surfaces, excess sealant shall be removed per sealant or caulking manufacturer's printed instructions.

END OF SECTION

SECTION 09800

PROTECTIVE COATING

PART 1 - GENERAL

1.01 THE REQUIREMENT

1. The CONTRACTOR shall provide protective coatings, complete and in place, in accordance with the Contract Documents.

2. Definitions:

   A. The term "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

   B. The term "DFT" means minimum dry film thickness, without any negative tolerance.

3. The following surfaces shall not be protective coated:

   A. Concrete, unless required by items on the concrete coating schedule below or the Drawings.

   B. Stainless steel

   C. Machined surfaces

   D. Grease fittings

   E. Glass

   F. Equipment nameplates

   G. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.

4. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the Drawings are used to show or extend the limits of coating schedules, to show exceptions to the schedules, or to clarify or show details for application of the coating systems.

5. Where protective coatings are to be performed by a lower tier contractor, the contractor shall possess a valid state license as required for performance of the painting and coating WORK called for in this specification.

6. EXISTING COATINGS/LININGS

A. To maintain all warranties, manholes and wetwells that have an existing coating or lining must only be penetrated and repaired with same lining material with the consent of the existing lining manufacturer. CONTRACTOR must not compromise any existing warranty.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be furnished in accordance with Section 01300 – Contractor Submittals.

2. Technical Data: Manufacturers technical data and literature, specifications and installation instructions.

3. Color Samples: CONTRACTOR shall submit color samples for paint and coatings where colors are designated in the specifications. CITY OF CAPE CORAL will select, with CITY concurrence, the colors to be used.

1.03 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS

1. Warranty Inspection: A warranty inspection may be conducted during the eleventh month following completion of all coating and painting WORK or as deemed necessary by the CITY. The CONTRACTOR and a representative of the coating material Manufacturer may be requested to attend this inspection. All defective WORK shall be repaired in accordance with these specifications and to the satisfaction of the CITY OF CAPE CORAL. The CITY OF CAPE CORAL may, by written notice to the CONTRACTOR, reschedule the warranty inspection to another date within the three-year correction period, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the CONTRACTOR is not relieved of its responsibilities under the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL

1. Suitability: The CONTRACTOR shall use suitable coating materials as recommended by the Manufacturer.

2. Compatibility: In any coating system 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. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

3. Containers: Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all of which shall be plainly legible at the time of use.

4. Colors: Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples.

2.02 INDUSTRIAL COATING SYSTEMS

1. Material Sources: Each of the following manufacturers is capable of supplying many of the industrial coating materials indicated herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. All industrial- coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.

2. System 1 – Ferrous metal surfaces, indoors or outdoors, exposed or covered, galvanized and not galvanized: All surfaces exposed to the atmosphere that do not come into contact with wastewater or corrosive atmosphere including pumps, motors, machinery, above ground piping, valves and pipe supports, miscellaneous steel shapes, angles, exposed surfaces of electric panels, conduit, ventilation fans, air-conditioning units, duct work, shall have surface preparation and coating system as listed in Article 3.10 of this Section.

3. Metal surfaces that are submerged in wastewater or subjected to wastewater gases including new equipment specified and installed in this Contract, miscellaneous steel, pumps, piping and valves, shall have surface preparation and coating system as listed in Article 3.10 of this Section.

4. System 2 – Interior coatings for wet wells, master manholes, and force main discharge manholes: The interior of the wet wells of lift stations, the first manhole upstream of a wetwell and manholes where force mains discharge, and other structures as indicated in the Drawings shall be lined as listed in Article 3.11.1. of this Section. All surface preparation shall be as indicated in Article 3.11.1 of this Section. A ten-year comprehensive warrantee against failure of workmanship and materials shall be provided by the coating supplier.

5. System 3 – Exterior coatings for wet wells, manholes, master manholes, force main discharge manholes and valve vaults: The exterior of the wet well of lift stations, valve vaults, and all manholes shall have surface preparations and shall be coated with coal tar epoxy as listed in Article 3.12.1 of this Section. The first coat shall be red and thinned and the topcoats shall be black. Cure time is a minimum of 24 hours and application shall be by spray or brush only.

6. System 4 - All aluminum surfaces in contact with concrete: All aluminum surfaces in contact with concrete, such as hatch covers for vaults and wetwell shall be coated with coal tar epoxy as listed in Article 3.13.1 of this Section.

7. System 5 – Non-Ferrous Metal, Plastic, and Fiber Glass: The interior of isolated non- ferrous parts associated with equipment or piping shall have surface preparation and shall be coated as listed in Article 3.12 of this Section. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

8. System 6 – Exterior Exposed PVC Piping: The exterior of exposed PVC piping shall have surface preparation and shall be coated as listed in Article 3.13 of this Section.

PART 3 - EXECUTION

3.01 MANUFACTURER'S SERVICES

1. If requested by the CITY OF CAPE CORAL, the CONTRACTOR shall require the protective

coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary.

3.02 WORKMANSHIP

1. Skilled craftsmen and experienced supervision shall be used on all WORK.

2. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to ensure thorough cleaning and an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. Special attention shall be given to ensure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures. Pinholes or holidays will not be allowed in the finished surface of the coating.

3. All damage to surfaces resulting from the WORK shall be cleaned, repaired, and refinished to original condition and to the satisfaction of the CITY. If coating systems are damaged prior to the acceptance by the CITY, the CITY reserves the right to reject the product or item and require it be replaced at the CONTRACTOR's expense.

3.03 STORAGE, MIXING, AND THINNING OF MATERIALS

1. Manufacturer's Recommendations: Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

2. All protective-coating materials shall be used within the manufacturer's recommended shelf life.

3. Storage and Mixing: Coating materials shall be stored under the conditions recommended by the Material Safety Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.04 PREPARATION FOR COATING

1. General: All surfaces to receive protective coatings shall be cleaned prior to application of coatings. The CONTRACTOR shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Surfaces to be coated shall be dry and free of visible dust. Interiors of all wet wells including wet well bottoms shall be completely cleaned and inspected by the OWNER or OWNER'S REPRESENTATIVE prior to any coating.

2. Protection of Surfaces not to be coated: Surfaces, which are not to receive protective coatings, shall be protected during surface preparation, cleaning, and coating operations.

3. All hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.

4. Care shall be exercised not to damage adjacent WORK during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent WORK or adjoining property occurring from blast cleaning or coating operations.

5. Protection of Painted Surfaces: Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

3.05 SHOP COATING REQUIREMENTS

1. Unless otherwise indicated, all items of equipment, or parts of equipment which are not submerged, shall be shop primed and then finish coated in the field after installation with the indicated or selected color. The methods, materials, application equipment and all other details of shop painting shall comply with this section. If the shop primer requires finish coating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.

2. All items of equipment, or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating WORK performed in the field.

3. For certain pieces of equipment, it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the indicated quality in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. The CONTRACTOR shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

4. For certain small pieces of equipment, the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

5. Shop painted surfaces shall be protected during shipment and handling by suitable

provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 30 days before being top coated or less time if recommended by the coating manufacturer.

6. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions. If coating systems are damaged prior to the acceptance by the CITY, the CITY reserves the right to reject the product or item and require it be replaced at the CONTRACTOR's expense.

7. The CONTRACTOR shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

8. Manufacturers of components regularly used in the CITY's utility system may submit factory applied coating systems for pre-approval through the CITY's Qualified Products List (QPL) process described in Section 01600. As part of the submittal process, the CONTRACTOR shall provide written verification or certification that the factory applied coating is suitable for the intended use. Factory applied coating systems that have been pre-approved through the CITY's QPL process may be used instead of the coating system schedules described herein.

3.06 APPLICATION OF COATINGS

1. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

2. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thickness are likely to be present.

3. Special attention shall be given to materials, which will be joined so closely, that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

4. Finish coats, including touch-up and damage repair coats shall be applied in a manner, which will present a uniform texture, and color matched appearance.

5. Coatings shall not be applied under the following conditions:

   A. Temperature is above the manufacturer's allowable maximum or below the manufacturer's allowable minimum.

   B. Dust or smoke laden atmosphere.

   C. Damp or humid weather that exceeds recommended maximum allowable.

   D. When the substrate or air temperature is less than 5 degrees F above dew point.

   E. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dew point within 8 hours after application of coating.

F. When wind conditions are not calm.

6. The finish coat on all WORK shall be applied after all concrete, masonry, and equipment installation is complete and the WORK areas are clean and dust free. Finish coat shall be applied within 30 days of factory shop prime coating application.

7. Prior to coating of concrete, CONTRACTOR shall administer a pH test to ensure that the concrete has sufficiently cured. pH testing shall be in the form of a TSW6 test or City approved equal. All concrete must pass pH testing prior to coating.

8. The full interior of wet wells including the wet well bottom shall be coated prior to installation of the stainless-steel base plate for the pumps.

3.07 CURING OF COATINGS

1. The CONTRACTOR shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section; whichever is the most stringent, prior to placing the completed coating system into service.

2. In the case of enclosed areas, forced air ventilation, using heated air, if necessary, may be required until the coatings have fully cured.

3.08 IDENTIFICATION OF PIPING

1. Identification of above ground piping shall be in accordance with the table provided below and with additional requirements set forth in Section 15000 – Mechanical, General.

2. Tnemec Safety Paint colors or a city approved equal shall be used for all projects as indicated below.

3. All above-ground pipe and fittings, Polyvinyl Chloride (PVC) pipe and fittings, metallic and non-metallic marking tapes, and any other marking device, will be color coded in accordance with the APWA Uniform Color Guide, which is as follows:

Color	Paint Color Number		Application
Red	Candy Apple Red/Safety - 06SF	RGB 186,42,26	Potable Water Hydrant Bonnet (6”)
Orange	Tangerine Orange/Safety - 04SF	RGB 217,110,25	Potable Water Hydrant Bonnet (8” and 10”), Communication, Telephone, Alarm, or
Green	Spearmint Green/Safety - 09SF	RGB 48,142,84	Potable Water Hydrant Bonnet (12” and greater)
Yellow	Lemon Yellow/Safety - 02SF	RGB 224,201,62	Potable Water Hydrant Body, Gas, Oil, Steam, Petroleum or Gaseous
Lavender	Purple Rain/Safety - 14SF	RGB 137,52,103	Irrigation Water Main

Color	Paint Color Number		Application
Lavender	Purple Rain/Safety - 14SF	RGB 137,52,103	Irrigation Water Hydrant Body
White	White - 00WH	RGB 248,253,254	Irrigation Water Hydrant Bonnet
Green	Spearmint Green/Safety - 09SF	RGB 48,142,84	Waste Water Forcemain, Sewer
Blue	True Blue/Safety - 11SF	RGB 0,94,145	Potable Water Main
White	White - 00WH	RGB 248,253,254	Irrigation Hydrant Bonnet
Black	N/A	N/A	Above ground HDPE pipe – no coating required

4. The following colors shall be used in conjunction with the Safety Paint colors for all projects:

Color	Paint Color Number	Application
Light Gray	32GR ANSI No. 70	Electrical (Conduits, Boxes, Motors, Generators, Signal Lines, Etc.) Stainless steel is not coated.

3.09 SHOP AND FIELD INSPECTION AND TESTING

1. Inspection Devices: The CONTRACTOR shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. The CONTRACTOR shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings.

2. Holiday Testing: As directed by the CITY, the CONTRACTOR shall holiday test all coated ferrous surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems including manholes and wet wells. Areas, which contain holidays, shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested.

   A. Coatings With Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as Tinker & Rasor Model AP- W, D.E. Stearns Co. Model 14/20, or City approved equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

   B. Coatings With Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M1 non-destructive type holiday detector, K-D Bird Dog, or City approved equal shall be used. Theunit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or City approved equal,

shall be added to the water prior to wetting the detector sponge.

3. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gage such as Mikrotest model FM, Elcometer model 111/1EZ, or City approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gage.

4. Surface Preparation: The exterior surfaces of pipes, valves and other above ground items that will be exposed to the atmosphere inside structures or above ground will be abrasive blasted to a maximum commercial Grade SSPC-SP-6, NACE 3 and given a high solids epoxy primer coat of Tnemec Series 66 Hi-Build Epoxoline, 4.0 mils DFT at the factory. A finish coat will be applied after installation according the color schedule specified in this Section or as listed in Specification 15000. Evaluation of blast cleaned surface preparation WORK will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standards TM-01-70 and TM-01-75.

3.10 SYSTEM 1 COATING SYSTEM SCHEDULES - FERROUS METALS

1. Coating System Schedule, Ferrous Metal - Not Galvanized:

Item	Surface Prep.	System No.
Non-immersion: All surfaces indoors and outdoors, exposed or covered, except those included below	SP-6	(1)Tnemec Primer at the factory – Hi- Build Epoxoline (66), DFT = 3.0 - 5.0 mils Second coat - Hi-Build Epoxoline (66), DFT = 3.0 - 5.0 mils Finish coat – Endura Shield III (73), DFT = min. 2.0 - 3.0 mils Or City approved equal
Immersion: All surfaces indoors and outdoors, exposed or covered, submerged in wastewater or subjected to wastewater gases	SP-10. Spot field repair damaged areas per SSPC- SP10.	(1)Tnemec Primer at the factory – Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT Spot Field Repair of Damaged Shop Primer: Tnemec Series 1 @ 2.5-3.5 mils DFT First Coat: Tnemec Series 446 Perma-Thane @ 5.0-7.0 mils DFT. 2nd Coat: Tnemec Series 446 @ 5.0-7.0 mils DFT. Or City approved equal

2. Coating System Schedule, Ferrous Metal - Galvanized:

	Surface Prep.	System No.
All exposed surfaces indoors and outdoors, except those included below.	SP-7 or per Manufacturer's Instructions	(1) Tnemec Primer at the factory - Hi-Build Epoxoline (66), DFT= 2.5-3.5 mils DFT Finish coat – 73 Endurashield @ 2.0-3.0) Or City approved equal
Immersion: All exposed surfaces indoors and outdoors, submerged in wastewater or subjected to wastewater gases	SP-7 or per Manufacturer's Instructions	(1) Tnemec Primer at the factory - Hi-Build Epoxoline (66), DFT= min. 4.0 mils Finish coat – 66 @ 2.5-3.5 mils DFT Or City approved equal

3.11 SYSTEM 2 COATING SYSTEM SCHEDULES – WETWELLS AND MANHOLES

1. Interior Coating System Schedule, Wetwells, Manholes, and Master Manholes:

Item	Surface Prep.	System No.
All interior surfaces of sewer wetwells, master manholes, and manholes where forcemains discharge	IET System "Duplex Prep Method" and applications shall be as specified by IET Systems	(2) Wetwell Liner Coating System as manufactured by IET Systems, DFT = min. 60 mils (125 mils for repair lining)

3.12 SYSTEM 3 COATING SYSTEM SCHEDULES – WETWELLS MANHOLES, AND VALVE VAULTS

1. Exterior Coating System Schedule, Wetwells, Manholes, Master Manholes, and Valve Vaults:

	Surface Prep.	System No.
All exterior surfaces of manholes, wet wells, valve vaults.	Per Manufacturer ’s instructions	(3) - Tnemec Hi-Build Tneme-Tar (46H-413), DFT = min. 16.0 – 20.0 mils - Or City approved equal

3.13 SYSTEM 4 COATING SYSTEM SCHEDULES – ALUMINUM SURFACES

1. Aluminum surfaces in contact with concrete:

Item	Surface Prep.	System No.
All aluminum surfaces in contact with concrete (covers for vaults and wetwells)	Per Manufacturer ’s Instructions SP-1 and SP-7 or per Manufacturer’ s Instructions	(4) - Tnemec Primer at the factory - Hi-Build Epoxoline (66), DFT = min. 4.0 mils Finish coat – Hi-Build Tneme-Tar (46H- 413), DFT = min. 16.0 mils - Or City approved equal

3.14 SYSTEM 5 COATING SYSTEM SCHEDULES - NON-FERROUS METAL, PLASTIC, and FIBER GLASS

Item	Surface Prep.	System No.
Interior (non-immersion) non- ferrous parts, plastic and fiberglass	SP-1 and scarify	(5) Tnemec Primer at the factory - Hi-Build Epoxoline (66), DFT = 2.5-3.5 mils Finish coat- Hi-Build Epoxoline(66), DFT = min. 2.5-3.5 mils City Approved Equal
Exterior (non-immersion) non-ferrous parts, plastic and fiberglass	SP-1 and scarify	(5) Tnemec Primer at the factory - Hi-Build Epoxoline (66), DFT = 2.5-3.5 mils Finish coat - Endura Shield III (73) , DFT = min. 2.0 - 3.0 mils City Approved Equal

3.15 SYSTEM 6 COATING SYSTEM SCHEDULES - EXPOSED PVC PIPE

Item	Surface Prep.	System No.
Exterior PVC Pipelines	SP-1 and scarify	(6) Tnemec Primer at the factory - Endura Shield III (73) , DFT = min. 2.0 - 3.0 mils Finish coat - Endura Shield III (73) , DFT = min. 2.0 - 3.0 mils City Approved Equal

END OF SECTION

SECTION 09900

PAINTING

PART 1 – GENERAL

1.01 SCOPE OF WORK

1. The work of this section consists of furnishing all materials, labor, equipment and incidentals required and performing all the painting necessary to complete this Contract in its entirety.

2. It is the intent of these Specifications to paint all proposed concrete, equipment and all other work obviously required to be painted unless otherwise specified. It is also intended to paint all existing interior and exterior surfaces affected or damaged by this project which may be exposed to view in the finished work including, but not limited to, concrete, metals, pipe, fittings, valves, equipment and all other existing items similar to proposed items specified for painting. Table 09900-A outlines the painting system to be applied to specific areas. Items omitted in the Table shall be included in the work of this Section where they come within the general intent of the specifications as stated herein.

3. In general, the following surfaces are to be painted. Table 09900-A provides a more specific schedule of surfaces to be painted.

4. The following items will not be painted unless otherwise noted:

   A. Any code-requiring labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

   B. Any moving parts of operating units, such as valve and damper operators, linkages, sensing devices, and motor and fan shafts.

   C. Aluminum or fiberglass handrails, walkways, toeboards, windows, louvers, grating, checker plate, hatches, and stairways.

   D. Stainless steel angles, tube, pipe, etc.

   E. Products with polished chrome, aluminum, nickel, or stainless-steel finish.

   F. Stainless steel, brass, bronze, and aluminum other than exposed utility tubing.

   G. Flexible couplings, lubricated bearing surfaces, insulation, and plastic pipe or duct interiors.

   H. Plastic switch plates and receptacle plates.

   I. Signs and nameplates.

   J. Finish hardware.

   K. Packing glands and other adjustable parts, unless otherwise indicated.

L. Portions of metal, other than aluminum, embedded in concrete. This does not apply to the back face of items mounted to concrete or masonry surfaces
which shall be painted before erection. Aluminum to be embedded in, or in contact with, concrete shall be coated to prevent electrolysis.

1.02 RELATED WORK

1. Painting piping and equipment for identification purposes in accordance with Section 09905: Piping, Valve, and Equipment Identification System.

1.03 QUALITY ASSURANCE

1. Manufacturer's Qualifications

A. It is the intent of this specification that all paints specified in this section be supplied by one paint supplier and be the product of one manufacturer, unless a specialty paint not available from that manufacturer is specified.

B. The paint manufacturer shall have supplied paint for water and wastewater facilities for a minimum of ten (10) years, and products supplied shall be contained within the manufacturer’s standard water and wastewater brochure.

C. Acceptable manufacturers are listed in Part 2 of this section.

2. The applicator shall be a licensed contractor having practical experience and successful history in the application of the specified products to surfaces and facilities of water and wastewater treatment plants. Upon request, this requirement shall be substantiated by furnishing a written list of references.

3. Provide undercoat paint produced by the same manufacturer as the finish coats. Undercoat and finish coat paints shall be compatible. Use only thinners approved by the paint manufacturer and use only within recommended limits.

4. Thickness and Holiday Checking: Thickness of coatings shall be checked with a nondestructive, magnetic type thickness gauge. Coating integrity of interior coated surfaces shall be tested with an approved holiday detection unit per the paint manufacturer's recommendation. All pinholes shall be marked, repaired in accordance with the paint manufacturer's printed recommendations and re-tested. No pinholes or other irregularities will be permitted in the final coating. In cases of dispute concerning film thickness or “holidays,” the RPR's/Engineer's properly calibrated instruments and measurements shall predominate and the Contractor shall abide by their decision unless independent tests are performed by a certified lab at the Contractor’s expense. Wide film thickness discrepancies shall be measured and verified with a micrometer or other standard approved measuring instrument.

5. Inspection Devices:

A. The Contractor shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thickness of protective coatings. The Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dry film thickness gauge and certified instrumentation to test accuracy of holiday detectors.

B. Dry film thickness gauges shall be made available for the RPR's use at all times while painting is being done, until final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the RPR.

C. Acceptable devices include, but are not limited to, Tniker Rasor Model holiday detectors for coatings in excess of twenty mils (0.50 mm) dry-film thickness, Model M-1 67 1/2-volt non-destructive holiday detector for coatings to twenty mils (0. 50 mm) dry-film thickness and Mikrotest units for dry-film thickness gauging. Inspection devices shall be operated in strict accordance with the manufacturer's printed instructions.

6. Meteorological Equipment: The Contractor shall have on site the following equipment:

A. Thermometer.

B. Sling psychrometer or other approved device to measure atmospheric humidity.

C. Appropriate charts.

7. Warranty Inspection: Warranty inspection shall be conducted during the eleventh month of the one (1) year warranty period following completion of all painting work. All defective work shall be repaired in strict accordance with this specification and to the satisfaction of the paint manufacturer and the Owner or his duly appointed representative.

1.04 SAFETY AND HEALTH REQUIREMENTS

1. General: In accordance with the requirements of the OSHA Regulations for Construction, the Contractor shall provide and require the use of personal protective and lifesaving equipment for all persons working in or about the project.

2. Head and Face Protection and Respiratory Devices: Applicable health and safety precautions required by appropriate regulatory agencies such as OSHA, ANSI, etc., should be followed.

3. Ventilation: Ventilation shall be adequate to reduce the contamination of air contaminant to the degree that a hazard to the worker does not exist.

4. Sound Levels: Whenever the occupational noise exposure exceeds the maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices.

5. Illumination: Adequate illumination shall be provided while work is in progress. Whenever required by the RPR, the Contractor shall provide additional illumination and necessary support sufficient to cover all areas to be checked. The level of illumination required for observation purposes shall be determined by the RPR.

6. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to the applicable requirements of the OSHA Regulations for Construction. They shall be erected where requested by the RPR to facilitate proper construction observation and be moved by the Contractor to locations requested by the RPR.

1.05 SUBMITTALS

1. Submit to the Engineer as provided in the General Conditions and Division 1, shop drawings, manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness.

2. Schedule of Painting Operations: The Contractor shall submit for approval a complete Schedule of Painting Operations within 30 days after the Notice to Proceed. This schedule is imperative so that the various fabricators may be notified of the proper shop prime coat to apply. It shall be the Contractor's responsibility to properly notify and coordinate the fabricators' surface preparation and painting operations with these Specifications. This Schedule shall include for each surface to be painted, the brand name, the volume solids, the coverage and the number of coats the Contractor proposes to use in order to achieve the specified dry film thickness, and color charts. When the schedule has been approved, the Contractor shall apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges may be utilized by the Engineer to verify the proper application while work is in progress.

3. Certification: Submit certification by the paint manufacturer that the primer used on equipment/materials is compatible with the finish coat paint.

4. One copy of references specified in 1.03.2.

5. Test panels/samples: At the request of the Engineer, samples of the finished work prepared in strict accordance with these Specifications shall be furnished and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the Engineer where, standard chart colors are not satisfactory.

6. Color Samples: Manufacturer's standard color charts for color selection by Owner.

7. Samples- Painting

   A. Paint colors will be selected by the Owner. Compliance with all other requirements is the exclusive responsibility of the Contractor.

   B. Samples of each finish and color shall be submitted to the Owner or Engineer for approval before any work is started.

   C. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats. For example, where three (3) coat work is specified, the sample shall be divided into three (3) areas:

      1) One (1) showing the application of one (1) coat only.

      2) One (1) showing the application of two (2) coats.

      3) One (1) showing the application of all three (3) coats.

   D. Such samples when approved in writing shall constitute a standard, as to color and finish only,

for acceptance or rejection of the finish work.

E. For piping, valves, equipment and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish, and general characteristics.

F. Rejected samples shall be resubmitted until approved.

8. The Contractor shall submit to the Owner, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to coat all surfaces, in accordance with the requirements of this Section. Such certification shall make reference to square footage figures provided to the manufacturer by the Contractor.

1.06 PRODUCT DELIVERY STORAGE AND HANDLING

1. All painting materials shall be delivered to the project site in unbroken containers, bearing the manufacturer's brand and name. They shall be used without adulteration and mixed, thinned, and applied in strict accordance with the manufacturer's directions for the applicable materials and surfaces and with the Engineer's approval before using.

2. Work areas will be designated by the Engineer for storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for painting wastes, and no plumbing fixture shall be used for this purpose.

3. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label in accordance with Section 01600: Products, Materials, Equipment and Substitutions.

A. Provide labels on each container with the following information:

1) Name or title of material.

2) Fed. Spec. number if applicable.

3) Manufacturer's stock number, date of manufacture and expiration date (shelf life).

4) Manufacturer's formula or specification number.

5) Manufacturer's batch number.

6) Manufacturer's name.

7) Generic type.

8) Contents by volume, for major pigment and vehicle constituents.

9) Application instructions: thinning, ambient conditions, etc.

10) Color name and number.

B. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.

4. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.

5. Used rags shall be removed every night and every precaution taken against spontaneous combustion.

1.07 WARRANTY AND GUARANTEES

1. Refer to Section 01740: Warranties and Bonds.

2. All paint and coatings work performed under these Specifications shall be guaranteed by the coatings applicator for 100 percent of the total coated area for both materials and labor against failures during the warranty period.

A. Warranty period: Minimum 5 years from date of substantial completion.

3. Failure under this warranty shall include flaking, peeling, or delaminating of the coating due to aging, chemical attack, or poor workmanship; but it shall not include areas which have been damaged by unusual chemical, thermal, or mechanical abuse.

PART 2 – PRODUCTS

2.01 GENERAL

1. All painting materials shall be fully equal to those manufactured by Carboline, Sherwin Williams, Tnemec. The painting schedule has been prepared on the basis of Carboline, Sherwin Williams, and Tnemec products (unless otherwise noted) and their recommendations for applications. No other brand will be considered for approval unless sufficient data substantiated by certified tests to demonstrate its equality to the paint(s) specified is submitted in writing to the Engineer for approval within 30 days after the Notice to Proceed. The type and number of tests performed shall be subject to the Engineer's approval.

2. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint. Shop paint shall be of the same type and manufacture as used for field painting by the Contractor.

3. Emulsion and alkyd paints shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P- 19.

4. Shop priming shall be done with primers that are certified by the paint manufacturer to be compatible with the finish paints to be used.

5. No paint containing lead shall be allowed.

6. Oil shall be pure boiled linseed oil.

2.02 PAINTING SYSTEMS

1. The following summarizes the painting systems for various types of applications. Table 09900-A outlines, in general, specific job application locations.

2. All colors will be selected by the Owner from color charts supplied by the Contractor.

3. Minimum thickness shall be per manufacturer's recommendations unless a greater thickness is specified.

4. The following surfaces shall have the types of paint scheduled below applied at the minimum dry film thickness (MDFT) in mils per coat noted or at the dry film thickness (DFT) in mils per coat noted. The schedule is applicable to existing and proposed surfaces, with the exception that priming for existing surfaces is only required as specified in Part 3.

5. Any surfaces not specifically named in the Schedule and not specifically excepted shall be prepared, primed and painted in the manner and with materials consistent with these Specifications. The Engineer shall select which of the manufacturer's products, whether the type is indicated herein or not, shall be used for such unnamed surfaces. No extra payment shall be made for this painting.

2.03 EXTRA PAINT

1. Paint To Be Supplied to Owner: Upon completion of painting work, the Owner shall be furnished at no additional cost, unopened containers providing a minimum of one (1) gallon of each type and color of finish paint for touching up. Multi-component coatings shall have each component supplied in separate containers boxed together. Paint container labels shall be complete with manufacturer's name, generic type, number, color, and location where used.

TABLE 09990-A

Coat	Carboline	Sherwin Williams	Tnemec
1. Unpainted wood finished shelving, window frames, door frames, door casework, and trim finish with			**3**
2. Wood-painted finish (interior or exterior) non-submerged:			
Prep	Surface must be clean and dry, remove any dust, dirt, oils or contaminants that could interfere with adhesion.		
Prime	1 coat Sanitile 120. 1.0 to 2.0 MDFT	1 coat Exterior Latex Wood Prime, B42W08041 @ 1.0-2.0 mils DFT	1 coat Series 10-99W Undercoater, 2.0 to 3.5 MDFT.
Finish	2 coats Carbocrylic 3359, 2.0 to 3.0 mils DFT/coat	2 coats of Pro Industrial DTM Acrylic, B66W1051 Series @2.0-3.0 mils DFT/coat	2 coats Series 1029 Enduratone, 1.5 to 2.5 MDFT per coat.

Coat	Carboline	Sherwin Williams	Tnemec
Total	5 to 8 mils DFT	5 to 8 mils DFT	5 to 8.5 mils DFT
3. Gypsum Dry Walls or Interior Cement Plaster:			
Prep	Surface must be clean and dry, remove any dust, dirt, oils or contaminants that could interfere with adhesion.		
Prime	1 coat Sanitile 120, 1.0 to 2.0 MDFT	1 coat ProMar 200 Zero VOC Interior Latex Primer, B28W02600 @ 1.0 mil DFT	Series 51PVA Sealer 1.0 to 2.0 MDFT
Finish	2 coats Carboguard 60 4.0 to 6.0 MDFT per coat	2 coats Macropoxy 646, B58-600 Series/B58V600 @ 3.0-5.0 mils DFT/coat	2 coats Series 66HS Hi-Build Epoxoline 3.0 to 5.0 MDFT per coat
Total	9 to 14 mils DFT	7 to 11 mils DFT	7 to 12 mils DFT
Note: Laboratory areas shall receive special titanium base epoxy paint containing no other metals that may affect testing procedure			

Coat	Carboline	Sherwin Williams	Tnemec
4. Interior non submerged concrete walls poured, precast, or masonry not subject to spray, splash and			
Prep	Concrete must clean and dry. Cured for 28 days @75F and 50% relative humidity or equivalent. Laitance, form oils, curing agents, and surface hardeners must be removed by suitable method before coating application.		
Prime	1 coat Sanitile 100 80 sf/gal (@ 12 mils DFT)	1 coat Heavy Duty Block Filler, B42W46 @10.0-15.0 mils DFT	N/A
Finish	2 coats Sanitile 155 2.0-3.0 MDFT per coat	2 coats of Pro Industrial DTM Acrylic, B66W1051 Series @2.0-3.0 mils DFT/coat	2 coats Series 1026 Tneme-Cryl 2.0 to 3.0 MDFT per coat
Total	14 to 15 mils DFT	14 to 21 mils DFT	4 to 6 mils DFT
5. Exterior no submerged concrete, masonry, or stucco above grade:			
Prep	Concrete must clean and dry. Cured for 28 days @75F and 50% relative humidity or equivalent. Laitance, form oils, curing agents, and surface hardeners must be removed by suitable method before coating application.		
Prime	1 coat Sanitile 100. 80 sf/gal (@ 12 mils DFT) For pre-colored manonry (split-face CMU) or stucco – no primer required.	1 coat Cement-Plex 875, B42W200/B42V201 @13.0-20.0 mils DFT For pre-colored manonry (split-face CMU) or stucco – no primer required.	For concrete, masonry, or stucco scheduled to be field painted: 1st coat Series 1254 at 125 sf/gal (CMU only). For pre-colored masonry (split-face CMU) – no primer required.
Finish	2 coats Carbocrylic 3359 2.0 to 3.0 MDFT per coat For pre-colored masonry (split-face CMU) or stucco: Apply Carbocrete Sealer WB @ 50 sf/gal per coat at 3.0 mils.	2 coats of Pro Industrial DTM Acrylic, B66W1051 Series @2.0-3.0 mils DFT/coat For pre-colored masonry (split-face CMU) or stucco: Apply Loxon 7% @ 50-75 sf/gal per coat.	For concrete, masonry, or stucco scheduled to be field painted: 2 coats Series 1026 Tneme-Cryl 2.0 to 3.0 MDFT per coat For pre-colored masonry (split-face CMU): Apply Series 626 Dur A Pell GS @ 65-85 sf/gal per coat.
Total	16 to 18 mils DFT	17 to 26 mils DFT	
6. Exterior non submerged concrete or masonry surfaces below grade to be backfilled:			
Prep	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oils and all other contaminants that could interfere with adhesion of the coating. Concrete must be cured 28 days at 75F and relative humidity of 50% or equivalent. Prepare concrete in accordance with ASTM D4528 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.		
Prime	1 coat Bitumastic 300M, thinned 33%, 4-6 MDFT	1 coat Targuard Epoxy, B69B60/B69V60 @ 8.0-12.0 mils DFT	1 coat Series 46H-413, thinned 33%, 4-6 MDFT
Finish	1 coat Bitumastic 300M 16.0 MDFT	1 coat Targuard Epoxy, B69B60/B69V60 @ 8.0-12.0 mils DFT	1 coat Series 46H-413, High Build Tneme-Tar, 14.0 to 20.0 MDFT
Total	20 to 22 mils DFT	16 to 24 mils DFT	18 to 26 mils DFT

Coat	Carboline	Sherwin Williams	Tnemec
7. Interior Concrete submerged or subject to spray concrete – Color:			
Prep	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oils and all other contaminants that could interfere with adhesion of the coating. Concrete must be cured 28 days at 75F and relative humidity of 50% or equivalent. Prepare concrete in accordance with ASTM D4528 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing		
Prime	1 coat Carboguard 60 (non potable) or Carboguard 61 (Potable water), 4.0 to 6.0 MDFT	1 coat Macropoxy 5500, B58-X740 Series/B58VX740 @ 3.0-5.0 mils DFT	Series 20HS Pota-Pox (potable water) 3.0 to 5.0 MDFT
Finish	2 coats Carboguard 60 (non potable) or Carboguard 61 (Potable Water), 4.0 to 6.0 MDFT per coat	2 coats Macropoxy 5500, B58-X740 Series/B58VX740 @ 4.0-6.0 mils DFT/coat	2 coats Series 20HS Pota-Pox (potable water), 4.0 to 6.0 MDFT per coat
Total	12 to 18 mils DFT	11 to 17 mils DFT	11 to 17 mils DFT
For potable water application, must NSF certified and approved color.			
8. Concrete or Masonry (Immersed, non-potable/ non-immersed, corrosive environment) - Black:			
Prep	NACE 6/SSPC SP13, and surface profile of ICRI CSP 4-6		
Prime	Carboguard 1340 WB, Filler Surfacer – Carboguard 510	Dura-Plate 5900, Filler Surfacer - Dura-Plate 2300	1 coat Series 434 125 mils DFT
Finish	Bitumastic 300M, 2-Coats each @ 3-5 mils DFT	Dura-Plate 5900	1 coat Series 435 16.0 to 20 mils DFT
Total			141 to 145 mils DFT
9. Concrete or Masonry (Immersed, non-potable/ non-immersed, corrosive environment) - Color:			
Prep	NACE 6/SSPC SP13,and surface profile of ICRI CSP 4-6		
Prime	Carboguard 1340 WB, Filler Surfacer – Carboguard 510	Dura-Plate 5900, Filler Surface – Dura-Plate 2300	
Finish	Plasite Series 4500, 2-Coats each @ 3-5 mils DFT	Dura-Plate 5900	
10. Existing Concrete or Masonry (Immersed, non-potable/ non-immersed, corrosive environment):			
Prep	NACE 6/SSPC SP13, and surface profile of ICRI CSP 4-6		
Prime	Filler Surfacer – Carboguard 510	Filler Surfacer – Dura-Plate 2300	1 coat Series 104 6.0-8.0 MDFT
Intermediate	N/A	N/A	1 coat Series 104 6.0-8.0 MDFT
Finish	Plasite Series 4500	Dura-Plate 5900 Mortar	1 coat Series 104 6.0-8.0 MDFT

Coat	Carboline	Sherwin Williams	Tnemec
11. Sodium Hypochlorite (trace up to 18%-Resistant Coating Secondary containment, continuous flow, frequent spills, or poor drainage.)			
Prep	Refer to Manufacturers Product Data Sheet and Semstone Application Guide for Surface Preparation Guidelines and recommendations		
Prime	Semstone 800 primer @ 300 sq ft per carton	Macropoxy 5500 @ 8.0-12.0 mils DFT	1 coat Series 208 16.0-20.0 MDFT
Intermediate	Semstone 870 w/agg @ 64 sq ft per gallon	N/A	1 coat Series 206SC-MCK Sub-Flex EP 60.0-80.0 MDFT 1 coat Series S211-0215 Chopped Strand Fiberglass pressed into the (wet) Series 206SC-MCK 1 coat Series 237SC-RCK 8.0-12.0 MDFT
Finish	Semstone 870 @ 100 sq ft per gallon	Macropoxy 5500 @ 8.0-12.0 mils DFT NOTE: This would be for intermittent splash and spillage. Immersion requires a different lining.	1 coat Series 280 6.0-8.0 MDFT 1 coat Series 290 2.0-3.0 MDFT
12. Concrete surfaces subject to sulfuric acid (interior/exterior) (Trace up to 98% Concentration Secondary containment, continuous flow, frequent spills, or poor drainage.)			
Prep	Refer to Manufacturers Product Data Sheet and Semstone Application Guide for Surface Preparation Guidelines and recommendations		
Prime	1 coat Carboguard 1340 @ 1-2 mils DFT	Corobond 100 @ 4.0-6.0 mils DFT	1 coat Series 208 16.0-20.0 MDFT
Intermediate	N/A	N/A	1 coat Series 206SC-MCK Sub-Flex EP 60.0-80.0 MDFT 1 coat Series S211-0215 Chopped Strand Fiberglass pressed into the (wet) Series 206SC-MCK 1 coat Series 252SC-RCK 8.0-12.0 MDFT
Finish	1 coat Semstone 145 @ 30 mils	Cor-Cote HCRFF @15.0-20.0 mils DFT	1 coat Series 282 6.0-8.0 MDFT 1 coat Series 290 CRU 2.0-3.0 MDFT
Total	31 to 32 mils DFT	19 to 26 mils DFT	92 to 123 mils DFT
13. Concrete floors subject to moisture and traffic.			
Prep	SSPC-SP13		
Prime	1 coat Carboguard 890 (thinned) 3.0 to 5.0 MDFT	1 coat Macropoxy 646, B58-600 Series/B58V600 @ 3.0-5.0 mils DFT	Series 66HS Hi-Build Epoxoline, 3.0 to 5.0 DFT
Finish	2 coats Carboguard 890, 4.0 to 6.0 MDFT, each coat, with non-skid aggregate	2 coats Macropoxy 646, B58-600 Series/B58V600 @ 4.0-6.0 mils DFT/coat. Broadcast 30-50 mesh silica sand into the intermediate coat at rate of 1 pound/150 Sq. Ft.	2 coats Series 66HS Hi-Build Epoxoline, 4.0 to 6.0 MDFT. Broadcast 30-50 mesh silica sand into the intermediate coat of Series 66HS at a rate of 5(five) lbs per 150 SF.
Total	11.0 to 17mils DFT	11 to 17 mils DFT	11 to 17 mils DFT
14. Interior Floors (Sealed)			
Prep	SSPC-SP 13		

Coat	Carboline	Sherwin Williams	Tnemec
Prime	1 coat Carboguard 1340 @ 1-2 mils DFT	2 coats Macropoxy 646 @ 4.0-6.0 mils DFT	Series 201 @ 10.0-12.0 mils DFT
Finish	1 coat Semstone 140 SL Series @ 25-30 mils DFT	N/A	N/A
Total	26 to 32 mils DFT	8 to 12 mils DFT	10 to 12 mils DFT
15. Concrete floors in chemical storage/feed areas:			
Prep	SSPC-SP 13		
Prime	1 coat Carboguard 1340 @ 1-2 mils DFT	1 coat Corobond 100 @ 4.0-6.0 mils DFT	See Systems 12 and 13
Finish	1 coat Semstone 140 SL Series @ 25-30 mils DFT	2 coats CorCote HCR FF @ 10.0-15.0 mils DFT	
Total	26 to 32 mils DFT	24 to 36 mils DFT	
16. Skid Resistant Concrete:			
Prep	SSPC-SP13		
Prime	Epoxy Nonskid (aggregated) 1 coat 10 MDFT plus aggregate (160 sfpg) Carboguard 868 Nonskid	Macropoxy 646 @ 6.0-10.0 mils DFT with aggregate.	66HS @ 6.0-8.0 mils DFT, with 30-50 mesh clean dry silica sand broadcast into the wet film at a rate of 5 lbs per 150 square feet
Finish	N/A	N/A	N/A
Total	10 mils DFT	6 to 10 mils DFT	6 to 8 mils DFT
17. Interior non-submerged ferrous metal:			
Prep	SSPC-SP6, Commercial Blast Cleaning, 1.5-3 mils anchor profile.		
Prime	1 coat Carboguard 60 4.0 to 6.0 MDFT	1 coat Macropoxy 646, B58-600 Series/B58V600 @ 3.0-5.0 mils DFT	
Finish	2 coats Carboguard 60 4.0 to 6.0 MDFT each	2 coats Macropoxy 646, B58-600 Series/B58V600 @ 4.0-6.0 mils DFT/coat	
Total	12.0 to 18.0 MDFT	11 to 17 mils DFT	
18. Exterior non-submerged ferrous metals non-UV exposure:			
Prep	SSPC-SP6, Commercial Blast Cleaning, 1.5-3 mils anchor profile.		
Prime	1 coat Carboguard 60 4.0 to 6.0 MDFT	1 coat Macropoxy 646, B58-600 Series/B58V600 @ 3.0-5.0 mils DFT	Series 66HS hi-Build Epoxoline 3.0 to 5.0 MDFT
Finish	1 coat Carboguard 60 4.0 to 6.0 MDFT	1 coat Macropoxy 646, B58-600 Series/B58V600 @ 4.0-6.0 mils DFT 1 coat of Acrolon Ultra, B65W821/B65V820 @ 2.0-3.0 mils DFT	2 coats Series 66HS Hi-build Epoxoline, 4.0 to 6.0 MDFT each
Total	8 to 12 mils DFT	9 to 14 mils DFT	11 to 17 mils DFT

Coat	Carboline	Sherwin Williams	Tnemec
19. Exterior non-submerged ferrous metals UV exposure:			
Prep	SSPC-SP6, Commercial Blast Cleaning, 1.5-3 mils anchor profile.		
Prime	1 coat Carboguard 60 4.0 to 6.0 MDFT	Macropoxy 646 @ 4.0-6.0 mils DFT	90-97 Zinc Rich Urethane @ 2.5-3.5 mils DFT (shop or field)
Intermediate	N/A	N/A	66HS @ 3.0-5.0 mils DFT
Finish	1 coat Carbothane 133 VOC @ 2-3 mils DFT	Acrolon Ultra @ 2.0-3.0 mils DFT	1095 @ 2.5-3.5 mils DFT
Total	6 to 9 mils DFT	6 to 9 mils DFT	8 to 12 mils DFT
20. Exterior non-submerged ferrous metals, UV exposure (Complete removal of existing coating system):			
Prep	SSPC-SP6 Commercial Abrasive Blast		
Prime	1 coat Carbozinc 859 Sereis @ 2-3 mils DFT	Corothane I Galva-Pac @ 3.0-4.0 mils DFT	See System 19
Intermediate	1 coat Carboguard 893 @ 3-5 mils DFT	Macropoxy 646 @ 4.0-6.0 mils DFT	
Finish	1 coat Carbothane 133 VOC @ 2-3 mils DFT	Acrolon Ultra @ 2.0-3.0 mils DFT NOTE: A fluoropolymer is also available for highest performance	
Total	7 to 11 mils DFT	9 to 13 mils DFT	
21. Exterior non-submerged ferrous metals, UV exposure (Over-coating of localized inaccessible existing coatings and galvanized steel):			
Prep	SSPC SP1/SP2/SP3		
Prime	1 coat Rustbond @ 1-2 mils DFT	Macropoxy 920 Pre-Prime @ 1.0-1.5 mils DFT	135 @ 3.0-5.0 MDFT
Intermediate	N/A	Macropoxy 646 @ 3.0-5.0 mils DFT	135 @ 3.0-5.0 MDFT
Finish	1-2 coats Carbothane 133 VOC @ 3-5 mils DFT	Acrolon ultra @2.0-3.0 mils DFT	1095 @ 2.5-3.5 MDFT
Total	4 to 7 mils DFT	6 to 9.5 mils DFT	8.5 to 13.5 mils DFT
22. Exterior non-submerged ferrous metals, non-UV exposure (Over-coating of localized inaccessible existing coating):			
Prep	SSPC-SP1/SP2/SP3		
Prime	1 coat Rustbond @ 1-2 mils DFT	Macropoxy 920 Pre-Prime @ 1.0-1.5 mils DFT	135 @ 3.0-5.0 MDFT
Intermediate	N/A	Macropoxy 646 @ 3.0-5.0 mils DFT	135 @ 3.0-5.0 MDFT
Finish	1 coat Carboguard 60 @ 3-5 mils DFT	Macropoxy 646 @ 3.0-5.0 mils DFT	N/A
Total	4 to 7 mils DFT	7 to 11.5 mils DFT	6 to 10 mils DFT

Coat	Carboline	Sherwin Williams	Tnemec
23. Exterior non-submerged ferrous metals, UV exposure (Over-coating of existing solvent-based coating system exposed to UV):			
Prep	SSPC-SP1/SP2/SP3		
Prime	1 coat Rustbond @ 1-2 mils DFT	Macropoxy 920 Pre-Prime @ 1.0-1.5 mils DFT	135 @ 3.0-5.0 MDFT
Intermediate	N/A	Macropoxy 646 @ 3.0-5.0 mils DFT	135 @ 3.0-5.0 MDFT
Finish	1-2 coats Carbothane 133 VOC @ 3-5 mils DFT	Acrolon Ultra @ 2.0-3.0 mils DFT	1095 @ 2.5-3.5 MDFT
Total	4 to 7 mils DFT	6 to 9.5 mils DFT	8.5 to 13.5 mils DFT
24. Exterior/interior non-submerged ferrous metals, non-UV exposure (Over-coating of existing coating, or manufacturer epoxy-primed surface not exposed to UV):			
Prep	SSPC-SP1/SP2/SP3		
Prime	1 coat Rustbond @ 1-2 mils DFT	Macropoxy 646 @ 4.0-6.0 mils DFT	
Intermediate	N/A	N/A	
Finish	1-2 coats Carboguard 60 @ 3-5 mils DFT	Macropoxy 646 @4.0-6.0 mils DFT	
Total	4 to 7 mils DFT	8 to 12 mils DFT	
25. Exterior non-submerged ferrous metals, UV exposure (Over-coating of existing water based or unknown coating surface exposed to UV):			
Prep	SSPC-SP1		
Prime	1 coat Sanitle 120 @ 1-2 mils DFT	Pro Industrial Procryl Universal Primer @ 3.0-4.0 mils DFT	135 @ 3.0-5.0 MDFT
Intermediate	N/A	N/A	135 @ 3.0-5.0 MDFT
Finish	1 coat of Carbocrylic 3359 @ 3-5 mils DFT	2 coats of Pro Industrial DTM Acrylic, B66W1051 Series @2.0-3.0 mils DFT/coat NOTE: WB Acrolon 100 @ 2.0-3.0 mils DFT acceptable if waterbased urethane is desired	N/A
Total	4 to 7 mils DFT	7 to 10 mils DFT	6 to 10 mils DFT
26. Submerged ferrous metals and ferrous metals subject to submergence or splashing (for contact with non-potable water)–Black:			
Prep	SSPC-SP5, Near White Blast Cleaning		
Prime	1 coat Bitumastic 300M Coal Tar Epoxy (thinned) 8.0 MDFT	1 coat Macropoxy 5500 Primer, B58-X740/B58VX740 @ 3.0-6.0 mils DFT	1 coat Series 66HS-1211 @ 3.0-5.0 mils DFT
Finish	1 coat Bitumastic 300M Coal Tar Epoxy 16.0 to 20.0 MDFT	1 coat Targuard Epoxy, B69B60/B69V60 @ 14.0-16.0 mils DFT	2 Coats of Series 104 H.S. Epoxy @ 6.0-8.0 mils DFT per coat.
Total	24 to 28 mils DFT	17 to 23 mils DFT	17 to 21 mils DFT

Coat	Carboline	Sherwin Williams	Tnemec
27. Submerged ferrous metals and ferrous metals subject to submergence or splashing (for contact with potable water) – Color – must be NSF certified and approved color:			
Prep	SSPC-SP10, White Blast Cleaning		
Prime	1 coat Carboguard 61 4.0 to 6.0 MDFT	1 coat Macropoxy 5500, B58-X740 Series/B58VX740 @ 3.0-5.0 mils DFT	Series 20HS Pota-Pox 3.0 to 5.0 MDFT
Finish	2 coats Carboguard 61 4.0 to 6.0 MDFT each	2 coats Macropoxy 5500, B58-X740 Series/B58VX740 @ 4.0-6.0 mils DFT/coat	2 coats Series 20HS Pota-Pox 4.0 to 6.0 MDFT per coat
Total	12.0 to 18.0 MDFT	11 to 17 mils DFT	11 to 17mils DFT
28. Exterior submerged ferrous metals (Complete removal of existing coating system for immersion surfaces):			
Prep	SSPC-SP10, Near White Blast Cleaning		
Prime	N/A	1 coat Macropoxy 5500, B58-X740 Series/B58VX740 @ 3.0-5.0 mils DFT	Series 20HS Pota-Pox 3.0 to 5.0 MDFT
Intermediate	N/A	N/A	Series 20HS Pota-Pox 4.0 to 6.0 MDFT
Finish	1 coat of Plasite 4500 Series 30-40 mils	2 coats Macropoxy 5500, B58-X740 Series/B58VX740 @ 4.0-6.0 mils DFT/coat	Series 20HS Pota-Pox 4.0 to 6.0 MDFT
Total	30 to 40 mils DFT	11 to 17 mils DFT	11 to 17 mils DFT
29. Steel Submerged in Process or Wastewater – High Abrasion Resistant			
Prep	SSPC-SP10, Near White Blast Cleaning		
Prime	N/A	Sher-Glass FF @ 10-15 mils DFT	1 Omnithane @ 2.5-3.5 mils DFT
Finish	1 coat of Plasite 4500 Series 30-40 mils	Sher-Glass FF @ 10-15 mils DFT	141 Epoxoline @ 8.0-10.0 mils DFT
Total	30 to 40 mils DFT	20 to 30 mils DFT	10.5 to 13.5 mils DFT
30. Steel or Metal surfaces subject to sulfuric acid (interior/exterior)			
Prep	SSPC SP-6 Commercial Abrasive Blast		
Prime	1 coat Carboguard 890 Series 3-5 mils	Macropoxy 5500 primer @ 2.0-4.0 mils DFT	282 6.0-8.0 MDFT
Finish	1 coat Carboguard 890 Series 3-5 mils DFT	2 coats Corcote HCFR FF @ 10.0-15.0 mils DFT/coat	282 6.0-8.0 MDFT
Total	6 to 10 mils DFT	22 to 34 mils DFT	12 to 18 MDFT
31. High Temperature Steel (to 750 degrees Fahrenheit)			
Prep	SSPC-SP 10 Near White Blast (1-3 mils angular profile)		
Prime	1 coat Carbozinc 11 Series 2-3 mils	Heat Flex Hi Temp 1200 @ 5.0-6.0 mils DFT	No Tnemec System
Finish	Thermaline 4700 VOC (most colors) @ 1.5 mils DFT	Heat Flex Hi Temp 1000 @ 1.5-2.0 mils DFT.	
Total	3.5 to 4.5 mils DFT	6.5 to 8 mils DFT	

Coat	Carboline	Sherwin Williams	Tnemec
32. High Temperature Steel (non-continuous up to 1200 degrees Fahrenheit)			
Prep	SSPC-SP 10 Near White Blast (1-3 mils angular profile)		
Prime	1 coat Carbozinc 11 Series 2-3 mils	Heat Flex Hi Temp 1200 @ 5.0-6.0 mils DFT	No Tnemec System
Finish	Thermaline 4700 VOC Aluminum or Black @ 1.5 mils DFT	Heat Flex Hi Temp 1200 @ 5.0-6.0 mils DFT NOTE: The 1200 comes in gray and dark gray. If other colors are desired, 1 coat of Heat Flex Hi Temp 1000 @ 1.5-2.0 mils DFT should be used.	
Total	3.5 to 4.5 mils DFT	10 to 12 mils DFT	
33. Aluminum & Dissimilar Metal Insulation			
Prep	SSPC-SP1 Solvent Clean		
Prime	In accordance with manufacturer's recommendations.	Macropoxy 646 @ 3.0-4.0 mils DFT	66HS @ 2.5-3.5 mils DFT
Finish	Coal Tar Epoxy 1 coat Bitumastic 300M @ 8-10	Macropoxy 646 @ 3.0-4.0 mils DFT	66HS @ 2.5-3.5 mils DFT
Total	8 to 10 mils DFT	6 to 8 mils DFT	5 to 7 mils DFT
34. Exposed FRP and UV Exposure, PVC (mild to moderate chemical exposure)			
Prep	Surface must be clean and dry, remove any dust, dirt, oils or contaminants that could interfere with adhesion. Mechanically abrade surface to create profile.		
Prime	N/A	N/A	1095 – Two Coats @ 2.5-3.5 MDFTPC
Finish	1-2 Coats of Carbothane 133 VOC @ 3-5 mils DFT	Acrolon Ultra @ 2.0-3.0 mils DFT Alternate acrylic: 2 coats of SherCryl HPA @ 2.0-3.0 mils DFT/coat also acceptable.	N/A
Total	3 to 5 mils DFT	2 to 3 mils DFT or 4 to 6 mils DFT	5 to 7 mils DFT
35. Plastic Piping – Below Grade coating not required, except as noted. Exposed piping shall be painted as required in the color coding schedule.			
Prep	Surface must be clean and dry, remove any dust, dirt, oils or contaminants that could interfere with adhesion.		
Prime	1 coat Sanitile 120 1.0 to 21.0 mils DFT	N/A	No primer required
Finish	1 coat Carbothane 133 VOC 3.0 to 5.0 mils DFT	2 coats of Acrolon Ultra, B65W821/B65V820 @ 2.0-3.0 mils DFT/coat	(2) Coats of Tnemec Series 1095 @ 2.5-3.5 mils DT
Total	4 to 26 mils DFT	4 to 6 mils DFT	5 to 7 mils DFT

PART 3 – EXECUTION

3.01 GENERAL

1. All coating and painting shall conform to the applicable requirements of the Steel Structures Painting Council Manual (most recent edition). Any material applied upon improperly prepared surfaces shall be removed and redone to the satisfaction of the Engineer at the sole expense of the Contractor.

2. All work shall be done by skilled craftsmen who am qualified to perform the required work and shall be done in a manner comparable with the best standards of practice found in that trade.

3. The Contractor shall provide a supervisor to be at the work site during blast cleaning and coating operations. The supervisor shall have the authority to coordinate the work and make other decisions pertaining to the fulfillment of their contract.

4. All dust, dirt, oil, or any contaminants which would affect the adhesion or durability of the finish coating must be removed before painting by cleaning per SPC-SP-1. Slag and weld metal accumulation and spatters shall be removed by chipping and grinding. All sharp edges shall be peened, ground or otherwise blunted as required and directed by the RPR.

5. The Contractor's coating and painting equipment shall be designed and suitable for the application of the specific materials herein specified. Equipment shall be maintained in condition required to obtain the specified coating application. Compressors shall have suitable traps and filters installed to remove water and oils from the air. The Contractor's equipment shall be subject to the approval of the RPR based on the manufacturer's data.

6. Sandblasting and priming shall be completed on any particular area, and the application of the primer shall follow immediately after surface preparation and cleaning prior to formation of any form of corrosion. If the surface is not primed within 24 hours, preparation shall be repeated.

7. Prior to assembly, all surfaces that will be made inaccessible after assembly, shall be prepared as specified herein and shall receive the paint or coating system as specified herein.

8. Coating shall not be applied to wet or damp surfaces and shall not be applied in inclement weather. Do not apply when the surface temporary is less than 5° F above the dew point. Dew or moisture condensation should be anticipated and if such conditions are prevalent, coating should be delayed until the surfaces are dry. Further, the day's coating should be completed well in advance of when condensation will occur, in order to permit the film a sufficient drying time prior to the formation of moisture.

3.02 SURFACE PREPARATION

1. All dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces which are to be coated.

2. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items and surfaces not to be painted which are in contact with or near surfaces to be painted shall be

3. Removed, masked, or otherwise protected prior to surface preparation and painting operations. Refer to Paragraph 3.09.1.

4. Before commencing work, the painter must make certain that surfaces to be covered are in proper condition and must obtain Engineer's approval to proceed. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the Engineer. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter will be held responsible for the results reasonably expected from the materials and processes specified.

5. Program the cleaning and painting so contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.

6. General: The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:

   A. Solvent Cleaning (SSPC-SP1): Solvent such as water, mineral spirits, xylol, toluol, etc., are used to remove solvent-soluble foreign matter from the surface of ferrous metal. Rags and solvents must be replenished frequently to avoid spreading the contaminant rather than removing it. Low-pressure (1,500-4,000 psi) high volume (3-5 gal/min) water washing with appropriate cleaning chemicals is a recognized “solvent cleaning” method. All surfaces should be cleaned per this specification prior to using hand tools or blast equipment.

   B. Hand Tool Cleaning (SSPC-SP2) (SSI-St2): A mechanical method of surface preparation involving wire brushing, scraping, chipping and sanding. Not the most desirable method of surface preparation, but can be used for mild exposure conditions. Optimum performances of protective coatings system should not be expected when hand tool cleaning is employed.

   C. Power Tool Cleaning (SSPC-SP3) (SSI-St3): A mechanical method of surface preparation widely used in industry and involving the use of power sanders or wire brushes, power chipping hammers, abrasive grinding wheels, needle guns, etc. Although usually more effective than hand tool cleaning, it’s not considered adequate for use under severe exposure conditions or for immersion applications.

   D. White Metal Blasting (SSPC-SP5), (SSI-Sa3), or (NACE #1): The removal of all visible rust, mill scale, paint, and contaminants, leaving the metal uniformly white or gray in appearance. This is the ultimate in blast cleaning. Use where maximum performance of protective coatings is necessary due to exceptionally severe conditions such as constant immersion in water or liquid chemicals.

   E. Commercial Blast (SSPC-SP6, (SSI-Sa2), or (NACE #3): All oil, grease, dirt, rust scale and foreign matter are completely removed from the surface and all rust, mill scale and old paint are completely removed by abrasive blasting except for slight shadows, streaks or discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating that may remain. If the surface is pitted, slight residues of rust or paint may be found in the bottom of pits, at least two-thirds of each square inch of surface area shall

be free of all visible residues and the remainder shall be limited to the light residues mentioned above.

F. Brush-Off Blast (SSPC-SP7, SSI-Sa1), or (NACE #4): A method in which all oil, grease, dirt, rust scale, loose mill scale, loose rust, and loose paint or coatings are removed completely. Tight mill scale and tightly-adhered rust, paint and coatings are permitted to remain. However, all mill scale and rust must have been exposed to the abrasive blast pattern sufficiently to expose numerous flecks of the underlying metal fairly uniformly distributed over the entire surface.

G. Near White Blast (SSPC-SP10), SSI-Sa2½) or (NACE #2): In this method, all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface by abrasive blasting, except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating. At least 95% of each square inch of surface areas shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above. From a practical standpoint, this is probably the best quality surface preparation that can be expected today for existing plant facility maintenance work.

H. High and Ultra-High-Pressure Water Jet Cleaning (SSPC-SP12) or (NACE #5): As part of the surface preparation, deposits of oil, grease, and foreign matter must be removed by ultra- high pressure water jetting, by steam cleaning with detergent, or by methods in accordance with SSPC-SP1. The difference in degrees of surface cleanliness is defined by the amount of pressure as follows:

Low Pressure Water Cleaning (LP WC)	34 MPa	(5,000 psi)
High Pressure Water Cleaning (HP WC)	34 to 70 MPa	(5,000-10,000 psi)
High Pressure Water Jetting (HP WJ)	70 to 170 MPa	(10,000-25,000 psi)
Ultra-High Pressure Water Jetting (UHP WJ)	Above 170 MPa	(25,000 psi)

7. The abrasive used in blast cleaning shall produce a height profile in accordance with the recommendations of the manufacturer of the protective coating which is to be applied to the surface being cleaned.

8. Field blasting cleaning for all surfaces shall be accomplished by dry sandblasting method unless otherwise directed.

9. At all times during the blast cleaning operations, adequate means shall be employed to absolutely insure that existing protective coatings shall not be exposed to abrasion from blast cleaning operations.

10. The Contractor shall at all times keep the area of his work in reasonably clean condition shall not permit blasting materials to accumulate in an uncontrolled manner such as to constitute a nuisance or hazard to the satisfactory prosecution or the work (or operation of the existing facilities).

11. All blast cleaned surfaces shall be carefully dried and cleaned prior to application or specified coatings. No coatings or paint shall be applied over damp or moist surfaces.

12. All welds shall be neutralized with a suitable solvent or other acceptable cleaner compatible with the specified Coating System materials.

13. Specified Surface Preparation: Surface preparation for the specific Service Condition shall be as follows:

    A. Masonry and Concrete: All concrete shall be cured 45 days, minimum. All surfaces shall be thoroughly cleaned by sandblasting, removing all traces of previous materials. Remove all loose concrete by chipping, etc. to leave only sound firmly bonded concrete. Cracks and voids shall be repaired or filled with grout, mixed and placed in strict accordance with manufacturer's instructions. In general, final surface shall be reasonably smooth and free to voids, cavities, dirt, dust, oils, grease, laitance or other contaminants. Concrete subject to submergence shall be brush-blasted (SSPC-SP7). All other concrete and CMU to be painted shall be commercial blast (SSPC-SP6).

    B. Plastic pipe shall be lightly sanded and washed clean.

    C. Wood Surfaces:

        1) These surfaces, other than stained or natural finish, shall be primed and finish-coated as specified. Wood surfaces to be painted shall be cleaned of dirt, oil, and other foreign substances with mineral spirits, scrapers, and/or sandpaper. Finish surfaces exposed to view shall be made smooth by sanding. All wood items to be painted and in contact with or built into concrete, masonry, or plaster shall be back primed. Small, dry seasoned knots shall be surface scraped and thoroughly cleaned, and shall be given a thin coat of knot sealer before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or if still soft, shall be removed with mineral spirits or turpentine and the resinous area thinly coated with knot sealer. After priming, all holes and imperfections in finish surfaces shall be filled with putty or plastic wood-filler colored to match the finish coat, allowed to dry, and sanded smooth. Unless otherwise authorized, painting shall proceed only when the moisture content of the wood does not exceed 12 percent as measured by a moisture meter.

        2) Stained or Natural Finish: Interior wood surfaces to receive stained or natural finish shall be properly prepared to the approved shade and lightly sanded. Oak, and other open-grained wood, shall be given the same treatment and, in addition, shall be given a coat of paste wood filler not less than eight hours after the application of the stain. Excess filler shall be removed and the surface then

sanded smooth. Each coat shall be lightly sanded prior to application of subsequent coat.

3) Wood should be clean and dry. Remove surface deposits of sap or pitch by scraping and wiping clean with rags dampened with mineral spirits or VM & P Naphtha. Seal knots and pitch pockets with shellac reduced with equal parts of shellac thinner (denatured alcohol) before sandpaper and finishing with fine grit and remove sanding dust. After the prime coat is dry, fill cracks and holes with putty or spackling compound. When filler is hard, sand flush with the surface using fine grit sandpaper. Sand lightly between coats with fine grit, open-coated sandpaper.

D. Exposed Pipe: Bituminous coated pipe shall not be used in exposed locations. Pipe which shall be exposed after project completion shall be factory primed. After installation all exterior, exposed flanged joints shall have the gap between adjoining flanges sealed with a single component Thiokol caulking to prevent rust stains.

E. Shop-Finished Surfaces: All shop-coated surfaces shall be protected from damage and corrosion before and after installation by treating damaged area immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be "Hand-Cleaned" and then touched up with the same materials as the shop coat. All shop coated surfaces which are faded, discolored, or which require more than minor touch up in the opinion of the Engineer shall be repainted. Cut edges of galvanized sheets and exposed threads and cut ends of galvanized piping, electrical conduit, and metal pipe sleeves, not to be finish painted, shall be "Solvent Cleaned" and primed.

F. Plaster Surfaces: These surfaces shall be clean, free from grit, loose plaster, and surface irregularities, and shall have an instrument-measured moisture content not exceeding eight
(8) percent.

G. Aluminum embedded or in contact with concrete must be painted with one shop coat of primer followed by one heavy coat of aluminum pigmented asphalt paint.

H. Ferrous Metal Services:

1) Remove any oil or grease from surfaces to be coated with clean rags soaked in toluol or other solvent recommended by coating manufacturer in accordance with SSPC specifications. Any chemical contamination shall be eliminated by means of neutralization or flushing or both prior to additional surface preparation.

2) All sharp edges and welds shall be ground smooth to a rounder contour, all weld splatter shall be removed, and all pits and dents shall be filled, and all imperfections shall be corrected prior to surface preparation.

3) Surfaces shall be clean and dry. Remove dust and dirt by blowing off the surface with high pressure air or wiping clean with dry rags. Oil, grease and

protective mill coatings shall be removed by solvent cleaning in accordance with SSPC-SPl.

4) White rust should be removed by hand or power brushing. Care should be taken not to damage or remove the galvanizing. Rust should be removed from old galvanized steel by Hand or Power Tool Cleaning in accordance with SSPC-SP2 or SP3.

I. Concrete Surfaces:

1) All efflorescence, laitance, chalk, dust, dirt, oils, grease, concrete curing agents, form release agents, sealers, old coatings and other chemical contaminants shall be removed either by steam cleaning with detergent, by scrubbing with a hot trisodium phosphate solution consisting of 2 pounds of trisodium phosphate to each gallon of hot water (160°F), or by high pressure water blasting (3,000 psi or higher). Multiple cleaning operations may be required to remove all contaminants. Repeat the cleaning operation until the contamination is removed and flush the area with clean water to remove residual cleaning solution. Allow to dry thoroughly before coating.

2) All concrete surfaces to be coated shall be clean and dry. "Dry" is defined for new concrete as free of moisture and fully cured which is a minimum of 30 days at 75°F and 50 percent relative humidity or some equivalent cure time at other conditions (7 days minimum for stucco). Moisture content of concrete shall be determined by using both of the following methods.

3) The presence of moisture shall be checked by taping a one-foot square piece of 20 mil thick minimum plastic film on the surface. Pieces of test plastic film should be placed at various locations that are likely to be slow curing, such as below grade, low spots in floors, inside corners and lower wall areas. The plastic film should be carefully sealed with tape to prevent the escape of any moisture or vapor that would be trapped behind the film. The film should be left in place overnight or longer to allow sufficient time for moisture migration. After 16 hours minimum remove and examine the backside for moisture condensation and inspect the concrete surface for darkened areas. The source of the moisture, if present, shall be located, and the cause corrected prior to coating.

4) The presence of moisture shall also be determined with a moisture detection device such as a Delmhorst Model DLM2E. Moisture determined by this method shall be less than 14 percent moisture content before coating operations shall be allowed to proceed.

5) Old paint and unremoved tar stains shall be solvent cleaned with naphtha, trichloroethylene, or perchloroethylene. Proper safety precautions shall be observed if this step is necessary. The surface shall be flushed with fresh water and dried.

6) Do not use form oils incompatible with coating, concrete curing agents, or concrete hardeners on concrete surfaces to be coated.

7) Concrete and/or cinder block walls to receive a coating shall be air-blasted with 100 psi clean, dry, oil-free air to remove dust, etc., and wire brushed to remove all loose and/or weak mortar.

J. Galvanized Steel and Non-Ferrous Metal

1) Galvanized steel and aluminum will only be coated when so specified.

2) Surfaces shall be clean and dry. Remove dust and dirt by blowing off the surface with high pressure air or wiping clean with dry rags. Oil, grease and protective mill coatings shall be removed by solvent cleaning in accordance with SSPC-SPl.

3) White rust should be removed from galvanized steel or aluminum by hand or power brushing. Care should be taken not to damage or remove the galvanizing. Rust should be removed from old galvanized steel by Hand or Power Tool Cleaning in accordance with SSPC-SP2 or SP3.

4) Other surface preparation as outlined in the coating manufacturer's latest written application instructions shall be observed for more demanding exposures.

K. Stainless Steel

1) Stainless steel will only be coated when so specified, or when it is adjacent to areas to be coated such as piping supports, anchor bolts or flange bolts.

2) Stainless steel requires only solvent cleaning prior to coating using any one of the methods in SSPC-SP1. Only solvents and cleaning solutions containing less than 200 ppm of halogens should be used to prevent stress corrosion cracking.

3) Stainless steel may be whip-blasted to provide a surface profile to increase the mechanical bond of the coating system. The height of the profile and the texture required shall be defined for the operator and as a standard for the acceptance of the work. Pictorial standards for the surface cleanliness of carbon steel are not applicable to stainless steel, since there are no corrosion products or mill scale to remove from the surface.

4) Abrasive blast cleaning procedures outlined by Steel Structures Painting Council may also be used for stainless steel. Only very hard silica sand or other abrasive media shall be used for a fast-cutting action and to obtain a sharp angular profile.

L. PVC or Other Plastic Piping or Ductwork

1) Solvent clean.

2) If recommended by manufacturer, lightly abrade surface with medium grade sandpaper. Remove dust by wiping with clean rags.

3.03 PREPARATION OF SURFACES - EXISTING FACILITIES

1. All existing facilities to be painted shall be thoroughly washed with a high strength chlorine solution or a trisodium phosphate solution to provide a surface suitable for finish painting. Any corrosion of ferrous surfaces shall be removed by sandblasting, and the area primed with the appropriate primer specified in the paint schedule.

3.04 MATERIALS PREPARATION

1. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt, and other foreign materials.

2. Except where otherwise specified, thinning shall be done only if necessary for the workability of the coating material and then, only in accordance with the coating manufacturer's most recent printed application instructions. Use only thinner provided by coating manufacturer. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or clean-up solvent shall be used for all clean-up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

3.05 APPLICATION

1. Paint all exposed surfaces in rooms scheduled for painting whether or not colors are designated in schedules, except where the natural finish of material is obviously intended and specifically noted as a surface that will not be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color of finish is not designated, the Engineer will select these from standard colors available for the materials systems as specified.

2. Color Selection

   A. Colors for Multi-Coat Systems: Each coat shall be applied in a different color or shade from the preceding coat to aid in determining the uniformity and coverage of the coating. The finish coat color shall be selected by the Owner or Engineer. When a white finish coat is specified, the last two (2) coats shall be white.

   B. Color Coding Piping: All exposed piping shall be identified as specified in Section 09905: Piping and Equipment Identification System. Pipe identification system shall include color coding or banding, legends, and arrows.

3. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.

4. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied. All equipment shall be maintained in good working order and shall be comparable to that described in the coating manufacturer's most recent application instructions. It shall be thoroughly cleaned and inspected daily. Worn spray nozzles, tips, etc., shall be replaced regularly. Effective oil and water separators shall be used and serviced on all air lines.

5. All paints and coating materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.

6. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance.

7. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness. Allow each coat to dry thoroughly before applying the next coat following manufacturer's recommendations taking into account temperature and relative humidity.

8. All interior surfaces of structures shall be finish coated prior to installation of equipment, conduit, and other exposed items. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.

9. Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise indicated.

10. Sand lightly between each succeeding enamel or varnish coat.

11. Omit the field primer on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.

12. The prime and intermediate coats as specified for the various coating systems may be applied in the shop by the manufacturer. The shop coats shall be of the type specified and shall be compatible with the field coating. Items such as pumps, motors, equipment, electrical panels, etc. shall be given at least one touch-up coat with the intermediate coating material and one (1) complete finish coat in the field.

3.06 APPLICATION RESTRICTIONS

1. Environmental Requirements

A. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

1) The conditions below shall be adhered to even if manufacturer's recommendations are less stringent. If manufacturer's recommendations are more stringent, they shall apply.

2) No coatings shall be applied when the air, surface, and material temperature is below 55°F or above 95°F for 24 hours prior to and 24 hours after coating application. Surface temperature shall be at least 5°F above the dew point for 24 hours prior to and 24 hours after coating application. The dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Weather Bureau psychometric tables. Do not apply coatings when the relative humidity exceeds 85 percent or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. No painting shall be done when the surfaces may become damaged by

rain, fog or condensation or when it is anticipated that these conditions will prevail during the drying period, unless suitable enclosures to protect the surface are used. Where heat is necessary, it shall be supplied by the painting applicator and shall be of such type that it will maintain an air and coated surface temperature of 55°F minimum prior to and after the coating application as described above, and 90°F minimum during the cure stage if hot air forced curing is recommended by the coating manufacturer for special coatings. Further, this heater shall be of such type as not to contaminate the surface area to be or being coated with combustion products. The Contractor shall supply utilities to run electric or gas heaters. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Owner or Engineer.

B. Do not apply finish in areas where dust is being or will be generated during application through full cure.

C. All exterior painting shall be done only in dry weather.

D. Spray application shall occur only when wind velocities, including gusts, are less than 10 miles per hour. All materials, equipment, etc. in the vicinity of spray application shall be protected from overspray.

2. Application of materials shall be done only on properly prepared surfaces as herein specified. Between any two coats of material, unless specifically covered in the coating manufacturer's most recent printed application instructions, if more than one (1) week passes between subsequent coats, the coating manufacturer shall be contacted for his recommended preparation of the surface prior to application of the next coat. This preparation might include brush-off blasting, steam cleaning, or solvent wiping (with an indicated solvent) and shall be specified in writing by the material supplier and followed by the applicator. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Owner or Engineer.

3. In no case shall paint be applied to surfaces which show a moisture content greater that 14 percent. The presence of moisture shall be determined prior to coating by testing with a moisture detection device such as a Delmhorst Model DLM2E.

3.07 MINIMUM COATING THICKNESS

1. Coating thickness shall meet or exceed the specified minimum dry film thickness (DFT) in all areas. The average coating thickness as determined by multiple representative DFT measurements shall meet or exceed the mid-point of the specified DFT range. If the measured DFT is below this value, the surface shall be recoated with at least the minimum DFT until the total DFT meets or exceeds the mid-point DFT.

2. Coverage rates are theoretical as calculated by the coating manufacturer and are, therefore, the maximum allowable.

3. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.

4. On masonry, application rates will vary according to surface texture; however, in no case shall the

manufacturer's stated coverage rate be exceeded. On porous surfaces, is shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

5. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

3.08 FINISHES

1. 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.

2. Complete Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specific requirements.

3.09 FIELD QUALITY CONTROL

1. The Contractor shall request acceptance of each coat by the Owner's representative before applying the next coat; and the Contractor shall provide the necessary properly calibrated gauges. All nonferrous surfaces shall be checked for number of coats and thickness by use of a Tooke gauge. All ferrous surfaces shall be checked for film thickness by use of an Elcometer or Micro-Test magnetic dry film gauge properly calibrated. In addition, submerged tank linings and metals shall be tested for freedom from holidays and pinholes by use of a Tinker-Rasor or K-D Bird Dog Holiday Detector. All defects shall be corrected to the satisfaction of the Owner.

3.10 PROTECTION

1. All other surfaces shall be protected while painting.

2. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operation. Remove all electric plates, surface hardware, etc., before painting; protect and replace when completed. Mask all machinery nameplates and all machined parts not to receive paint. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage.

3.11 WORKMANSHIP

1. General:

A. Primer (spot) and paint used for a particular surface shall, in general, be as scheduled for that type of new surface. Confirm with the paint manufacturer that the paint proposed for a particular re-paint condition will be compatible with the existing painted surface. Sample re-painted areas on the actual site will be required to insure this compatibility. Finished repainted areas shall be covered by the same guarantee specified for remainder of work.

B. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operations. Canopies of lighting fixtures shall be

loosened and removed from contact with surface, covered and protected and reset upon completion. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery nameplates and all machined parts not receiving a paint finish. Dropped or spattered paint shall be promptly removed. Lay drop clothes in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

C. All safety equipment shall be painted in accordance with OSHA Standards.

D. Paints shall be mixed in proper containers of adequate capacity. All paints shall be thoroughly stirred before use and shall be kept stirred while using. No unauthorized thinners or other materials shall be added to any paint.

E. Only skilled painters shall be used on the work and specialists shall be employed where required.

2. Field Priming:

A. Equipment which is customarily shipped with a baked enamel finish or with a standard factory finish shall not be field painted unless the finish has been damaged in transit or during installation. Surfaces that have been shop painted and have been damaged, or where the shop coats or coats of paint have deteriorated, shall be properly cleaned and retouched before any successive painting is done on them in the field. All such field painting shall match as nearly as possible the original finish.

3. Field Painting:

A. All painting at the site shall be designated as Field Painting.

B. All paint shall be at room temperature before applying, and no painting shall be done when the temperature is below 50 degrees F, in dust-laden air, when rain or snow is falling, when relative humidity exceeds manufacturer's recommendation when temperature is less than 5° F above the dewpoint, or until all traces of moisture have completely disappeared from the surface to be painted.

C. Each application of paint shall be applied at the recommended thickness, free to sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Paint shall be sharply cut to lines. Finished surfaces shall be free from defects of blemishes.

D. Protective coverings or drop cloths shall be used to protect floors, fixtures and equipment. Care shall be exercised to prevent paint or coating from being spattered onto surfaces which are not to be painted. Surfaces from which such materials cannot be removed satisfactorily shall be painted or repainted, as required to produce, a finish satisfactory to the Engineer.

E. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.

F. All welds and irregular surfaces shall receive a brush coat of the specified product prior to application of the first complete coat.

G. Finish surfaces shall not show brush marks or other irregularities. Under coats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface. Top and bottom edges of doors shall be painted and all exterior trim shall be back-primed before installation.

H. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. All exterior concrete and masonry painting shall be performed in one continuous manner structure by structure. Materials subject to weathering shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

I. All materials shall be brush painted unless spray painting is specifically approved by the Engineer. If spray painting is approved, Contractor shall accept all responsibility for any damage caused by overspray and/or drifting paint mist.

J. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be removed and repainted in accordance with the Engineer's directions.

K. Before final acceptance of the work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.

L. The aluminum work noted on the Drawings or in the Painting Schedule except all structural walkways, supports, railings, toeboards, grating, and checkered plate shall be field painted.

3.12 CLEANUP

1. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave work “broom clean” unless more exactly specified.

2. Upon completion, remove all paint where it has been spilled, splashed, or splattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the work ready for inspection.

3.13 COLOR CODING FOR PIPES AND EQUIPMENT

1. Color coding is required and shall consist of color code painting and identification of all exposed conduits and pipelines for the transport of gases, liquids and semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and all operating accessories which are integral to be whole functional mechanical pipe and electrical conduit system. The color coding schedule shall be in accordance with Specification Section 09905.

2. All hangers and pipe support floor stands shall be painted. The system shall be painted up to and

3. including the flanges attached to the mechanical equipment. Colors shall be as selected by the Owner.

4. 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 fixed flanges or connections on the equipment.

5. The color code establishes, defines and assigns a definite color for each category of pipe. Pipelines which are not listed on the Paint Color Code Schedule shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.

6. All pipes, equipment, and accessories shall be painted according to Paint Color Code Schedule attached. All pipes shall have 6" long color coded flow arrows with letters defining its function (i.e., potable water, air, sludge, etc.).

3.14 FABRICATED EQUIPMENT

1. Unless otherwise indicated, all fabricated equipment shall be shop primed and shop or field finished.

2. All items to be shop primed shall be thoroughly cleaned of all loose material prior to priming. If, in the opinion of the Engineer, any prime coating shall have been improperly applied or if material contrary to these Specifications shall have been used, that coating shall be removed by sandblasting to white metal and reprimed in accordance with these Specifications.

3. All shop prime coats shall be of specified materials and applied in accordance with these Specifications. The Contractor shall remove any prime coats not in accordance with these Specifications by sandblasting and apply the specified prime coat at no additional cost to the Owner.

4. Shop primed surfaces shall be cleaned thoroughly and retouched with the specified primer before the application of successive paint coats in the field.

5. Shop finish coats may be the standard finish as ordinarily applied by the manufacturer when approved by the Engineer. All pumps and motors shall be repainted after installation.

6. 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.

7. If, in the opinion of the Engineer, a shop finish coat does not give the protection quality of other work of similar nature, the Contractor shall apply the coat or coats of paint as directed by the Engineer to accomplish the desired protection quality.

8. 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 by the Contractor.

END OF SECTION

SECTION 09905

PIPING, VALVE, AND EQUIPMENT IDENTIFICATION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

1. Scope of Work: The work included under this Section consists of providing an identification system for piping systems and related equipment.

1.02 QUALITY ASSURANCE

1. Standards: ANSI Standard A13.1, Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

1. Submit manufacturer's descriptive literature, illustrations, specifications, and other pertinent data in accordance with Section 01340.

2. Schedules:

A. Provide a typewritten list of all tagged valves giving tag color, shape, letter code and number, the valve size, type, use, and general location.

B. Provide a complete list of materials to be furnished and surfaces on which they will be used.

3. Samples:

A. Provide a sample of each type valve tag supplied.

B. Provide a sample of each type of identification tape supplied.

C. Provide manufacturer's color charts for color selection by Engineer.

1.04 PRODUCTS DELIVERY, STORAGE, AND HANDLING

1. Delivery Of Materials: Except for locally mixed custom colors, deliver sealed containers with labels legible and intact.

2. Storage Of Materials:

A. Store only acceptable project materials on project site.

B. Store in suitable location.

C. Restrict storage to paint materials and related equipment.

D. Comply with health and fire regulations.

1.05 JOB CONDITIONS

1. Environmental Requirements:

A. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

B. Do not apply finish in areas where dust is being generated.

2. Protection: Cover or otherwise protect finished work of other trades and surfaces not to be painted.

PART 2 - PRODUCTS

2.01 MATERIALS

1. Materials for painting shall conform to requirements of Section 09900: Painting.

2. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

3. Aboveground piping shall be identified by self-adhesive pipe markers equal to those manufactured by W. H. Brady Company.

A. Markers shall be of wording and color as shown in Table 09905.

B. Lettering shall be:

1) 2 1/4-inches high for pipes 3 inches diameter and larger.

2) 1 1/8-inches high for pipes less than 3 inches diameter.

C. Flow arrows shall be:

1) 2 1/4-inches by 6 inches for pipes 3 inches diameter and larger.

2) 1 1/8-inches by 3 inches for pipes less than 3 inches diameter.

2.02 IDENTIFICATION SYSTEMS FOR BURIED PIPE

1. Description

A. Furnish and install identification systems for buried potable water mains, reclaimed water mains and wastewater force mains as shown on the Drawings and specified herein.

2. Identification Tape for Buried Pipe

A. Identification tape shall be manufactured of inert polyethylene and be resistant to alkalis, acids and other destructive agents found in soil. Minimum thickness of tape shall be 4

mils. Tape width shall be minimum 6 inches and shall be imprinted with black letters. Imprint shall be repeated a minimum of once every 2 feet for the entire length of tape.

B. Tape background colors and imprints shall be as follows:

SERVICE TYPE	IMPRINT	BACKGROUND COLOR
Potable Water	"Caution - Potable Water Line Buried Below"	Blue
Wastewater/Drain	"Caution – Wastewater Line Buried Below"	Green
Reuse Water	"Caution – Reuse Water Line Buried Below"	Pantone (Purple)
Sanitary Sewer or Force Main	"Caution – Sanitary Sewer Water Line Buried Below"	Green

C. Identification tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, Texas, (800) 231-6074, Allen Systems Inc., Wheaton, IL (800) 323-1749, or approved equal.

3. Detecting Wire and Marker Posts

A. Shall be as detailed on the Contract Drawings.

B. Where feasible, combine detecting wire termination point with marker post such as the rigid "Tri View Test Station", manufactured by Repent of Bloomington, MN, (800) 522-4343, or approved equal.

C. Color for marker posts identification decals shall be blue for potable water and made of Schedule 80 PVC.

4. Aboveground Valve Identifications: A coded and numbered tag attached with brass chain and/or brass "S" hooks shall be provided on all valves.

A. Tag Types: Tags for valves on pipe shall be brass or anodized aluminum. Colors for aluminum tags shall, where possible, match the color code of the pipe line on which it is installed. Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.

B. 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 Table 09905, 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.

PART 3 - EXECUTION

3.01 COLOR CODING FOR PIPES AND EQUIPMENT

1. Piping color codes, and code labels for pipe identification shall conform to Table 09905.

2. General Notes and Guidelines:

   A. 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.

   B. 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 system.

   C. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange.

   D. All safety equipment shall be painted in accordance with OSHA Standards.

   E. 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.

   F. All pipe hangers and pipe supports shall be painted, unless specified otherwise due to material of construction.

3. All pipe hangers, pipe supports, and accessories 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 09900.

4. 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.

5. All insulated surfaces, unless otherwise specified, shall be given one (1) coat of sizing, one (1) prime coat, and one (1) finish coat.

6. System code lettering and arrows shall conform to the requirements of ANSI A 13.1 marked on piping as follows:

A. Legends shall be of the following color for the respective pipe color:

Key to Classification of Predominant Colors For Piping			Color of Letters, if not Otherwise Specified
1)	Fire Protection:	Red	White
2)	Dangerous:	Yellow	Black
		Orange	Black
3)	Safe:	Green	Black
		White	Black
		Black	White
		Light Grey	Black
		Dark Grey	White
		Aluminum	Black
4)	Protective:	Blue	White

B. All piping containing or transporting corrosive or hazardous chemicals shall be identified with labels every 10 feet and 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 pipes pass through walls.

C. An arrow indicating direction of flow shall be placed adjacent to each marker.

3.02 FABRICATED EQUIPMENT

1. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished. See Section 09900 - Painting.

2. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage.

3. Where specified in other Sections of these Specifications for mechanical equipment, the Contractor shall apply field coats of paint in accordance with Section 09900. If the shop finish coating is unsatisfactory due to poor adhesion or other problems with primer or finish coats, coatings shall be removed and replaced by sandblasting, priming and finishing in accordance with Section 09900 and this Section.

4. 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

1. Identification tape shall be installed for all buried pipelines and conduits in accordance with the manufacturer's installation instructions and as specified herein.
2. Identification tape for piping shall be installed at two (2) locations:

A. One (1) foot below finished grade along centerline of pipe, and;

B. Directly on top of the pipe.

3.04 INSTALLATION OF DETECTING WIRE

1. Attach to the pipe at the 12 o'clock position.

2. The detecting wire shall be held in place with nylon cable ties at each end and at the midpoint of the pipe. The cable ties shall be Ty-Rap as manufactured by T and B Electrical Company or approved equal.

3. The wire shall be capable of being extended 12 inches above the surface at air release valves and valve boxes so that a current can be induced through the wire to detect the location of the pipe.

4. The wires shall be brought to the surface at each valve box using the Test Station Box for buried valves to protect the wire.

TABLE 09905

PAINT COLOR CODE SCHEDULE
(COLOR SHALL MATCH EXISTING, WHERE APPLICABLE)

Equipment and Materials	Paint Color	Code Label
Potable Water	Blue	PW
Reuse Water	Pantone (Purple)	RW
Drains, Sewers, or Force Mains	Green	DR
Electrical conduit (above 220 volts)	Gray w/Yellow Bands	EC
Electrical Conduit in MCC	Gray w/Yellow Bands	EC
Electrical Motors, Blower	White	N/A
Pipe Hangers	Match Piping	N/A
Fuel Oil	Red	FO
Sodium Hypochlorite	Orange	CL

	Key to Classification of Predominant Colors for Piping	Color	Color of Letters for Stenciling
(F)	Fire Protection	Red	White
(D)	Dangers	Yellow Orange	Black Black
(S)	Safe	Green White Black Light Gray Dark Gray Aluminum	Black Black White Black White Black
(P)	Protective	Blue	White

Width of color bands and letter size shall conform to the following schedule:

Outside Diameter of Pipe or Covering (Inches)	Size of Legend Letters (Inches)	Width of Color Band (Inches)
3/4 to 1 1/4	1/2	8
1 1/2 to 2	¾	8
3 1/2 to 6	1 ¼	12
8 to 10	2 ½	24
Over 10	3 ½	32

END OF SECTION

SECTION 10000

PRECAST CONCRETE BUILDING

ELECTRICAL ROOM (ADDED)

PART 1 – GENERAL

1.01 SUMMARY

1. Contractor to furnish Electrical Room as a precast concrete building. Building to be field assembled by the manufacturer on the contractor's poured-in-place foundation. Building to be provided by manufacturer with all necessary openings as specified by contractor in conformance with manufacturer's structural requirements.

1.02 QUALITY ASSURANCE

1. Must meet 2020 Florida Building Code, ACI-318-08, and ACI-318R-08 for precast concrete buildings.

1.03 DESIGN REQUIREMENTS

1. Interior Dimensions: 8' x 12' x 9' H

2. Design Loads:

   A. Live Roof Load: 100 PSF

   B. Live Floor Load: 200 PSF

   C. Wind Loading – 160 MPH

   D. Floor Dead Load – 63 PSF

3. Roof panel shall be sloped ½" from front to back in 12-foot direction. The roof shall extend a minimum of 2 ½" beyond the wall panel on each side and have a turndown design which extends ½" below the top edge of the wall panels to prevent water migration into the building along top of wall panels. Roof shall also have an integral architectural ribbed edge.

4. Roof and wall panels must each be produced as single component monolithic panels. No roof, or vertical wall joints will be allowed, except at corners. Wall panels shall be set on top of floor foundation.

5. Floor foundation slab must have ½" step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels.

1.04 SUBMITTALS

1. Engineering calculations that are designed and sealed by a Florida professional engineer shall be submitted for approval.

PART 2 – PRODUCTS

2.01 MATERIALS

1. Concrete: Steel-reinforced, 5000 PSI minimum 28-day compressive strength, air-entrained (ASTM C260)

2. Reinforcing Steel: ASTM A615, grade 60 unless otherwise specified.

3. Sloped roof

   A. The entire precast concrete roof panel surface must be cleaned and primed with a material that prepares the concrete surface for proper adherence to the coating material.
   B. The entire precast concrete roof panel surface shall be sealed with a continuous membrane cemented to the concrete with a compound designed for this purpose.

4. Caulking: Joint between building and floor slab shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-1A elastic sealant or equal. Exterior caulk joint to be 3/8" x 3/8" square so that sides of joint are parallel for correct caulk adhesion. Back of joint to be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of joint.

5. Wall Panels shall be 4" thick consisting of R-21 insulation with 5/8" gypsum on ceiling. Interior insulation shall be Fiber-Reinforced Polymer (FRP) R-14 on walls, with ½" plywood and FRP laminate.

2.02 ACCESSORIES

1. Doors and Frames: The building shall be equipped with one double door 60" wide x 96" high x 1- 3/4" and one single door 36" wide x 80" high x 1-3/4", 18-gauge galvanized/insulated metal doors with 16-gauge galvanized frames.

2. Door Hardware:

   A. Handle: Stainless steel, 8-½" x 2".

   B. Hinges: 4 ½" x 4 ½" chrome-plated with non-removable hinge pins, 3 per door.

   C. Lock Set: Stainless steel finish.

   D. Surface Bolt: Satin chrome finish.

2.03 FINISHES

1. Interior of Building: Smooth steel form finish on all interior panel surfaces.

2. Exterior of Building: Architectural precast concrete brick finish.

PART 3 – EXECUTION

3.01 SITE PREPARATION REQUIREMENTS

1. Building shall be placed on concrete slab, substrate below pavement or slab must have a vertical soil capacity of 1,500 pounds per square foot. Place stone or sand to 1" above highest point of area where building will be placed and at least 1'-0" wide all around the building footprint. Retain stone or sand with a perimeter form to prevent the material from washing out.

2. Provide positive drainage for the fill, concrete pad, or slab as required.

3.02 ACCESS

1. Contractor must provide a level unobstructed area large enough for a 35-ton crane and a 55-ft tractor-trailer to park adjacent to the pad. Crane shall be provided by others. No overhead lines may be within 75' radius of center of pad. Firm roadbed with turns that allow 65' lowbed tractor- trailer must be provided directly to site. No building shall be placed closer than 2'-0" to an existing structure.

3.03 MANUFACTURER

1. Acceptable suppliers shall be as noted below, or equal

Concrete Modular Systems, Inc.
St. Petersburg, FL 33747
concretemodular@aol.com
727.945.1864
Contact: Frederick Kennedy

END OF SECTION

SECTION 11000

EQUIPMENT GENERAL PROVISIONS

PART 1 – GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide all equipment and appurtenant work, complete and operable, in accordance with the Contract Documents.

2. The provisions of this Section shall apply to all equipment except where otherwise indicated.

3. Equipment Arrangement: Unless specifically indicated otherwise, the arrangement of equipment shown on the Drawings is based upon information available at the time of design and is not intended to show exact dimensions particular to a specific manufacturer in all cases. Some aspects of the Drawings are diagrammatic and some features of the illustrated equipment arrangement may require revision to meet the actual equipment requirements. Structural supports, foundations, piping and valve connections, and electrical and instrumentation connections indicated may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions and alterations. Substantiating calculations and drawings shall be submitted prior to beginning the installation of equipment.

1.02 CONTRACTOR SUBMITTALS

1. General: Furnish submittals in accordance with Section 01300 - Contractor Submittals.

1.03 QUALITY ASSURANCE

1. Costs: Responsibility shall be the Contractor's for performing and paying the costs of inspection, startup, testing, adjustment, and instruction services performed by factory representatives. The city will provide a meter for all water provided. Contractor shall be responsible for the cost of power until the equipment is turned over to the City. If available, the City's operating personnel will provide assistance in the field-testing.

2. Inspection: The Contractor shall inform the local authorities, such as building and plumbing inspectors, fire marshal, OSHA inspectors, and others, to witness all required tests for piping, plumbing, fire protection systems, pressure vessels, safety systems, and related items to obtain all required permits and certificates, and shall pay all inspection fees.

3. Quality and Tolerances: Tolerances and clearances shall be as shown on the Shop Drawings and shall be closely adhered to.

   A. Machine work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts.

B. All materials shall meet the physical and mechanical properties in accordance with the reference standards.

PART 2 -- PRODUCTS

2.01 GENERAL REQUIREMENTS

1. Noise Level: When in operation, no single piece of equipment shall exceed the noise level requirements of OSHA, the City of Cape Coral or any other regulatory agencies.

2. Mechanical Service Factors

	Mechanical Service Factors	
	Electric Motor	Internal Combustion Engine
Uniform	1.25	1.50
Moderate Shock	1.50	1.75
Heavy Shock	2.00	2.25

3. Where load classifications are not indicated, service factors based on AGMA 514.02 shall be used for standard load classifications and service factors for flexible couplings.

4. Welding: Unless otherwise indicated, welding shall conform to the following:

A. Latest revision of AWWA D100, Welded Steel Tanks for Water Storage.

B. Latest revision of AWWA C206, Field Welding of Steel Water Pipe.

C. Butt fusion welding in accordance with ASTM D 2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

D. Welding Requirements and Procedures per ANSI/AWS D.1.1.

E. American Welding Society Welding Handbook (AWS-032) and Welded Joint Design (AWS- 062)

F. All welding shall be in accordance with the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.

G. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. Sharp corners of material that are to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

5. Protective Coating: Equipment shall be painted or coated in accordance with Section 09800 - Protective Coating, unless otherwise indicated. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated as indicated in Section 09800 – Protective Coating. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

6. Protection of Equipment: Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers should be avoided, to prevent accumulation of condensate in gears and bearings. Equipment delivered to the Site with rust or corroded parts shall be rejected. If equipment develops defects during storage, it shall be disassembled, cleaned, and recoated to restore it to original condition.

7. Identification of Equipment: Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number for the particular item.

8. Vibration Isolators: Air compressors, blowers, engines, inline fans shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations.

9. Shop Fabrication: Shop fabrication shall be performed in accordance with the Contract Documents and the Shop Drawings.

2.02 EQUIPMENT SUPPORTS AND FOUNDATIONS

1. Equipment Supports: Unless otherwise indicated, equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, and wind loads.

2. Equipment Foundations: Mechanical equipment, tanks, electrical and control cabinets, enclosures, and related equipment shall be mounted on minimum 3.5-inch high concrete bases, unless otherwise indicated. Equipment foundations are indicated on Drawings. The Contractor through the equipment manufacturer shall verify the size and weight of equipment foundation to ensure compatibility with equipment.

2.03 BEARINGS

1. General: Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA).

2. To assure satisfactory bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and lubrication shall be considered in bearing selection.

3. Re-lubricatable type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

4. Lubricated-for-life bearings shall be factory-lubricated with the manufacturer's

recommended grease to ensure maximum bearing life and best performance.

5. Anti-Friction Type Bearing Life: Except where otherwise indicated, bearings shall have a minimum L-10 life expectancy of 5 years or 20,000 hours, whichever occurs first. Where so indicated, bearings shall have a minimum rated L-10 life expectancy corresponding to the type of service, as follows:

Type of Service	Design Life (years) (whichever comes first)	L-10 Design Life (hours)
8-hour shift	10	20,000
16-hour shift	10	40,000
Continuous	10	60,000

6. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as indicated or as recommended in the published standards of the manufacturer. Split-type housings may be used to facilitate installation, inspection, and disassembly.

7. Sleeve Type Bearings: Sleeve-type bearings shall have a cast iron or ductile iron housing and Babbitt or bronze liner. Bearing housing shall be bolted and doweled to the lowercasing half. These housings shall be provided with cast iron caps bolted in place and the bearing end caps shall be bored to receive the bearing shells. Sleeve bearings shall be designed on the basis of the maximum allowable load permitted by the bearing manufacturer. If the sleeve bearing is connected to an equipment shaft with a coupling, the coupling transmitted thrust will be assumed to be the maximum motor or equipment thrust. Lubricant, lubrication system, and cooling system shall be as recommended by the bearing manufacturer.

2.04 EQUIPMENT LUBRICANTS

1. The Contractor shall install lubricants for all equipment during storage and prior to initial testing of the equipment. When specified, after successful initial testing, final testing, and satisfactory completion startup testing, the Contractor shall conduct one complete lubricant change on all equipment. In addition, the Contractor shall be responsible for the proper disposal of all used lubricants. The city will then be responsible for subsequent lubricant changes.

2.05 FACTORY TESTING

1. The following tests shall be conducted on each indicated pump system:

   A. Motors: Motors shall be factory tested in conformance with ANSI/IEEE 112, IEEE 43 - Recommended Practice for Testing Resistance of Rotating Machinery, and NEMA MG-2. Except where specific testing or witnessed shop tests are required by the specifications for driven equipment, factory test reports may be copies of routine test reports of electrically duplicate motors. Test reports shall indicate test procedure and instrumentation used to measure and record data, be certified by the motor manufacturer's test personnel and be submitted to the City. Where test reports are indicated, proof of design test reports for mass-produced equipment shall be submitted

with the shop drawings, and factory performance test reports for custom-manufactured equipment shall be submitted and be approved prior to shipment. Field test reports shall be submitted for review prior to Substantial Completion.

1) The Contractor shall furnish all necessary testing equipment and pay all costs of tests, including all replacement parts and labor, due to damage resulting from damaged equipment or from testing and correction of faulty installation. Test results shall be furnished to the pump manufacturer prior to the pump test.

2) Any equipment or material which fails a test shall be removed and replaced.

B. Pump Systems: All centrifugal pump systems shall be tested at the pump factory in accordance with the American National Standard for Centrifugal Pump Tests (ANSI/HI 1.6) acceptance Level "A" or the American National Standard for Vertical Pump Tests (ANSI/HI 2.6) as approved by ANSI and published by the Hydraulic Institute. Tests shall be performed using the complete pump system to be furnished, including the project motor and variable speed drive if equipped with variable speed drive. Testing of prototype models will not be acceptable. The following minimum test results shall be submitted:

1) Hydrostatic test results

2) At maximum speed, a minimum of five hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, recorded on data sheets as defined by the Hydraulic Institute. For variable speed driven pumps, each pump shall be tested between maximum and minimum speed at 100 rpm increments.

3) Pump curves showing head, flow, BHP, and efficiency requirements.

4) NPSH required test curve if required by the pump specification. Otherwise, a calculated NPSH required curve may be submitted.

5) Certification that the pump shaft horsepower demand did not exceed the motor horsepower equivalent to the 1.0 service rating at any point on the curve.

C. Acceptance: In the event of failure of any pump to meet any of the requirements, the Contractor shall make all necessary modifications, repairs, or replacements to conform to the requirements of the Contract Documents and the pump shall be re-tested until found satisfactory.

PART 3 -- EXECUTION

3.01 SERVICES OF MANUFACTURER

1. Inspection, Startup, and Field Adjustment: Where required by individual sections, an authorized, experienced, and competent service representative of the manufacturer shall visit the Site for the number of days indicated in those sections to witness or perform the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

   A. Installation of equipment

   B. Inspection, checking, and adjusting the equipment and approving its installation

   C. Startup and field testing for proper operation, efficiency, and capacity

   D. Performing field adjustments during the test period to ensure that the equipment installation and operation comply with requirements

2. Instruction of the City's Personnel

   A. Where required by the individual equipment sections, an authorized training representative of the manufacturer shall visit the Site for a number of days indicated in those sections to instruct the City's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.

   B. The representative shall have at least 2 years' experience in training.

   C. Training shall be scheduled 3 weeks in advance of the scheduled session.

   D. Proposed training material and a detailed outline of each lesson shall be submitted for review. Review comments from the City shall be incorporated into the material.

   E. The training materials shall remain with the trainees after the session.

   F. The city may videotape the training for later use by the City's personnel.

3.02 INSTALLATION

1. General: Equipment shall be installed in accordance with the manufacturer's written recommendations.

3.03 PACKAGED EQUIPMENT

1. When any system is furnished as pre-packaged equipment, the Contractor shall coordinate all necessary space and structural requirements, clearances, utility connections, signals, and outputs with lower tier contractors to avoid interferences.

2. If the packaged system has any additional features (as safety interlocks, etc.) other than required by the Contract Documents, the Contractor shall coordinate such features

with the City OF CAPE CORAL and provide all material and labor necessary for a complete installation as required by the manufacturer.

3.04 FIELD ASSEMBLY

1. Studs, cap screws, bolt and nuts used in field assembly shall be coated with “Never Seize” compound or City approved equal.

3.05 WELDING

1. Welds shall be cleaned of weld-slag, splatter, etc. to provide a smooth surface.

3.06 FIELD TESTS

1. Where indicated by the individual equipment sections, equipment shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, or overheating of bearings or motor.
2. The following field testing shall be conducted:

   A. Start equipment, check, and operate the equipment over its entire operating range. Vibration level shall be within the amplitude limits as indicated or as recommended by the reference applicable Standards.
   B. Obtain concurrent readings of motor voltage, amperage, capacity, and bearing temperatures.

3. Field-testing shall be witnessed by the City. The Contractor shall notify the City of the test schedule three weeks in advance.

4. In the event that any equipment fails to meet the test requirements, the equipment shall be modified and retested until it satisfies the requirement.

END OF SECTION

SECTION 11150

PUMP STATION START-UP AND PERFORMANCE TESTING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall be responsible for performance testing the pump station installed under this Contract.

1.02 CONTRACTOR SUBMITTALS

1. Submittals shall be in accordance with Section 01300 - Contractor Submittals.

2. The Contractor shall provide the City the documentation required by the testing procedures discussed in this Section.

PART 2 -- PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PUMP STATION START-UP

1. Contractor Requirements Prior to Start-Up:

A. The Contractor shall notify the City five (5) working days in advance of start-up.

B. Start-up shall occur on Tuesday, Wednesday, and Thursday between the hours of 9:00 AM and 1:00 PM only.

C. An email meeting request sent to the city of Cape Coral is required to schedule a start-up.

D. The following parties are required to attend the start-up:

1) Prime contractor and/or project supervisor

2) Electrical contractor

3) Mechanical contractor

4) Pump and control panel representative

5) Project engineer

6) City inspector

E. All parties shall be notified and coordinated by the Contractor.

F. A minimum of two working days prior to the station start-up, the Contractor shall notify the City for an inspection. The city will inspect the system and test the removal of the pumps.

G. If the Contractor fails to comply with any of the requirements of this section the start-up shall be rescheduled at the Contractor's expense with a minimum of two working days' notice for the next scheduled date.

H. It is the sole responsibility of the Contractor to maintain the security of the station and site until acceptance by the city.

2. Pump Station Inspections and Start-Up

A. All RTU work must be completed and tested by the City prior to start-up. Contractor shall allow sufficient time for the City to complete this work prior to requesting a start-up.

B. The Contractor shall verify that all systems are clear for operation and all valves are in the proper position.

C. The Contractor shall inspect all electrical, mechanical, and valve vault components prior to the station start-up.

3. Contractor Responsibilities During Start-Up

A. All pump test results must be documented by the pump manufacturer or there representative.

4. Upon completion of the lift station start-up, the Contractor and pump manufacturer shall complete the Lift Station Information data sheet provided in this section.

3.02 PUMP STATION THREE DAY TEST PROCEDURES

1. Contractor Requirements:

A. The Contractor shall contact the City's Water Reclamation department to schedule the three- d a y test. An email meeting request is required to schedule the test.

B. The three-day test must run three consecutive working days. All three-day tests shall be scheduled Monday through Friday between the hours of 7:00 AM and 3:00 PM. No testing shall begin after Wednesday of each week.

C. The Contractor shall employ a competent contact person to be on-site each morning of the testing period. This person's name and phone number must be provided to the city prior to testing.

D. Two working days' notice is required in advance of scheduling the three-day test.

E. It is the sole responsibility of the Contractor to maintain the security of the station and site until acceptance by the City. The Contractor shall be financially responsible and liable for the lift station prior to acceptance by the City.

F. If deemed necessary and at the sole discretion of the City, the three-day test may be required to be extended due to abnormal operation or failure during the three-day test. The contractor shall be responsible for supplying all necessary personnel and materials necessary for the additional testing.

2. Testing Procedures:

A. The Contractor shall test the station at 25% max capacity, 50% max capacity, 75% max capacity and 100% max capacity.

B. On the third day, the City's Maintenance Supervisor will confirm if the test has been successfully completed or if additional testing is required.

END OF SECTION

SECTION 15000

MECHANICAL, GENERAL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide all piping and mechanical systems indicated, complete and operable, in accordance with the Contract Documents.

2. The provisions of this Section shall apply to all piping sections in Divisions 2 and 15.

3. The mechanical drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, and connectors for a complete and functional system.

4. All above-ground pipe, valves, fittings, metallic and non-metallic marking tapes, and any other marking device, will be color coded as specified in Section 09800 – Protective Coating.
5. Pipeline markers shall be as specified in Sections 02595 irrigation water if applicable. The markers will not be placed in contact with DIP fittings.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be furnished in accordance with Section 01300 – Contractor Submittals.

2. Certifications

A. All necessary certificates, test reports, and affidavits of compliance shall be submitted by the Contractor.

PART 2 -- PRODUCTS

2.01 GENERAL

1. Extent of Work: All pipes, fittings, couplings and appurtenances shall be provided in accordance with the requirements of the applicable Sections of Divisions 2 and 15 and as indicated.

2. Pipe Supports: All pipes shall be adequately supported, restrained, and anchored as required on the Contract Drawings and Section 15006 – Pipe Supports.

3. Lining: Application, thickness, and curing of lining shall be in accordance with the requirements of the applicable Sections of Division 2, unless otherwise indicated.

4. Coating: Application, thickness, and curing of coating shall be in accordance with the requirements of the applicable Sections of Division 2, unless otherwise indicated. Pipes, valves and fittings above ground or in structures shall be field-coated in accordance with Section 09800 - Protective Coating.

5. Pressure Rating: All piping systems shall be designed for the maximum expected pressure as defined in Section 02666 - Pipeline Testing and Disinfection, or as indicated in this Specification.

6. Inspection: All pipe shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the City shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with requirements.

7. Tests: Except where otherwise indicated, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as recommended by AWS.

8. Torque Requirements: Tightening shall be performed as recommended by ASME PCC-1.

2.02 PIPE FLANGES

1. Steel Pipe Flanges: Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C 207 - Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In., Class D, or ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings, 150- lb. class. Where the design pressure is greater than 150 psi up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C 207 Class E or Class F, or ANSI/ASME B16.5 150-lb class. However, AWWA flanges shall not be exposed to test pressures greater than 125 percent of rated capacity. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ANSI/ASME B16.5, 300-lb class. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207. Flanges for miscellaneous small pipes shall be in accordance with the standards indicated for these pipes.

2. Flanged ductile iron pipe (with ductile iron threaded flanges): Where the design pressure is 125 psi or less, flanges shall conform to either ANSI/AWWA C115/A21.15 Class D or ANSI B16.1 125-lb class. Where the design pressure is greater than 125 psi, up to a maximum of 250 psi, flanges shall conform to either ANSI/AWWA C115/21.15 or ANSI B16.1 250-lb class. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA 115/21.15. Flanges for miscellaneous small pipes shall be in accordance with the standards specified for these pipes.

3. Blind Flanges: Blind flanges shall be in accordance with ANSI/AWWA C 207, or as indicated for miscellaneous small pipes. All blind flanges for pipe sizes 12 inches and over shall be provided with lifting eyes in the form of welded or screwed eye bolts.

4. Flange Coating: All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

5. Flange Bolts: All bolts and nuts shall conform to the materials as shown on the Construction Drawings, or as specified in the Specifications. Studs and bolts shall extend through the nuts a minimum of 1/4-inch. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts. The cut ends of all-thread shall be free of burs and sharp edges. Flange bolts/nuts shall be torqued to bolt specifications unless otherwise indicated. All threads on stainless steel bolts shall be protected with an anti-seize lubricant suitable for submerged stainless-steel bolts, to meet government specification MIL-A-907E. Anti-seize lubricant shall be classified as acceptable for potable water use by the NSF, organization which develops standards relating to public health safety and the environment. Buried bolts in poorly drained soil shall be coated the same as the buried pipe. Unless otherwise indicated, flange bolts shall be of Type 316 stainless steel (SS) and American made.

6. Flange Gaskets: Gaskets for flanged joints shall be full-faced, 1/16-inch-thick compressed sheets of aramid fiber base, with nitrile binder and non-stick coating, suitable for temperatures to 700 degrees F, a pH of one to eleven, and pressures to 1000 psig. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted, unless otherwise indicated.

7. Flange Gasket Manufacturers, or City approved equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.03 PIPING CONNECTIONS

1. Pipe Hangers, Supports, and Guides: Pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment. Supports and hangers shall be in accordance with Section 15006 – Pipe Supports.

2. Flanges and Pipe Threads: Flanges on equipment and appurtenances shall conform to ANSI B16.1, Class 125, or B16.5, Class 150, unless otherwise indicated. Pipe threads shall be in accordance with ANSI/ASME B1.20.1.

3. Flexible Connectors: Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment, and in piping systems where indicated. Flexible connectors shall be harnessed or otherwise anchored to prevent separation of the pipe where required by the installation. Flexible connectors for service temperatures up to 180 degrees F shall be flanged, reinforced Neoprene or Butyl spools, rated for a working pressure of 40 to 150 psi, or reinforced, flanged duck and rubber, as best suited for the application. Flexible connectors for service temperatures

above 180 degrees F shall be flanged, braided stainless steel spools with inner, annular, corrugated stainless steel hose, rate for minimum 150 psi working pressure, unless otherwise indicated. The connectors shall be a minimum of 9 inches long, face-to-face flanges, unless otherwise indicated. The final material selection shall be approved by the Manufacturer. The Contractor shall submit manufacturer's shop drawings and calculations.

2.04 GASKETS AND PACKINGS

1. Gaskets shall be in accordance with this Section.

2. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used.

3. Packing around rotating shafts (other than valve stems) shall be "O"-rings, stuffing boxes, or mechanical seals, as recommended by the manufacturer and approved by the City.

2.05 LIFT STATION DISCHARGE PIPING

1. Discharge piping in lift stations shall be HDPE, unless otherwise specified in the Drawings. All pipe penetrations in the wet well and valve vault shall be core bit drilled. Breaking, hammering, and other methods of concrete removal in these areas will not be accepted. All pipe penetrations in the wet well and valve vault shall be sealed with modular seals.

2.06 LOW-LEAD BRASS

1. All brass shall comply with the Federal Reduction of Lead in Drinking Water Act.

PART 3 – EXECUTION

3.01 MATERIAL DELIVERY, STORAGE, AND PROTECTION

1. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

3.02 GENERAL

1. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of the applicable Sections of Divisions 2 and 15.

2. Lined Piping Systems: The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints of lined pipes at screwed flanges shall be epoxy-coated to assure continuous protection.

3. All underground pipes shall be installed with 3" detectable marking tape, of appropriate

color, along the entire pipe length in accordance with manufacturer's specification.

4. All pipe, fittings, and identification tape shall be color coded in accordance with the APWA Uniform Color Code as specified in the respective pipe service specifications section. Electronic markers shall be installed at all fittings and changes in direction.
5. The detectable marking tape shall be installed during back-filling to 12 to 18 inches directly above the pipe.

6. Locating markers, as manufactured by 3M, shall be placed at all changes of direction, start and end of vertical deflections, and potable water and sanitary sewer services at the curb stop and property line respectively. Markers will be located at a maximum depth of 4 feet and shall not be placed in direct contact with metallic fittings.

7. The use of burlap, wood, or other similar temporary plugs will not be permitted on and pipes or valves.

8. Cleanup: After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be turned over in a clean and functional condition.

END OF SECTION

SECTION 15001

SADDLES, STOPS AND SMALL VALVES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide all miscellaneous small valve systems indicated, complete and operable, in accordance with the Contract Documents.

2. The provisions of this Section shall apply to all piping sections in Divisions 2 and 15.

3. The mechanical drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, and connectors for a complete and functional system.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be furnished in accordance with Section 01300 – Contractor Submittals.

2. Contractor shall provide manufacture data for all valves, saddles, and stops.

PART 2 -- PRODUCTS

2.01 GATE VALVES FOR SERVICES (2-INCH)

1. All Gate Valves shall be resilient-seated gate valves. Resilient-seated gate valves shall conform to ANSI/AWWA C 515 – Resilient-Seated Gate Valves for Water Supply Service. The valves shall be suitable for a design working water pressure of 250 PSI. The valve body, bonnet, and disc shall be of ductile iron and the disc or body shall be rubber-coated. Body and bonnet wall thickness shall be equal to or greater than the minimum wall thickness as listed in Table 1 of ANSI/AWWA C 515. The stem, stem nuts, glands, and bushings shall be of bronze, with the stem seal per ANSI/AWWA C 515. Gate Valves shall be provided on all 2-inch services. The valves shall be threaded. Brass nipples shall be used to connect the valve to the tapping saddle, and the valve to the Sch. 80 PVC transition coupling.

2. Manufacturers for Gate Valves for Services (2-inch):

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 VALVE BOXES

1. Cast iron valve boxes shall be provided for all valves that are below finished grade elevations. Valve boxes shall be a two-piece screw type consisting of a cast iron base and adjustable cast iron top section with cover that shall be marked "WATER," "IRR" or "SEWER", unless otherwise noted on the Drawings.

2. Manufacturers of Valve Boxes for Water, or City approved equal:

   SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

3. Manufacturers of Valve Boxes for Irrigation Water, or City approved equal:

   SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.03 METER BOXES

1. Meter boxes shall be provided for all potable water and irrigation water meters below finished grade elevations.

2. Meter boxes for potable water service shall consist of a base box and adjustable cover with dimensions shown in the Drawings. The meter box shall have appropriate pipe penetrations for service connections. The box cover shall have a hinged lid marked "City of Cape Coral" and "POTABLE WATER" as shown on the Drawings. The base box and hinged lid shall be black color for identification.

3. Meter boxes for irrigation water service shall consist of a base box and adjustable cover with dimensions shown in the Drawings. The meter box shall have appropriate pipe penetrations for service connections. The box cover shall have a hinged lid marked "City of Cape Coral" and "Reuse Water for Irrigation Only – Do Not Drink – No Beber" as shown on the Drawings. The base box and hinged lid shall be lavender color for identification.

4. Manufacturers of Meter Boxes

   A. Unimproved Properties

      1) No meter boxes on unimproved properties.

   B. Improved Properties

      1) Single Residential Potable Water Service (1") to Accommodate One 5/8" Meter: **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**. Boxes shall be black, reading CITY OF CAPE CORAL, POTABLE WATER, furnished with a hinged cover without reading lead, snap lock tab & no hole. The box shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** with 12" deep body. Provide one 3" wide x 4" tall mouse hole centered at both ends of box body.

      2) Double Residential Potable Water Service (1") to Accommodate Two 5/8" Meters: **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT**

LIST. Boxes shall be black, reading CITY OF CAPE CORAL, POTABLE WATER, furnished with a hinged cover without reading lead, snap lock tab & no hole. The box shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** with 12" deep body. Provide one 3" wide x 4" tall mouse hole centered on the inlet end of box body. Provide two 3" wide x 4" tall mouse holes centered 6.5" apart at outlet end of box body.

3) Single Commercial/Residential Potable Water Service (2") to Accommodate One 1.5" or 2" Meter: **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**. Boxes shall be black, reading CITY OF CAPE CORAL, POTABLE WATER, furnished with a flush solid cover without reading lead, snap lock tab & no hole. The box shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** with 12" deep body. Provide one 3" wide x 4" tall mouse hole centered at both ends of box body.

4) Single and Double Residential Irrigation Water Service (1") to Accommodate No Meters: **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**. Boxes shall be lavender, reading **CITY OF CAPE CORAL, REUSE WATER FOR IRRIGATION** USE ONLY, furnished with a hinged cover without reading lead, snap lock tab & no hole. The box shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** with 12" deep body. Provide one 3" wide x 4" tall mouse hole centered at both ends of box body.

5) Single Commercial/Residential Irrigation Water Service (2") to Accommodate One 1.5" or 2" Meter: **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**. Boxes shall be lavender, reading CITY OF CAPE CORAL, REUSE WATER FOR IRRIGATION USE ONLY, furnished with a flush solid cover without reading lead, snap lock tab & no hole. The box shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** with 12" deep body. Provide one 3" wide x 4" tall mouse hole centered at both ends of box body.

2.04 SERVICE SADDLES

1. Service saddles up to 6-inches shall be brass only. Service saddles 10-inches and greater shall be double strap, ductile iron saddles. Saddles shall be anchored by a minimum of two bolts for brass saddles up to 6" and a minimum of four bolts for cast iron saddles 10" and larger and sized to fit the pipe material of the line being tapped. For AWWA C 900 PVC pipe the saddle shall be sized for the exact outside diameter of the pipe. The saddles will have a bearing area of sufficient width along the axis of the pipe so that the pipe will not be distorted when the saddle is made tight. Sealing gaskets will be BUNA-N rubber and straps will be corrosion resistant alloy steel. If the outlet is greater than 2 inches then tapping sleeves and valves for full body fitting will be used.

2. An internal shell cutter will be used to drill through the corporation stop to minimize PVC shavings, retain the coupon, and reduce stress. Single fluted shell cutters, twist

drills or hole saws are not acceptable. Shell cutter will have sufficient depth to handle the heavy wall PVC pipe.

3. Ductile iron pipe may not be directly tapped. Service Saddles must be used on all pipes that are to be tapped.

4. Manufacturers for Service Saddles:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.05 CORPORATION STOPS

1. All corporation stops shall be designed and manufactured to conform to AWWA Standard C- 800 and shall be ball valve type. This specification covers thread dimensions, the metal alloy, and the pressure rating for all valves. All corporation stops shall be individually inspected and tested for leaks with air pressure. The corporation stops shall all be compatible with tapping machines of current design. Corporation stops shall be designed to withstand working pressures up to 300 psi.

2. Manufacturers for Corporation Stops:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.06 CURB STOPS AND BRASS FITTINGS

1. All curb stops shall be designed and manufactured to conform to AWWA Standard C-800 (ASTM B-62) and shall be oriseal or ball valve type of same size as the connecting service line unless otherwise indicated on the drawings. Curb stops shall be compression fitting and ensure tightness in both directions at all pressures, easy turning, non-binding, with minimum pressure loss. Curb stops shall be a solid one-piece tee-head and stem. Curb stops shall allow 90° motion and shall be enclosed and protected. Curb stops shall have a heavy cast bronze body and shall be designed to withstand working pressures up to 300 PSI. The ends shall be integral or secured with adhesive to prevent unintentional disassembly. A bronze or plastic ring shall lock the stem solidly into the body of the valve. EPDM O-rings in the stem shall assure permanent watertight seal at top. The curb stops shall have lock wings. Irrigation water curb stops shall be positively identified by manufacturer supplied tag or bronze imprint. Potable water curb stops shall be positively identified by field attached blue plastic tie-wrap fixed to the body of the curb stop on the inlet and outlet side of the valve or through hole in the tee- head.

2. Manufacturers for Curb Stops and Brass Fittings:

   A. The following equipment and manufacturers shall be used for potable water and irrigation water curb stops as shown on the Contract Drawings:

   B. 1” SINGLE POTABLE WATER (RESIDENTIAL, SHORT AND LONG SIDE) Ball type curb stop with CTS compression x FNPT. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

1) 1” SINGLE IRRIGATION WATER (RESIDENTIAL, SHORT AND LONG SIDE) Ball type curb stop with CTS compression x FNPT for reclaimed water. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

C. 1” DOUBLE POTABLE WATER (RESIDENTIAL, SHORT SIDE AND LONG SIDE)

1) 1” x ¾” x 6 ½” U-branch and two (2) ¾” ball type curb stop with FNPT x FNPT. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

D. 1” DOUBLE IRRIGATION WATER (RESIDENTIAL, SHORT AND LONG SIDE)

1) 1” x 1” x 1” Brass Tee and two (2) 1” ball type curb stop with CTS compression x FNPT for reclaimed water. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

E. 2” POTABLE WATER (COMMERCIAL/RESIDENTIAL) – HDPE OPTION

1) Ball type curb stop with CTS compression adaptor x FNPT. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

F. 2” POTABLE WATER (COMMERCIAL/RESIDENTIAL) – PVC OPTION

1) Ball type curb stop with PVC compression adaptor x FNPT. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

G. 2” IRRIGATION WATER (COMMERCIAL/RESIDENTIAL) – HDPE OPTION

1) Ball type curb stop with CTS compression adaptor x FNPT for reclaimed water. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

H. 2” IRRIGATION WATER (COMMERCIAL/RESIDENTIAL) – PVC OPTION

1) Ball type curb stop with PVC compression adaptor x FNPT for reclaimed water. **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

2.07 LEAD REQUIREMENTS

1. All products shall comply with the Safe Drinking Water Act (SDWA), including the amendment from Bill S. 3874 the Reduction of Lead in Drinking Water Act. This amendment reduces the maximum allowable percentage of lead from 8.00% to 0.25% (weighted average) as it pertains to “pipe, pipe fittings, plumbing fittings and fixtures”.

PART 3 – EXECUTION

3.01 MATERIAL DELIVERY, STORAGE, AND PROTECTION

1. All fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

3.02 GENERAL

1. All valves and appurtenances shall be installed in accordance with the requirements of the applicable Sections of Divisions 2 and 15, and in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 15006

PIPE SUPPORTS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide pipe supports, hangers, guides, and anchors, complete, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be in accordance with Section 01300 - Contractor Submittals.

2. Contractor shall submit manufacturer's data.

3. The requirements of Section 15000 – Mechanical, General apply to this Section.

PART 2 -- PRODUCTS

2.01 GENERAL REQUIREMENTS

1. Code Compliance: All piping systems and pipe connections to equipment shall be properly anchored and supported to prevent undue deflection, vibration, dislocation due to seismic events and line pressures, and stresses on piping, equipment, and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME B31.1 - Power Piping, except as supplemented or modified below. Supports for plumbing piping shall be in accordance with and meet the requirements of the latest edition of the applicable plumbing code or local administration requirements.

2. Structural Members: Wherever possible, pipes shall be supported from structural members. Where it is necessary to frame structural members between existing members, the Contractor shall provide such supplementary members. All supplementary members shall be in accordance with the requirements of the building code and the American Institute of Steel Construction and shall be acceptable to the City.

3. Pipe Hangers: Pipe hangers shall be capable of supporting the pipe in all conditions of operation, allowing free expansion and contraction of the piping, and preventing excessive stress on equipment. All hangers shall have a means of vertical adjustment after erection. Hangers shall be designed to prevent becoming disengaged by any movement of the supported pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading only.

4. Spring-Type Hangers: Spring-type pipe hangers shall be provided for piping subject to vibration or vertical expansion and contraction, such as engine exhausts and similar piping. All spring-type hangers shall be sized to the manufacturer's printed recommendations and the loading conditions encountered. Variable spring supports

shall be provided with means to limit misalignment, buckling, eccentric loading, or to prevent overstressing of the spring and with means to indicate at all times the compression of the spring. Supports shall be capable of accommodating at least 4 times the maximum travel due to thermal expansion.

5. Thermal Expansion: Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints permitting the piping to expand and contract freely in directions away from the anchored points. All components shall be structurally suitable to withstand all loads imposed.

6. Heat Transmission: Supports, hangers, anchors, and guides shall be so designed and insulated to prevent excessive heat from being transmitted to the structure or to other equipment.

7. Riser Supports:

   A. Above Grade: Where practical, risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.

   B. Below Grade: Riser supports shall be anchored into the wet well walls as shown on the Drawings.

8. Freestanding Piping: Free-standing pipe connections to equipment such as chemical feeders and pumps shall be firmly attached to steel frames fabricated from angles, channels, or I- beams anchored to the structure. Exterior, free-standing overhead piping shall be supported on fabricated pipe stands consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps securing the pipes.

9. Materials of Construction:

   A. General: All pipe support assemblies, including framing, hardware, and anchors, shall be 316 American made stainless steel construction, unless otherwise indicated.

   B. Submerged Supports: All submerged piping, as well as piping, conduits, and equipment in hydraulic structures within 24 inches of the water level, shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 American made stainless steel, unless otherwise indicated.

   C. Corrosive: All piping in chemical and corrosive areas shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 American made stainless steel or FRP, unless otherwise indicated.

10. Point Loads: Any meters, valves, heavy equipment, and other point loads on PVC, FRP, and other plastic pipes, shall be supported on both sides, according to manufacturer's recommendations to avoid undue pipe stresses and failures. To avoid

point loads, all supports on PVC, FRP, and other plastic piping shall be equipped with extra wide pipe saddles or 316 American made stainless steel shields.

11. Noise Reduction: To reduce transmission of noise in piping systems, all copper tubes in buildings and structures shall be wrapped with a 2-inch-wide strip of rubber fabric or similar, suitable material at each pipe support, bracket, clip, or hanger.

2.02 SUPPORT SPACING

1. Supports for piping with the longitudinal axis in approximately a horizontal position shall be spaced to prevent excessive sag, bending, and shear stresses in the piping, with special consideration given where components such as flanges and valves impose concentrated loads. Pipe support spacing shall not exceed the maximum spans in the tables below. For temperatures other than ambient temperatures, or those listed, and for other piping materials or wall thickness, the pipe support spacing shall be modified in accordance with the pipe manufacturer's recommendations. Vertical supports shall be provided to prevent the pipe from being overstressed from the combination of all loading effects.

A. Support Spacing for Ductile-Iron Pipe:

Nominal Pipe Diameter	Maximum Span (feet)
All Diameters	Two supports per pipe length or 10 feet (one of the 2 supports located at joint) (except at canal crossings)

B. Support Spacing for Copper Tubing:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
1/2 to 1-1/2	6
2 to 4	10
6 and greater	12

C. Support Spacing for Schedule 80 PVC Pipe:

NominalPipe Diameter (inches)	Maximum Span (at 100 degrees F) (feet)
1/2	4
3/4	4.5
1	5
1-1/4	5.5
1-1/2	5.75
2	6.25
3	7.5
4	8.25
6	10
8	11
10	12.25
12	13.25

2.03 COATING

1. Galvanizing: Only where indicated, fabricated pipe supports other than stainless steel or non-ferrous supports shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM A 123 - Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

2. Other Coatings: Other than stainless steel or non-ferrous supports, all supports shall receive protective coatings in accordance with the requirements of Section 09800 - Protective Coating.

PART 3 -- EXECUTION

3.01 INSTALLATION

1. General: All pipe supports, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions and ANSI/ASME 831.1 - Power Piping. All concrete inserts for pipe hangers and supports shall be coordinated with the placement of concrete.

2. Appearance: Pipe supports and hangers shall be positioned to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, without interference with other WORK.

END OF SECTION

SECTION 15201

TAPPING VALVES AND SLEEVES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide tapping valves, sleeves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. The Contractor shall furnish submittals in accordance with Section 01300 – Contractor Submittals.

2. Contractor shall submit manufacturer's data.

PART 2 – PRODUCTS

2.01 TAPPING VALVE AND SLEEVE

1. Construction: Tapping valves shall conform to ANSI/AWWA C 515 - Standard for Resilient seated gate valves for Water Supply Service except as modified for passage and clearance of tapping machine cutters. Tapping valves shall allow full-size cutters to be used. Seats in the body shall be replaceable without removing the valve from the pipeline. Tapping sleeves shall conform to AWWA C223 and be constructed of ductile iron, gaskets shall be vulcanized natural or synthetic rubber. Stainless steel sleeves are not allowed. Hardware and fasteners for tapping sleeves and valves shall be 304 or 316 stainless steel and American made. Tapping sleeves shall be epoxy coated inside and out. The epoxy coating shall conform to City of Cape Coral Technical Specifications Section 09800 for potable water use or for force main fittings.

2. Actuators: Unless otherwise indicated, all gate valves shall have manual actuators.

3. Manufacturers for MJ Tapping Sleeves:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

4. Manufacturers for Tapping Valves:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

PART 3 -- EXECUTION

3.01 INSTALLATION

1. All tapping valves and sleeves shall be installed in strict accordance with the Manufacturer's written recommendations. DO NOT drill a hole in PVC pipe with a twist drill or auger bit. DO NOT use a hand-held drill. Cutting tool shall be of a shell type design, having a minimum of two slots that retains the cut coupon after penetrating the pipe wall and shall be designed to accommodate C900 PVC pipe. Tapping branches of same diameter as pipeline being tapped shall not be permitted. In this case a cut-in tee shall be provided.

2. All materials including but not limited to the tee, valve, and cutting tool shall be disinfected prior to assembly.

3. The assembly shall be pressure tested at 150 PSI under the supervision of a City of Cape Coral inspector with a minimum of 48-hours advanced noticed required.

4. Remove the coupon of flush out all debris after the tap has been completed.

5. The Contractor is responsible to retrieve any coupon that was not removed after the tap and flush. This may include flushing the nearest hydrant and/or removing a section of the water main to remove the coupon. Any bacteriological testing required due to removal is the sole responsibility of the contractor.

6. All tapping sleeves must be located a minimum of 24” from an existing bell, flange, fitting, or tap.

7. Size on size taps are not permitted.

END OF SECTION

SECTION 15203

CHECK VALVES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide check valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. The Contractor shall furnish submittals in accordance with Section 01300 – Contractor Submittals.

2. The Contractor shall submit manufacturer's data.

PART 2 – PRODUCTS

2.01 CHECK VALVES (3-INCH AND SMALLER)

1. Check valves 3 inches and smaller in size shall be bronze swing check valves complying with all requirements for Type III and Type IV valves as covered in Federal Specification WW-V-51a for Class "A" 125-pound Bronze Check Valves. Check valves for chemical feed lines, except sulfuric acid lines, shall be swing check valves with PVC body and EPDM seats and seals by Asahi/America, Inc., Medford, Mass.

2.02 CHECK VALVES (4-INCH AND LARGER)

1. The valves shall be designed, manufactured, tested and certified to American Water Works Association Standard ANSI/AWWA C508.

2. The valves used in potable water service shall be certified to NSF/ANSI 61 Drinking Water System Components – Health Effects, and certified to be Lead-Free in accordance with NSF/ANSI 372.

3. The valves shall have flanges with drilling to ANSI B16.1, Class 125.

4. The valve body shall be full flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for field installation of a backflow actuator or oil cushion device without special tools or removing the valve from the line.

5. The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operating in lines containing high solids content. A threaded port with

pipe plug shall be provided in the access cover to allow for field installation of a mechanical, disc position indicator.

6. The disc shall be of one-piece construction, precision molded with an integral O-ring type sealing surface and reinforced with alloy steel. The flex portion of the disc contains nylon reinforcement and shall be warranted for twenty-five years. Non-Slam closing characteristics shall be provided through a short 35-degree disc stroke and a memory disc return action to provide a cracking pressure of 0.25 psig.

7. The valve disc shall be cycle tested 1,000,000 times in accordance with ANSI/AWWA C508 and show no signs of wear, cracking, or distortion to the valve disc or seat and shall remain drop tight at both high and low pressures.

8. The valve body and cover shall be constructed of ASTM A536 Grade 65-45-12 ductile iron.

9. The disc shall be precision molded Buna-N (NBR), ASTM D2000-BG.

10. The exterior and interior of the valve shall be coated with an NSF/ANSI 61 approved fusion bonded epoxy coating.

11. All exposed bolts, nuts, hardware, and other miscellaneous items shall be 316 stainless steel and American made.

12. Manufacturers:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

PART 3 -- EXECUTION

3.01 GENERAL

1. All valves shall be installed in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 15206

RESILIENT WEDGE GATE

VALVES

PART 1 – GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide gate valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. The Contractor shall furnish submittals in accordance with Section 01300- Contractor Submittals.

2. The Contractor shall submit manufacturer's data.

PART 2 – PRODUCTS

2.01 GENERAL

1. All buried valves shall be of the inside screw, non-rising stem type. The valve actuators shall be as indicated, with counter-clockwise opening stems.

2.02 RESILIENT-SEATED GATE VALVES (12 inches and smaller)

1. General: All Gate Valves shall be resilient-seated gate valves.

2. Construction: Resilient-seated gate valves shall conform to ANSI/AWWA C 515 - Resilient- Seated Gate Valves for Water and Sewerage Systems. The valves shall be suitable for a design working water pressure of 200 psig, with flanged or mechanical joint ends. The valve body, bonnet, and disc shall be of ductile iron and the disc or body shall be rubber-coated. Body and bonnet wall thickness shall be equal to or greater than the minimum wall thickness as listed in Table 2 of ANSI/AWWA C515. The stem, stem nuts, glands, and bushings shall be of bronze or stainless steel, with the stem seal per ANSI/AWWA C 515. Valves shall have 2" actuating nuts. All associated plugs, bolts, hardware and other miscellaneous items for valves shall be 304 or 316 stainless steel unless otherwise specified.

3. Two stem seals will be provided and the stem seals will be of the O-ring type. The stem nut must be independent of the gate.

4. Protective Coating: All valves shall be factory painted and coated in accordance with Section 09800 - Protective Coating.

5. Actuators: Resilient-seated gate valves shall have manual actuators. The actuator must be the same manufacture or brand of the installed valve. All associated plugs, bolts, hardware and other miscellaneous items for valves shall be 304 or 316 stainless steel unless otherwise specified.

6. Manufacturers: **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

2.03 RESILIENT-SEATED GATE VALVES (Above Ground Installation)

1. General: All Gate Valves shall be Resilient-Seated Gate Valves.

2. Construction: Resilient-seated gate valves shall conform to ANSI/AWWA C 515 - Resilient- Seated Gate Valves for Water and Sewerage Systems. The valves shall be suitable for a design working water pressure of 250 psig (unless otherwise specified), with flanged ends. The valve body, bonnet, and disc shall be of ductile iron and the disc shall be rubber-coated. Body and bonnet wall thickness shall be equal to or greater than the minimum wall thickness as listed in Table 2 of ANSI/AWWA C515. The stem, stem nuts, glands, and bushings shall be of bronze or stainless steel, with the stem seal per ANSI/AWWA C 515. Valves shall have handwheel operation. All associated plugs, bolts, hardware and other miscellaneous items for valves shall be 304 or 316 stainless steel unless otherwise specified.

3. Two stem seals (minimum) will be provided and the stem seals will be of the O-ring type. The stem nut must be independent of the gate.

4. Protective Coating: All valves (interior and exterior) shall be factory fusion-bonded epoxy-coated in accordance with AWWA C550. See Section 09800 - Protective Coating.

5. Actuators: Resilient-seated gate valves shall have manual actuators. The actuator must be the same manufacture or brand of the installed valve. All associated plugs, bolts, hardware and other miscellaneous items for valves shall be 304 or 316 stainless steel unless otherwise specified. Valve installation (vertical or horizontal) must be verified for proper gear orientation.

6. Manufacturers: **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

PART 3 – EXECUTION

3.01 GENERAL

1. All gate valves shall be installed in accordance with the manufacturer's instructions. All valves in plastic lines shall be properly supported at each end of the valve.

END OF SECTION

SECTION 15208

AIR RELEASE VALVES AND COMBINATION AIR/VACUUM RELEASE VALVE'S

PART 1 – GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide air release valves and combination air/vacuum release valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. The Contractor shall furnish submittals in accordance with Section 01300 – Contractor Submittals.

2. The Contractor shall submit manufacturer's data.

PART 2 – PRODUCTS

2.01 AIR RELEASE AND COMBINATION AIR/VACUUM RELEASE VALVES FOR SEWER F O R C E MAINS

1. General: All sewer force mains shall have air release valves or combination air/vacuum release valves installed as indicated on the Drawings. Valves shall be slow-closing type. All combination air/vacuum release valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer's recommendations. The floats, float- guide, and stem shall be type 316 stainless steel and American made. All below ground air release valves shall be covered with a cast iron manhole lid, minimum 24-inches in diameter.

2. Manufacturers, or approved equal:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 COMBINATION AIR RELEASE VALVES FOR WATER SERVICE

1. General: All potable water and irrigation water mains shall have air release valves or combination air/vacuum release valves installed as indicated on the Drawings. Valves shall be slow-closing type. The floats, float-guide, and stem shall be type 316 stainless steel and American made. All below ground air release valves shall be covered with a cast iron manhole lid, minimum 24-inches in diameter.

2. Manufacturers, or approved equal:

A. All combination air/vacuum release valves for water and irrigation service shall be:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.03 AIR RELEASE VALVE AND COMBINATION AIR/VACUUM RELEASE ASSEMBLY

1. Construction: The air release and combination air/vacuum release valve assembly shall include a pedestal housing designed to accommodate the assembly. The housing shall be self-latching with locking mechanism and shall have complete 360-degree access working area. The base shall be ribbed for strong support and stability. A location stripe shall be available for customized labeling and identification.

2. A total of six keys for the locking mechanism for each air release valve and combination air/vacuum release assemblies shall be provided by the Contractor to the City. The locking device shall be series LOO locking device.

3. All air release and combination air/vacuum release valve assemblies shall be provided with a one- foot concrete pad at the base as shown in the drawings.

PART 3 -- EXECUTION

3.01 INSTALLATION

1. All combination air release valves shall have an isolation valve connection for control as shown on the Drawings and shall be installed in strict accordance with the Manufacturer's published recommendations.

2. All piping shall be installed to prevent sewage from draining onto the ground.

3. Air release valve assemblies shall not be located in swales. Where swales are present, the ARV's shall be located one-foot from Right-Of-Way line as shown on the Drawings.

END OF SECTION

SECTION 16050

ELECTRICAL WORK, GENERAL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide electrical Work, complete and operable, in accordance with the Contract Documents.

2. The provisions of this Section apply to all sections in Division 16, except as indicated otherwise.

3. The Work of this Section is required for operation of electrically driven equipment provided under specifications in other Divisions. The Contractor's attention is directed to the requirement for proper coordination of the Work of this Section with the Work of equipment specifications and other sections.

4. All concrete, excavation, backfill, and steel reinforcement work required for encasement, installation, or construction of the Work of the various sections of Division 16 shall be performed per the applicable specification section, including duct banks, manholes, handholds, equipment housekeeping pads, and light pole bases.

5. Section Includes: General administrative, procedural requirements, and installation methods for electrical installations specified in Division 16.

6. The Drawings are schematic and are not intended to show every detail of construction.

   A. In general, conduits/raceways, transitions and offsets shown on Drawings indicate approximate locations in plan and elevation where the systems are intended to be run.

   B. Contractor shall fully coordinate electrical Work with other trades to avoid interferences.

   C. In the event of interferences, Contractor shall request clarification from ENGINEER in writing.

1.02 REFERENCE STANDARDS

1. The Work of this Section and all sections in Division 16 shall comply with the following as applicable:

NEC (NFPA 70)	National Electrical Code
NETA	International Electrical Testing Association
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
NFPA	National Fire Protection Association

2. All electrical equipment including electrical control panel system shall be listed by and shall bear the label of Underwriters' Laboratories, Inc. (UL) or an independent testing laboratory acceptable to the local code enforcement agency having jurisdiction.

3. Installation of electrical equipment and materials shall comply with OSHA Safety and Health Standards (29 CFR 1910 and 29 FR 1926, as applicable), state building standards, and applicable local codes and regulations.

4. Where the requirements of the specifications conflict with UL, NEMA, NFPA, or other applicable standards, the more stringent requirements shall govern.

1.03 SIGNAGE AND MARKINGS

1. Identification: Provide danger, caution, and warning signs and equipment identification markings in accordance with applicable federal and state OSHA, NFPA, and NEC requirements. Refer to Section 16075 for additional requirements.

1.04 PUBLIC UTILITIES REQUIREMENTS

1. The Contractor shall contact the serving utility and verify compliance with requirements before construction. The Contractor shall coordinate schedules. Payment for Work performed by all utilities will be provided by the CITY. Bracing of power poles and relocation of power drops, as required, will be by the Contractor.

2. Electrical service shall be as indicated and be as required by the serving utility.

3. The Contractor shall verify and provide all service conduits, fittings, transformer pads, grounding devices, handholes, service wires not provided by the serving utility, and any additional requirements per the utility's standard in order to provide power to the site.

4. The Contractor shall verify with the utility and the City, the exact location of each service point and type of service. Payment of charges levied by the serving utilities will be by the Contractor.

5. In lift station locations where there are no existing power poles on site, new electrical service shall be run underground.

1.05 PERMITS AND INSPECTION

1. Contractor shall procure all necessary permits and licenses, observe and abide by all applicable laws, codes, regulations, ordinances, and rules of the State, territory, or political subdivision thereof, wherein Work is done, or any other duly constituted public authority, and further agrees to hold OWNER harmless from liability or penalty which might be imposed by reason of an asserted violation of such laws, codes, regulations, ordinances, or other rules. The Contractor is responsible for acquiring the electrical permit and obtaining a satisfactory inspection of the completed facility.

   A. Upon completion of Work, Contractor shall secure certificates of inspection from the inspector having jurisdiction and shall submit 3 copies of the

certificates to OWNER. Contractor shall pay the fees for the permits, inspections, licenses, and certifications when such fees are required.

1.06 CONTRACTOR SUBMITTALS

1. General: Submittals shall be furnished in accordance with Section 01300 – Contractor Submittals

2. Shop Drawings: Include the following:

   A. Complete material lists stating manufacturer and brand name of each item or class of material.
   B. Shop Drawings for all grounding Work not specifically indicated.
   C. Front, side, rear elevations, and top views with dimensional data.
   D. Location of conduit entrances and access plates.
   E. Component data including size parameters.
   F. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size, and cable numbers.
   G. Method of anchoring and equipment weight.
   H. Types of materials and finish.
   I. Nameplates.
   J. Temperature limitations, as applicable.
   K. Voltage, phase, and panel full load current data, as applicable.
   L. Front and rear access requirements.
   M. Test reports.
   N. Grounding requirements.
   O. Catalog cuts or photocopies of applicable pages of bulletins or brochures for mass produced, non-custom manufactured material. Catalog data sheets shall be stamped to indicate the project name, applicable Section and paragraph, model number, and options.

3. Shop Drawings shall be custom prepared. Drawings or data indicating "optional" or "as required" equipment are not acceptable. Options not proposed shall be crossed out or deleted from Shop Drawings.

4. Materials and Equipment Schedules: The Contractor shall deliver to the City within 30

days of the commencement date of the Notice to Proceed, a complete list of materials, equipment, apparatus, and fixtures proposed for use. The list shall include type, sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

5. OWNER'S MANUALS: Complete information in accordance with Section 01300.

6. Record Drawings: The Contractor shall show invert and top elevations and routing of all duct banks and concealed below-grade electrical installations. Record drawings shall be prepared, be available to the City, and be submitted according to Section 01300.

7. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01730, operation and maintenance manuals for items included under this Section. Include following information for equipment items:

   A. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

   B. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

   C. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

   D. Servicing instructions and lubrication charts and schedules.

1.07 AREA DESIGNATIONS

1. General

   A. Electric Work specifically indicated in sections within any Division of the Specifications shall comply with those requirements.

   B. Installations in hazardous locations shall conform strictly to the requirements of the Class, Group, and Division indicated. All influent wet wells are classified as Class I, Division I, and Group C and D.

2. Material Requirements

   A. NEMA 4X enclosures shall be American made 316 stainless steel.

   B. NEMA 7 enclosures shall be cast aluminum.

1.08 TESTS

1. The Contractor shall be responsible for all factory and field tests required by the specifications. All field tests shall be witnessed by the City. The Contractor shall furnish all necessary testing equipment and pay all costs of tests, including all replacement parts and labor, due to damage resulting from damaged equipment or from testing and correction of faulty installation.

2. Where test reports are indicated, proof of design test reports for mass-produced equipment shall be submitted with the shop drawings, and factory performance test reports for custom- manufactured equipment shall be submitted and be approved prior to shipment. Field test reports shall be submitted for review prior to Substantial Completion.

3. Any equipment or material, which fails a test, shall be removed and replaced.

PART 2 – PRODUCTS

2.01 GENERAL

1. All equipment and materials including electrical control panel system shall be new, shall be listed by UL, and shall bear the UL label. All equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the Work shall be products of the same manufacturer. All equipment and materials shall be of industrial grade standards of construction.

2. Where a NEMA enclosure type is indicated in a non-hazardous location, the Contractor shall utilize that type of enclosure, despite the fact that certain modifications such as cutouts for control devices may negate the NEMA rating.

3. All devices indicated to display dates, shall display the year as 4-digit number.

2.02 MOUNTING HARDWARE

1. Miscellaneous Hardware

A. All nuts, bolts, and washers shall be 316 American made stainless steel.

B. Threaded rods for trapeze supports shall be continuous threaded, 316 American made stainless steel, 3/8" diameter minimum.

C. Strut for mounting of conduits and equipment shall be 316 American made stainless steel. Where contact with concrete or dissimilar metals may cause galvanic corrosion, suitable non-metallic insulators shall be utilized to prevent such corrosion. Strut shall be as manufactured by Unistrut, B-Line, or City approved equal.

D. Anchors for attaching equipment to concrete walls, floors and ceilings shall be 316

American made stainless steel expansion anchors, such as "Rawl-Bolt," "Rawl-Stud" or "Lok-Bolt" as manufactured by Rawl; similar by Star, or City approved equal. Wood plugs shall not be permitted.

2.03 ELECTRICAL IDENTIFICATION

1. Nameplates: Nameplates shall be fabricated from white-letter, blackface laminated plastic engraving stock, Formica types ES-1, or City approved equal. Each shall be fastened securely, using American made stainless steel fasteners screwed into inserts or tapped holes, as required. Engraved characters shall be block style with no characters smaller than 1/8-inch high.

2. Conductor and Equipment Identification: Conductor and equipment identification devices shall be either imprinted plastic-coated cloth marking devices such as manufactured by Brady, Thomas & Betts, or City approved equal, or shall be heat-shrink plastic tubing, imprinted split- sleeve markers cemented in place, or City approved equal.

PART 3 -- EXECUTION

3.01 GENERAL

1. Incidentals: The Contractor shall provide all materials and incidentals required for a complete and operable system, even if not required explicitly by the Specifications or the Drawings. Typical incidentals are terminal lugs not furnished with vendor supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and control wiring required by vendor furnished equipment to connect with other equipment indicated in the Contract Documents.

2. Field Control of Location and Arrangement: The Drawings diagrammatically indicate the desired location and arrangement of outlets, conduit runs, equipment, and other items. Exact locations shall be determined by the Contractor in the field based on the physical size and arrangement of equipment, finished elevations, and other obstructions. Locations shown on the Drawings, however, shall be followed as closely as possible.

3. Where conduit development drawings or "home runs" are shown, the Contractor shall route the conduits in accordance with the indicated installation requirements. Routings shall be exposed or encased as indicated, except that conduit in finished areas shall be concealed unless specifically indicated otherwise. Conduits encased in a slab shall be sized for conduit OD not to exceed one-third of the slab thickness and be laid out to not impede concrete flow. Encased conduits shall not be spaced closer than 3 outside diameters on centers.

4. Wherever conduits and wiring for lighting and receptacles are not indicated, it shall be the Contractor's responsibility to provide lighting and receptacle-related conduits and wiring as required, based on the actual installed fixture layout and the circuit designations as indicated. Wiring shall be #12 AWG minimum, and conduits shall be 3/4-inch minimum (exposed) and 1-inch minimum (encased). Where the number of current-carrying conductors in a raceway or cable exceeds three, the allowable ampacity

of each conductor shall be reduced in conformance to the NEC.

5. Workmanship: All materials and equipment shall be installed in strict accordance with printed recommendations of the manufacturer. Workers skilled in the Work shall accomplish installation. Installation shall be coordinated in the field with other trades to avoid interferences. All exposed conduits, fixtures, panels, etc. shall be installed in a plumb and neat manner.

6. Protection of Equipment and Materials: The Contractor shall fully protect all materials and equipment against damage from any cause. All materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. All moving parts shall be kept clean and dry. The Contractor shall replace or refinish all damaged materials or equipment, including faceplates of panels and switchboard sections, at no additional cost.

7. Incoming utility power equipment shall be provided in conformance with the utility's requirements. Coordinate with power company high voltage and/or low voltage metering requirements. Furnish, install, and connect metering equipment not furnished, installed or connected by power company. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

3.02 CORE DRILLING

1. The Contractor shall perform core drilling required for installation of raceways through concrete walls and floors. Locations of floor penetrations are approximate. Verify all exact core-drilling locations based on equipment actually furnished as well as exact field placement. To the extent possible, identify the existence and locations of encased raceways and other piping in existing walls and floors prior to any core drilling activities. Damage to any encased conduits, wiring, and piping shall be repaired at no extra cost.

3.03 EQUIPMENT ANCHORING AND IDENTIFICATION

1. Floor supported, wall, or ceiling hung equipment and conductors shall be anchored in place by methods that will meet seismic requirements in the area where project is located. Wall- mounted panels that weigh more than 500 pounds or which are within 18 inches of the floor shall be provided with fabricated steel support pedestals. If the supported equipment is a panel or cabinet enclosed within removable side plates, it shall match supported equipment in physical appearance and dimensions. Transformers hung from 4- inch stud walls and weighing more than 300 pounds shall have auxiliary floor supports.

2. Leveling channels anchored to the concrete pad shall be provided for all switchgear and pad- mounted transformer installations.

3. Anchoring methods and leveling criteria specified in the printed recommendations of the equipment manufacturers are a part of the Work of this Contract.

4. Floor mounted electrical equipment shall be mounted on a 4-inch-thick concrete housekeeping slab.
5. General: Equipment and devices shall be identified as follows:

   A. Nameplates shall be provided for all panelboards, control and instrumentation panels, starters, switches, and pushbutton stations. In addition to nameplates, control devices shall be equipped with standard collar-type legend plates.

   B. Control devices within enclosures shall be identified. Identification shall be similar to the subparagraph above.

   C. Toggle switches which control loads out of sight of switch and all multi-switch locations of more than 2 switches shall have suitable inscribed finish plates.

   D. Empty conduits shall be tagged at both ends to indicate the destination at the far end. Where it is not possible to tag the conduit, marking an adjacent surface shall identify destination.

   E. Equipment names and tag numbers shall be provided on all nameplates.

   F. The Contractor shall furnish typewritten circuit directories for panelboards; circuit directory shall accurately reflect the outlets connected to each circuit.

3.04 EQUIPMENT TESTING

1. Equipment Testing: The following tests which are applicable for a particular item of equipment shall be performed:

   A. Megger power circuit breakers and circuits supplied phase-to-phase and phase-to- ground (100 megohms minimum).

   B. Test current transformer circuits by applying current to secondary wiring at current transformer terminals until contactor trips.

   C. Test, time, and set protective relays. Relays shall be timed at various multiples (minimum of 3 points) of the pick-up value to determine agreement with published curves and adjust as necessary to agree with coordination study required settings. Exact tests to be performed vary with type of relay. Manufacturer's instructions for relay shall be complied with.

   D. After Work has been completed, demonstrate to OWNER's Representative that entire electrical installation is in proper working order and will perform functions for which it was designed by functional testing.
   E. Perform any specific tests required by the manufacturer's installation instructions.

3.05 CHECK-OUT PROCEDURES

1. In general, check-out procedures (as listed below) which are applicable for a particular item of equipment shall be performed:

   A. Before final acceptance, all parts of the Work shall be thoroughly cleaned. Exposed parts shall be thoroughly cleaned of cement, plaster, and other materials. All oil and grease spots shall be removed with a non-flammable cleaning solvent. Such surfaces shall be carefully wiped, and all cracks and corners scraped out. Paint touch- up shall be applied to all scratches on panels and cabinets. Electrical cabinets or enclosures shall be vacuum-cleaned.

   B. Wipe clean with a lint-free cloth insulator, bushings, bus supports, etc.

   C. Check and adjust time delay, under-voltage devices, phase relay, over-current relays, etc., as required by coordination study or ENGINEER.

   D. Fill motor bearings requiring oil.

   E. Check and change, as required, thermal overload heater elements to correspond with motor full-load current and service factors of installed motor.

   F. Check direction of rotation of motors and reverse connections if necessary. Check rotation with motor mechanically uncoupled where reverse rotation could damage equipment.

   G. Equipment with two or more sources of power connected by tie breakers, transfer switches, or generator receptacles shall be checked for rotation from each possible combination of power sources. Power sources must have the same phase sequence for each source throughout entire facility.

   H. Check exposed bolted power connections for tightness.

   I. Check operation of breakers, contactors, etc., and control and safety interlocks.

   J. Check tightness of bolted structural connections.

   K. Check leveling and alignment of enclosures.

   L. Check operating parts and linkages for lubrication, freedom from binding, vibration, etc.

   M. Check tightness and correctness of control connections at terminal blocks, relays, meters, switches, etc.

   N. Clean auxiliary contacts and exposed relay contacts after vacuuming.

END OF SECTION

SECTION 16070

SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

1. Section Includes: Secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.02 SUBMITTALS

1. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

   A. Product data for each type of product specified.

1.03 QUALITY ASSURANCE

1. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

1. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

   A. Slotted Metal Angle and U-Channel Systems:

      SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

   B. Conduit Sealing Bushings:

      SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 COATINGS

1. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors, in NEMA 4 or 4X areas, or embedded in concrete shall be hot-dip galvanized.

2.03 MANUFACTURED SUPPORTING DEVICES

1. Raceway Supports: Riser clamps and conduit straps.

2. Fasteners. Types, materials, and construction features as follows:

   A. Expansion Anchors: Carbon steel wedge or sleeve type.

   B. Toggle Bolts: Steel springhead type.

3. Conduit Sealing Bushings: Factory fabricated, watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

4. Cable Supports for Vertical Conduit: Factory fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable iron casting with hot-dip galvanized finish.

5. U-Channel Systems: 12 gauge or 0.105-inch-thick steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center in top surface. Provide fittings and accessories that mate and match with U-channel and are of same manufacturer.

2.04 FABRICATED SUPPORTING DEVICES

1. Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

2. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

1. Section Includes: Identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including, but not limited to, the following:

   A. Buried electrical line warnings.

   B. Identification labeling for cables and conductors.

   C. Operational instruction signs.

   D. Warning and caution signs.

   E. Equipment labels and signs.

1.02 SUBMITTALS

1. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

   A. Product Data for each type of product specified.

PART 2 – PRODUCTS

2.01 ELECTRICAL IDENTIFICATION PRODUCTS

1. Colored Adhesive Marking Tape for Wires and Cables: Self-adhesive, vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

2. Pre-tensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: Flexible acrylic bands sized to suit raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

3. Underground Line Marking Tape: Permanent, bright colored, continuous printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.

4. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letter.

5. Aluminum, Wraparound Cable Marker Bands: Bands cut from 0.014-inch-thick

aluminum sheet, fitted with slots or ears for securing permanently around wire or cable jacket or around groups of conductors. Provide for legend application with stamped letters or numbers.

6. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16 inch minimum thick for signs up to 20 square inches or 8 inches in length;
1/8-inch thick for larger sizes. Engraved legend in black letters on white face and punched for mechanical fasteners.

   A. Disconnect Switches: each disconnect switch shall be labeled to indicate its voltage, phase, amperes, and purpose or short description (e.g. Main Disconnect).

7. Baked Enamel Warning and Caution Signs for Interior Use: Pre-printed aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.

   A. 600 volts nominal or less: Entrances to enclosures that contain electrified components shall be marked with conspicuous signs prohibiting unqualified persons to enter.
   B. Lock-out/Tag-out devices will be used on the disconnect prior to startup of the panel systems.
   C. Arc Flash Protection - Panelboards, control panels, disconnects, and meter socket enclosures shall be field marked to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment and shall be in conformance to the guidelines and references of NFPA-70, NEC-2005 - Article 110.16.

8. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, pre-printed cellulose acetate butyrate signs with 20-gauge galvanized steel backing, with colors, legend, and size appropriate to location. Provide 1/4-inch grommets in corners for mounting.

9. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless-steel screws or Number 10/32 stainless steel machine screws with nuts and flat and lock washers.

10. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-pound minimum tensile strength, and suitable for a temperature range from minus 50 to 350 degrees F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.01 INSTALLATION

1. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification Work with corresponding designations specified or

indicated. Install numbers, lettering, and colors as approved in submittals and as required by Code.

2. Underground Electrical Line Identification: During trench backfilling for exterior nonconcrete encased underground power, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench, do not exceed an overall width of 16 inches; install a single line marker.

3. Install line marker for underground wiring, both direct buried and in raceway.

4. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the Project secondary electrical system following OWNER's method of phase identification or as follows:

Phase	480/277 Volts
A	Yellow
B	Brown
C	Orange
Neutral	White
Ground	Green

5. Wiring Standards:

A. 480/277 Volt, 3-Phase Power:

1) Brown.

2) Orange.

3) Yellow.

4) Grey Neutral.

B. 208 Volt, 3-Phase and 240 Volt, 3-Phase Power:

1) Black.

2) Red.

3) Blue.

4) White Neutral

C. 240/120 Volt, 1-Phase Power:

1) Black.

2) Red.

3) White Neutral.

D. Motor Leads, Control Cabinet/MCC:

1) Black, numbered L1-T1, etc.

E. Control Wiring:

1) Red Control circuit wiring that is de-energized when the main disconnect is opened.

2) Yellow Control circuit wiring that remains energized when the main disconnect is opened.

3) Blue DC.

4) Green Ground.

6. Use conductors with color factory applied entire length of conductors except as follows:

A. The following field applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.

1) Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last 2 laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

2) In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply 3 ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

7. Power Circuit Identification: Securely fasten identifying metal tags of aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-pound test monofilament line or one-piece self-locking nylon cable ties.

8. Install wire/cable designation tape markers at termination points, splices, or junctions in each circuit. Circuit designations shall be as indicated on Drawings.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide wires and cable, complete and operable, in accordance with the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

1. The Contractor shall submit manufacturer's data for all products in accordance with Sections 01300 - Contractor Submittals.

2. Reports of field tests prepared as noted in Section 01650.

1.03 QUALITY ASSURANCE

1. UL Compliance: Provide components which are listed and labeled by UL. For cables intended for use in air handling space comply with applicable requirements of UL Standard 710, "Test Method for Fire and Smoke characteristics of cables used in Air Handling Spaces."

2. NEMA/ICEA Compliance: Provide components which comply with following standards:

   A. NEMA WC 70-1999/ICEA S-95-658-1999, Non shielded Power Cables Rated 2,000 Volts or Less for the Distribution of Electrical Energy.

3. IEEE Compliance: Provide components which comply with the following standard.

   A. Standard 82, Test procedures for Impulse Voltage Tests on Insulated Conductors.

4. Labeling: Handwritten labels are not acceptable. All labels shall be machine printed on clear or opaque tape, stenciled onto adhesive labels, or typewritten onto adhesive labels. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be of a color contrasting with the label such that is may be easily read. If labeling tape is utilized, the font color shall contrast with the background. Patch panels shall exhibit workstation numbers or some type of location identifier, in sequential order, for all workstations or devices attached. Each Network cable segment shall be labeled at each end with its respective identifier.

PART 2 -- PRODUCTS

2.01 GENERAL

1. All conductors, include grounding conductors, shall be copper. Aluminum conductor wire and cable shall not be permitted. Insulation shall bear UL Listed label, the manufacturer's trademark, and identify the type, voltage, and conductor size. All

conductors except flexible cords and cables, fixture wires, and conductors that form an integral part of equipment such as motors and controllers shall conform to the requirements of Article 310 of the National Electric Code, latest edition, for current carrying capacity. Flexible cords and cables shall conform to Article 400 and fixture wires shall conform to Article 402. All wiring shall have identical wire markers at each end.

2.02 LOW VOLTAGE WIRE AND CABLE

1. Power and Lighting Wire

A. All wire rated for 600 volts in duct or conduit for all power and lighting circuits shall be Class B Type XHHW cross-linked polyethylene conforming to UL-44-UL Standard for Safety Rubber Insulated Wires and Cables. THHN/THWN wire shall not be permitted to be used for any power or control wiring in this project.

B. Conductors for feeders as defined in Article 100 of the NEC shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.

C. Conductors for branch circuits as defined in Article 100 of the NEC, shall be sized to prevent voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent under full load conditions.

D. Wiring for 600-volt class power and lighting shall be as manufactured by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

E. Wiring shall be #12 AWG minimum, and conduits shall be 3/4-inch minimum (exposed) and 1-inch minimum (encased).

2. Control Wire

A. Control wire in duct or conduit shall be the same type as power and lighting wire indicated above.

B. Control wiring shall be No.14 AWG minimum.

C. Control wires at panels and cabinets shall be machine tool grade type MTW, UL Listed, rated for 90 degrees C at dry locations, and be as manufactured by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

3. Instrumentation Cable

A. Instrumentation cable shall be rated at 600 volts.

B. Individual conductors shall be No. 16 AWG minimum stranded tinned copper. Insulation shall be color-coded polyethylene: black-red for two-conductor cable and black-red-white for three-conductor cable.

C. Instrumentation cables shall be composed of the individual conductors, an aluminum polyester foil shield, a No. 18 AWG minimum stranded tinned copper drain wire, and a PVC outer jacket with a thickness of 0.048 inches.

D. Single pair, No. 16 AWG minimum, twisted, shielded cable shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

E. Single triad, No. 16 AWG minimum, twisted, shielded cable shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

2.03 SUBMERSIBLE PUMP CABLE

1. General

A. Cables shall be designed specifically for submersible pump applications and shall be properly sealed. The cable entry at the control panel shall be rated Class I, Division I, Groups C and D. Cable splices must be pre-approved by the City of Cape Coral.

2.04 CABLE TERMINATIONS

1. Compression connectors shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**. Threaded connectors shall be split bolt type of high strength copper alloy. Pressure type, twist-on connectors will not be acceptable.

2. Pre-insulated fork tongue lugs shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

3. General purpose insulating tape shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

4. High temperature tape shall be polyvinyl as manufactured by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

5. Labels for coding all 600- v o l t wiring shall be computer printable or pre-printed, self- laminating, self-sticking, as manufactured by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

2.05 ELECTRICAL INSULATING RESIN

1. Re-enterable splice protection shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** Re-enterable Electrical Insulating Resin.

PART 3 – EXECUTION

3.01 GENERAL

1. The Contractor shall provide and terminate all power, control, and instrumentation conductors except where indicated.

3.02 INSTALLATION

1. Conductors shall not be pulled into raceways if raceways have not been cleared of moisture and debris.

2. Pulling tensions on raceway cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where required, shall be UL Listed.

3. Instrumentation wire shall not be run in the same raceway with power and control wiring except where specifically indicated.

4. Wire in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps and shall be fanned out to terminals.

5. Ground and neutral wiring within the electrical panel shall be routed around the entire interior perimeter of panels. These cables shall be mounted to maximize separation from voltage components.

3.03 SPLICES AND TERMINATIONS

1. General

   A. All wiretaps and splices shall be properly taped and insulated according to their respective classes.

   B. In general, there shall be no cable splices in underground manholes or pull boxes. If splices are necessary, the cables shall be brought above-ground and terminated in a NEMA 4X, 316 stainless steel terminal or splice cabinet on a concrete pad, utilizing a 316 stainless steel mounting frame, where applicable Splices in underground manholes and pull boxes may be made only with the approval of the City.

   C. Stranded conductors shall be terminated directly on equipment box lugs making sure that all conductor strands are confined within lug. Use forked-tongue lugs where equipment box lugs have not been provided.

   D. Excess control and instrumentation wire shall be properly tagged and terminated as spares.

2. Control Wire and Cable

A. Control conductors shall be spliced or terminated only at the locations indicated and only on terminal strips or terminal lugs of vendor furnished equipment.

B. In junction boxes, motor control centers, and control panels, all control wire and spare wire shall be terminated to terminal strips.

3. Instrumentation Wire and Cable

A. Shielded instrumentation cables shall be grounded at one end only, preferably the receiving end on a 4-20 mA system.

B. Two- and three-conductor shielded cables installed in conduit runs, which exceed available standard cable lengths, may be spliced in pull boxes.

C. Splicing of instrument wire and cable is not allowed.

4. Power Wire and Cable

A. All 120/208-volt, 120/240-volt, and 277/480-volt branch circuit conductors may be spliced in suitable fittings at locations determined by the Contractor.

B. Splices to motor leads in motor terminal boxes shall be wrapped with mastic material to form a mold and then shall be taped with a minimum of two layers of varnished cambric tape overlapped with a minimum of two layers of electrical insulating varnished cambric tape, Scotch 2520 or City approved equal.

3.04 CABLE IDENTIFICATION

1. General: Wires and cables shall be identified for proper control of circuits and equipment and to reduce maintenance effort.

2. Identification Numbers: The Contractor shall assign to each control and instrumentation wire and cable a unique identification number. Numbers shall be assigned to all conductors having common terminals and shall be shown on all "as built" drawings. Identification numbers shall appear within 3 inches of conductor terminals. "Control Conductor" shall be defined as any conductor used for alarm, annunciator, or signal purposes.

A. Multiconductor cable shall be assigned a number that shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath freestanding equipment. It is expected that the cable number shall form a part of the individual wire number. All individual control conductors and instrumentation cable shall be identified at pull points as described above. The instrumentation cable numbers shall incorporate the loop numbers assigned in the Contract Documents.

B. The 240/120-volt, 1-Phase system conductors will be color coded as follows:

Phase A-Black, Phase B-Red, and Neutral-White. The 208/120-volt, 3-Phase system conductors will be color coded as follows: Phase A-Black, Phase B-Red, Phase C-Blue, and Neutral-White. The 240/120-volt, 3-Phase system will be color coded as follows: Phase A-Black, Phase B-Red, Phase C-Blue, and Neutral-White. The 480/277-volt, 3-Phase system conductors shall be color coded as follows: Phase A-Brown, Phase B-Orange, Phase C-Yellow, and Neutral- Gray. Color coding tape shall be used where colored insulation is not available. Branch circuit switch shall be yellow. Insulated ground wire shall be green, and neutral shall be gray. Color coding and phasing shall be consistent throughout the Site, but bars at panelboards shall be connected Phase A-B-C, top to bottom, or left to right, facing connecting lugs.

C. General-purpose AC control cables shall be red. General-purpose DC control cables shall be blue.

D. All spare cable shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.

E. Terminal strips shall be identified by computer printable, cloth, and self-sticking marker strips attached under the terminal strip.

3.05 TESTING

1. Cable Assembly and Testing: Cable assembly and testing shall comply with applicable requirements of ICEA Publication No. S-66-524 – Cross-linked Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

2. The following field tests, as required by the City, shall be conducted:

A. Power cable rated at 600 volts shall be tested for insulation resistance between phases and from each phase to a ground using a megohmmeter.

B. Field testing shall be done after cables are installed in the raceways.

C. Field tests shall be performed by a certified test organization acceptable to the cable manufacturer. Test results shall be submitted to the City for review and acceptance.

D. Cables failing the tests shall be replaced with a new cable or be repaired. Repair methods shall be as recommended by the cable manufacturer and shall be performed by persons certified by the industry.

END OF SECTION

SECTION 16130
RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY

1. Section Includes: Raceways for electrical wiring. Types of raceways in this Section include the following:

   A. Liquidtight flexible conduit.

   B. Underground plastic utilities duct.

   C. Rigid metal conduit.

   D. Rigid nonmetallic conduit.

   E. PVC externally coated rigid metal conduit.

   F. Electrical nonmetallic tubing.

   G. Conduit bodies.

1.02 SUBMITTALS

1. Shop Drawings: Submit in accordance with Section 01300, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

   A. Product data for the following products:

      1) Conduit.

      2) Conduit bodies.

1.03 QUALITY ASSURANCE

1. Codes and Standards:

   A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.

   B. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

1. Subject to compliance with requirements, manufacturers offering products which may be incorporated in Work include:

   A. Conduit:

      SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

   B. Liquidtight Conduit:

      SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

   C. Conduit Bodies:

      SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

   D. Conduit Thread Paint:

      SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 METAL CONDUIT AND TUBING

1. Rigid Metal Conduit: ANSI C 80.1, hot-dip galvanized.

2. PVC Externally Coated Rigid Metal Conduit and Fittings: ANSI C 80.1 and NEMA RN 1., Type 40, 40 mil nominal coating and thickness. The bond of the PVC to the substrate shall be stronger than the tensile strength of the PVC.

3. Liquidtight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

2.03 NONMETALLIC CONDUIT AND DUCTS

1. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 80 PVC.

2. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

3. Underground PVC and ABS Plastic Utilities Duct: NEMA TC 6, Type I for encased burial in concrete, Type II for direct burial.

4. PVC and ABS Plastic Utilities Duct Fittings: NEMA TC 9; match to duct type and material.

5. Liquidtight Flexible Nonmetallic Conduit and Fittings: UL 1660. Fittings shall be specifically approved for use with this raceway.

2.04 CONDUIT BODIES

1. Provide matching gasketed covers secured with corrosion-resistant screws. Use cast covers in NEMA 4 areas and stamped steel covers in NEMA 1 and 12 areas. Use nonmetallic covers in NEMA 4X areas and threaded, ground joint covers in NEMA 7 and NEMA 9 areas.

2. Metallic Conduit and Tubing: Use metallic conduit bodies as follows:

   A. Rigid Metal Conduit: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and threaded hubs.

   B. PVC Externally Coated Rigid Metal Conduit: Use hot-dipped galvanized or cadmium-plated cast or malleable iron conduit bodies with threaded hubs factory PVC-coated. Field application of PVC coating to conduit bodies is not acceptable. Secure covers using PVC encapsulated or stainless-steel screws.

   C. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies conforming to UL 514 B.

   D. NEMA 7 and NEMA 9 Areas: Use materials conforming to UL standards for the area.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide wiring devices, complete and operable, in accordance with the Contract Documents.

2. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

1.02 CONTRACTOR SUBMITTALS

1. General: Contract submittals shall be in accordance with Section 01300 - Contractor Submittals.

2. Contractor shall submit manufacturer's technical information for all products.

PART 2 – PRODUCTS

2.01 GENERAL

1. All devices shall UL listed and carry the UL label.

2. General-purpose duplex receptacles and toggle switch handles shall be ivory. Receptacles and switches shall conform to Federal Specifications W-C-596E and W-S-896E, respectively.

2.02 LIGHTING SWITCHES

1. Local branch switches shall be toggle type, rated at 20 amperes, 120 VAC, and shall be General Electric Cat. No. GE-5951-1 for single pole, GE-5953-1 for three-way and GE-5954-1 for four- way or similar types as manufactured by Hubbell.

2.03 GENERAL PURPOSE RECEPTACLES

1. Duplex receptacles rated 120 V, 20 amperes shall be polarized 3 wire type for use with 3 wire cord with grounded lead. Duplex 120 V receptacles shall be ground-fault circuit interrupting (GFCI's) type E. GFCI's shall be rated 125V, 20A and shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

2. Receptacles for hazardous locations shall be single gang receptacles with spring door. Receptacles shall have a factory-sealed chamber. The receptacles shall have a delayed action feature requiring the plug to be inserted in the receptacle and rotated before

the electrical connection is made. The receptacle shall not work with non-hazardous rated plugs. One plug shall be furnished with each receptacle. 120-volt receptacles shall be rated for 20 amps at 125 VAC. Hazardous location receptacles shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

3. Where indicated, hazardous location receptacles shall be provided with ground fault protection. Ground fault protection shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

2.04 ENCLOSURES AND COVERS

1. Surface mounted switches and receptacles shall be in FS or FD type weatherproof conduit fittings.

2. Switch and receptacle covers on surface mounted boxes shall be die cast copper-free aluminum.

3. In areas where cast boxes are used, switch and receptacle covers shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

4. Receptacles in wet locations shall be provided with a hinged cover/enclosure marked "Suitable for Wet Location". There shall be a gasket between the enclosure and the mounting surface and between the hinged cover and mounting plate/base. The cover shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

2.05 NAMEPLATES

1. Provide nameplates or equivalent markings on switch enclosures to indicate ON and OFF positions of each switch. ON and OFF for 3-way or 4-way switches is not required. Provide receptacles for special purposes with nameplates indicating their use. Conform to requirements of Section 16050 - Electrical Work, General.

PART 3 -- EXECUTION

3.01 GENERAL

1. Perform work in accordance with the National Electrical Code.

3.02 CONNECTION

1. Rigidly attach wiring devices in accordance with National Electrical Code, and as indicated, avoiding interference with other equipment.

2. Securely fasten nameplates using screws, bolts, or rivets centered under or on the device, unless otherwise indicated.

3.03 GROUNDING

1. Ground all devices, including switches and receptacles, in accordance with NEC, ART250, and Section 16450 - Grounding.

2. Ground switches and associated metal plates through switch mounting yoke, outlet box, and raceway system.

3. Ground flush receptacles and their metal plates through positive ground connections to outlet box and grounding system. Maintain ground to each receptacle by spring-loaded grounding contact to mounting screw or by grounding jumper, each making positive connection to outlet box and grounding system at all times.

3.04 FIELD TESTING

1. Provide checkout, field, and functional testing of wiring devices in accordance with Section 16050 Electrical Work, General.

2. Test each receptacle for polarity and ground integrity with a standard receptacle tester.

END OF SECTION

SECTION 16151

VARIABLE FREQUENCY DRIVE UNIT

PART 1 - GENERAL

1.01 DESCRIPTION:

1. Provide complete simplex type variable frequency drive (VFD) units and appurtenances including drive reactors, DC chokes, harmonic filters, enclosures, and certain auxiliary items, as indicated and as specified, to provide a complete operating system.

2. Variable frequency drive unit shall be furnished, installed, and electrically connected by the electrical subcontractor.

3. VFD units shall be manufacturer's standard technology and in production for a minimum of 5 years.

4. Provide control system operation, input and control signals, status signals, and additional requirements, including but not limited to, conduit and wire, per the VFD manufacturer's requirements for a fully functional system.

5. Provide Underwriter's Laboratories listed drive components where applicable.

6. Provide VFD output filter or reactor, when cable length between VFD and motor is greater than 100 feet, to ensure motor terminals do not experience overvoltage condition as defined by NEMA Standard MG-1, section 30.02.2.9.

7. Each VFD unit to be provided is to exhibit less than 5% voltage total harmonic distortion and less than 3% voltage distortion on each harmonic at their immediate upstream distribution bus as verified by calculation and testing. Harmonic current distortion to be in accordance with Institute of Electrical and Electronics Engineers Standards for Harmonics, IEEE519, Latest Edition. This bus to be referred to as the point of common coupling (PCC).

1.02 RELATED WORK:

1. Division 1: General Requirements

1.03 REFERENCES:

1. Underwriter's Laboratories Inc. (U.L.):

   A. UL-508 Electrical Industrial Control Equipment.

2. National Electrical Manufacturers Association (NEMA): MG 1.

3. National Fire Protection Association (NFPA):

A. NFPA-70 National Electric Code.

1.04 SUBMITTALS:

1. Shop Drawings: Submit the following in accordance with Section 01300 – Shop Drawings and Submittals:

A. Shop Drawings: Provide a complete list of equipment components, and materials, including manufacturer's descriptive and technical literature, and catalog cuts. Provide complete wiring, system interconnection and schematic diagrams for the equipment and controls furnished including external interlocked and controlled components, equipment layout, time versus current curves for protective devices and any other details required to demonstrate that the system and the required external controls has been coordinated and will properly function as designed.

1) Provide enclosure drawings and details showing all dimensions and construction details.

B. Submit information relative to location and expertise of local service office and personnel.

C. Provide installation and anchoring details to meet earthquake requirements as specified and indicated on structural drawings.

D. Submit manufacturer’s printed installation instructions.

E. Spare Parts Data: Submit a list of spare parts for the equipment specified.

F. Operating and Maintenance Instruction Manuals:

1) Furnish:

a. Operating instruction manuals outlining step-by-step procedures required for system startup and operation.

b. Manufacturer's name, model number, service manual parts list.

c. Brief description of equipment and basic operating features.

d. Maintenance instruction manuals outlining maintenance procedures.

e. Troubleshooting guide listing possible breakdown and repairs.

f. Point-to-point connection wiring diagram for the system.

g. Performance Test Reports: Upon completion of installed system, submit in booklet form all shop and field tests performed to prove compliance with specified performance criteria.

1.05 QUALITY ASSURANCE:

1. Provide conduit size and wire quantity, size, and type are suitable for the equipment supplied. Coordinate all design information with the Electrical Contractor. Review the proper installation of each type of VFD unit with the equipment supplier prior to installation.

A. Services of Service Engineer specifically trained on type of equipment specified. Man-day requirements listed exclusive of travel time.

1) Assist in location of devices, methods of mounting, field erection, etc. (1 man-day).

2) Start-up and testing (3 man-day).

3) At the end of start-up service provide for owner's staff at the facility site to receive training from the startup/testing service Engineer. (1 man-day)

4) Service-inspections during first year of operation, for use at Owner's request, and exclusive of repair, malfunction or other trouble-shooting service calls: (2 man-day).

5) Man-day is defined as one 8-hour day, excluding travel time.

1.06 DELIVERY, STORAGE AND HANDLING:

1. Shipping:

A. Ship equipment and materials, except where partial disassembly is required by transportation regulations or for protection, complete with identification and quantity of items.

B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

C. Deliver spare parts after installation but as specified before start-up of drives. Deliver to Owner after completion of work.

2. Storage:

A. Inspect and inventory items upon delivery to site.

B. Store and safeguard equipment, material and spare parts.

1.07 WARRANTY AND SERVICE:

1. Guarantee components, parts, and assemblies supplied by manufacturer against defects in materials and workmanship for a period of 36 months after turning the equipment over to the Owner, and in this time, period include onsite, parts and labor warranty. All labor to be performed by local factory trained service engineers.

2. Ensure that equipment manufacturer has local branch office staff with trained, full-time employees who are capable of performing testing, inspecting, repair, and maintenance services.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

1. Manufacturer shall have at least five years commercial experience in the manufacture, operation and servicing of equipment of type, size, quality, performance, and reliability equal to that specified.

2. Variable Frequency Drive Units:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

3. VFD Input Filters and Output Filters/Reactors:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 PROVISIONS:

1. Service Conditions:

A. Ambient Temperature Range: 0 deg. C to 40 deg. C.

B. Operational Humidity: Up to 90 percent non-condensing.

C. Altitude: Below 3,300 ft. above sea level.

D. Input Power:

1) Nominal voltage: 480 volts, 3-phase

2) Nominal Frequency: 60 Hertz (plus or minus 2 Hz.)

3) Service provided from feeder breaker on distribution bus.

2. Drive System: 0-500 HP Units

A. General:

1) Furnish solid state variable frequency, microprocessor type with Pulse Width Modulated (PWM) output wave form converter. The VFD shall employ a full wave rectifier to prevent input line notching, a DC bus choke, DC bus capacitors and Insulated Gate Bipolar Transistors (IGBT) as the output switching. Provide output speed control of required motor under variable torque load.

2) Motor control circuits shall be wired in accordance with the requirements specified herein or indicated on the Drawings. Where not indicated, the control circuits shall be standard two-wire "start-stop" and the Contractor shall furnish wiring accordingly.

3) Variable frequency drive manufacturer shall be responsible for the successful application and operation of the entire drive and control system serving the motor and driven equipment. This includes the responsibility for obtaining loads, torque, speed and performance requirements from the respective sources and integrating these into a variable frequency drive system that fulfills the requirements of this Specification.

4) The Contractor and variable frequency drive system manufacturer are cautioned regarding the review and compliance with the total Contract Documents. Typical examples are circuit breakers, motor circuit protectors, magnetic starters, relays, timers, control and instrumentation products, pilot devices including pushbuttons, selector switches and pilot lights, enclosures, conduit, disconnect switches, terminal boxes, and other equipment.

5) Provide flux vector control type drives, also known as field-oriented control, with hard- wired motor speed feedback encoder or tachometer, for full torque at zero speed capability.

6) Provide VFD control which ensures accurate zero to full load torque control at low frequencies, including zero speed, with torque repeatability accuracy of 2% or better and torque response time less than 20 ms.

7) Provide on drive, a disconnecting device and fixed diode input rectifier (for a constant power factor).

8) For units rated 100 Hp or less, provide 6 pulse drives with 3% impedance input line reactor.

9) All components of the drive shall be designed and sized for the abnormal condition of continuous operation of the driven equipment specified herein at loads up to 15% above rated full load.

10) RMS harmonic output of the drive not to provide more than 5 percent increase in motor heating over similar operation of the motor with zero harmonics in the current.

11) The unit shall withstand drive output terminal line-to-line and line-to-ground short circuits without component failure during start-up and during operation. Drive to safely shutdown until short is cleared.

12) NEMA type cabinet for each drive unit, as indicated on drawings and enclosure schedule. NEMA 4 and NEMA 4X enclosures to be provided with stainless steel hand operated quick disconnect devices. Provide hinged acrylic door with gasketing on front of door for each access to keypad controls.

13) For inverter rated squirrel cage motors, per NEMA Standard MG-1, part 31.40.4.2, the following limit values at the motor terminals are to be observed:

    a. For motors with base rating voltage less than or equal to 600 volts, the peak instantaneous voltage must be limited to 1600 volts or less, with a voltage rise time greater than or equal to 0.1 micro-seconds.

14) The VFD manufacturer shall guarantee that the above voltage limits will be met with the motor installed up to 100 cable feet [30 m] from the VFD drive unit. If the VFD manufacturer is not able to guarantee that the above voltage limits will be met, provide a drive output filter or reactor, appropriately rated, located within the VFD enclosure and near the VFD output terminals, which shall ensure that the limitations listed above are maintained. A device located at the motor terminals is not acceptable.

15) The drive unit shall be of modular design to provide for ease and speed of maintenance.

16) Control circuits shall be isolated from power circuits. Unit to accept a 4-20 mA DC speed control signal from an isolated, ungrounded transmitter with unit in remote mode and from local door-mounted manual speed potentiometer or micro-processor type keypad with unit in local mode. The input 4-20 mA signal to be optically isolated from the drive run control circuit. Manual speed potentiometer or keypad controls to have adjustable minimum speed setting of 10 to 80% of full speed and maximum speed setting of 50 to 100% of full speed. The total speed setting to follow a linear time ramp, adjustable from 1-300 seconds for acceleration and deceleration control.

17) VFD shall be capable of full rated output when powered by incoming voltage with Total Harmonic Distortion (THD) in excess of 10%.

18) Furnish series choke and capacitors on dc bus to reduce ripple in rectifier output and to reduce harmonic distortion reflected into incoming power feeders.

19) Provide conformal coating of internal circuitry.

20) Properly size control panel enclosure to dissipate heat generated by VFD within limits of specified service conditions. VFDs located within control panel shall be rated NEMA

B. Provide integral fans or cooling systems as required by the application. Circuit breaker interlocks to be able to be bypassed via lever on front door surface. NEMA 1 type enclosures to have keypad controls located on dead front of control panel. Provide visual alarm indicator on dead front of control panel.

C. Performance characteristics:

1) Output amps: 110 percent of rated, continuous.

2) Current limit: Range 0 to 130% for constant torque applications, 0 to 110% for variable torque applications, for 1 minute minimum.

3) Acceleration time to top speed, 1-300 seconds, minimum, adjustable.

4) Deceleration time from top speed, 1-300 seconds, minimum, adjustable.

5) Frequency stability: +/- 0.5% (at 25 degrees C, +/10 degrees C) after reaching operating temperature.

6) Output voltage: Proportional to frequency with low-speed boost.

7) Combined drive/and filtering efficiency, defined as motor shaft KW divided by VFD input KW, shall meet the following minimum requirements at the specified operating points:

a. 97 percent at 60 Hz VFD output and 100 percent load.

b. 92 percent at 50 Hz VFD output and 60 percent load.

8) VFD fundamental power factor shall be 0.98 or higher at all speeds and loads.

9) The VFD shall be capable of sustaining continued operation with a 30% dip in nominal line voltage. Output speed may decline only if current limit rating of the VFD is exceeded.

10) Losses to be utilized in drive system efficiency calculation shall include the input isolation transformer, harmonic filter and power factor correction if applicable. Auxiliary controls such as internal VFD control boards and cooling fans shall be included in all loss calculations.

D. Drive Protection:

1) General:

a. Fault detection and trip circuits shall protect VFD and connected motor against line voltage transients, single-phase, power line overvoltage and undervoltage, output overvoltage and overcurrent, and VFD overtemperature. The VFD shall employ three (3) current limit circuits to provide trip free operation. The slow current regulation limit circuit shall be adjustable to a minimum 125% of the VFD's variable torque current rating. The rapid current regulation limit shall be adjustable to a minimum 170% of the VFD's variable torque current rating. The current switch off limit shall be fixed at a minimum 225% of the VFD's variable torque current rating.

2) Internal Protection: Minimum circuitry as follows:

a. Current limiting, fast acting, semiconductor input fuses for protection of internal power semiconductors.

b. Instantaneous output overcurrent trip max. - 200 percent.

c. DC bus and control circuit transformer fusing.

d. Grounded control chassis.

e. Under and over voltage trip, 3 phases.

f. Motor overload protection, with solid state relays.

g. Fault reset push button.

h. Line to ground faults.

i. Input metal oxide varistor and input line reactor for transient protection.

j. VFD over temperature.

3) Troubleshooting: Diagnostic aids to indicate cause of fault; used to assist in troubleshooting circuit problems. Isolated Form C contacts for remote indication of alarms to include the following:

a. Over/under voltage indication.

b. Overcurrent trip indication.

c. DC bus charged indication.

d. Fault detection indication.

e. Recycle start indication (to indicate that the unit tried to pick up load for three previous tries and failed).

4) Provide power loss ride through capability which will allow the logic to maintain control due to load inertia without faulting.

3. Auxiliary Systems:

A. Provide variable frequency drive unit with appropriate power circuitry and auxiliary contacts for energizing and controlling the following devices associated with the motor, if required:

1) Space heaters

2) Remote indication of motor start and stop (isolated contacts)

4. Minimum Control Features:

A. LOCAL-REMOTE selection of Start/Stop control.

B. LOCAL/REMOTE selection of Speed Control.

C. Accept a grounded, isolated, 4-20 mA input remote speed control signal from an external device.

D. Provide a 4-20 mA output signal proportion to VFD output frequency for remote speed indication.

E. Provide Ethernet/IP communication module

5. Network and Operator Interface:

A. The VFD shall be connected to the PLC via Ethernet/IP and be monitored and controlled via ethernet by a remote operator interface terminal.

2.03 SPARE PARTS:

1. Provide one spare board or card, three diodes, for each horsepower size drive. Spares will be color-coded or otherwise keyed to their original counterpart such that improper installation of spare cards is impossible. In addition to the cards, the manufacturer shall

2. provide three spares for all expendable items such as pilot lamps, power fuses, and control fuses, and provide one spare for all additional items on the manufacturer's recommended spare parts list. Provide one keypad for each series VFD.

PART 3 – EXECUTION

3.01 INSPECTION:

1. Examine VFD location for satisfactory preparation. Check conduits and raceway location for connection to units.

2. Visually inspect delivered unit(s) and accessories for conformance with specification and drawings.

3. Verify availability of appropriate pacing signal.

4. Maintain variable frequency drive in upright position at all times.

5. Protect variable frequency drive against damage. Store drive in clean, dry environment with temperature and humidity within range as specified by drive manufacturer. Energize space heaters during storage as recommended by manufacturer.

3.02 INSTALLATION:

1. Erect, install, and start-up equipment.

2. The VFD's shall be installed as shown on the Drawings and in accordance with the manufacturer's installation instructions.

3. Install VFD's to allow complete door swing required for component removal. This is specifically required where a VFD is set in the corner of a room.

3.03 FIELD TESTING:

1. Perform testing checkout, and start-up for variable frequency drive equipment under technical direction of manufacturer's service engineer.

2. Field Tests:

A. Test each drive over the total speed range that it will be required to operate through for the load being driven for a minimum of two hours. Determine for each drive, motor, and load combination the following at minimum speed, maximum speed, and at 1/3 and 2/3 points between the minimum and maximum speeds:

1) Input power (kW), voltage, current and RMS power factor on the line side of the drive isolation device.

2) Output to the driven load in kilowatts.

3) For each drive, measure the harmonic voltage distortion and harmonic current distortion for each harmonic at the main distribution bus for maximum and minimum load conditions.

4) Measure the total harmonic voltage distortion and total harmonic current distortion at each PCC for maximum and minimum load conditions.

B. Test each drive by using the actual control signal for remote and local operation.

C. Test each driver's alarm functions.

D. Perform all tests in the presence of the Owner's representative.

E. Perform the above test in addition to the manufacturer's normal field tests.

F. Submit final test report with summary comparing field test data with harmonic analysis design calculated values for each drive.

END OF SECTION

SECTION 16420

MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SUMMARY

1. Section Includes: Types of motor controllers, including:

   A. Combination controllers.

1.02 SUBMITTALS

1. Shop Drawings: Submit in accordance with Section 01300, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

   A. Shop Drawings: Submit Shop Drawings of motor controllers showing dimensions and sizes.

   B. Product Data: Submit manufacturer's data and installation instructions on motor controllers.

   C. Wiring Diagrams: Submit power and control wiring diagrams for motor controllers

1.03 QUALITY ASSURANCE

1. Codes and Standards:

   A. UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL listed and labeled.

   B. NEMA Compliance: Comply with applicable requirements of NEMA Standards ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub No. 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)," pertaining to motor controllers and enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

1. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

   SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.02 MOTOR CONTROLLERS

1. Except as otherwise indicated, provide motor controllers and ancillary components which comply with manufacturer's standard materials, design, and construction in accordance with published product information and as required for a complete installation.

2. Combination Controllers: Consist of controller and circuit breaker or fusible disconnect switch mounted in common enclosure of types, sizes, ratings, and NEMA sizes indicated. Equip starters with block-type manual reset overload relays. Provide control and pilot devices indicated. Provide 90 degree C SIS or MTW, No. 14 AWG control wiring, tagged at each termination. Provide operating handle for disconnect switch mechanism with indication and control of switch position, with enclosure door either opened or closed, and capable of being locked in OFF position with 3 padlocks. Construct and mount controllers and disconnect switches in single NEMA-type enclosure suitable for the location in which it is installed; coat with manufacturer's standard color finish.

   A. The 3-phase starter shall be the following type:

      1) Full Voltage Non-reversing (FVNR): One 3-pole magnetic contactor with a set of 3 overload devices.

3. Control and Pilot Devices: Provide an individually fused control power transformer in each starter unit. Provide 2 fuses in the transformer primary circuit and 1 in transformer secondary circuit. Size transformers such that they can supply 100VA in excess of the unit requirements or provide 150VA rated transformer, whichever is greater. Provide 300 volt rated, oil tight type pilot lights, push buttons with extended guard and black color insert. Equip stop push buttons with half guard and red color insert. Provide 120/6-volt transformer type push-to-test pilot lights with lens color indicated. Provide machine tool type relays, each with 1 spare N.O. contact. Provide 6-digit elapsed time indicators with one-tenth hour increments. When timers are required, they shall be synchronous type.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16450

GROUNDING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall provide the electrical grounding system, complete and operable, in accordance with the Contract Documents.

2. The requirements of Section 16050 – Electrical Work, General, apply to this Section.

3. Single Manufacturer: Similar products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts and manufacturer's services.

4. Codes and Standards:

   A. UL Compliance: Comply with applicable requirements of UL Standards No. 467, "Electrical Grounding and Bonding Equipment," and No. 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and labeled for their intended usage.

   B. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141, and 142 pertaining to grounding and bonding of systems, circuits, and equipment.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be in accordance with the requirements of Section 01300 - Contractor Submittals.

2. Contractor shall submit a grounding report from an independent testing company, certifying compliance with the requirements of this Section.

PART 2 -- PRODUCTS

2.01 GENERAL

1. Components of the grounding electrode system shall be manufactured in accordance with ANSI/UL 467 - Standard for Safety Grounding and Bonding Equipment and shall conform to the applicable requirements of National Electrical Code Article 250 and local codes. The Contractor shall provide drawings clearly showing the Electrical Grounding System. An underground perimeter cable grounding system shall be installed with connections to at least the following equipment:

A. Control Panels including generator outlet

B. Stationary Generator, if provided

C. Electrical Meter Box, including transformer and main disconnect switch

D. Wet Well Hatch and all Guide Rail (not to interfere with removal of pump)

E. Fence and Gate Posts, if provided

2.02 GROUNDING ELECTRODE SYSTEM

1. Grounding loop conductors shall be bare tinned copper conductors suitable for direct burial. Conductors shall be No. 4/0 AWG unless indicated otherwise.

2. Ground rods shall have a uniform covering of electrolytic copper metallically bonded to a rigid steel core conforming to ANSI/UL 467. The copper to steel bond shall be corrosion resistant.

   A. Ground rods shall be 3/4-inch diameter and 10 feet long unless indicated otherwise

   B. Where ground rod lengths indicated on the Contract Drawings are unavailable, ground rods shall be coupled together using threaded copper alloy couplings.

3. Underground cable-to-cable and cable-to-ground rod connections shall be made using exothermic welds. Exothermic welds shall be by Cadweld by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**

4. Exposed grounding connectors shall be of the compression type (connector to cable), made of high copper alloy, and be manufactured specifically for the particular grounding application. The connectors shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST**.

5. Grounding clamps shall be used above ground to bond each conductor to the system.

6. Equipment Grounding Circuit Conductors
   A. These conductors shall be the same type and insulation as the load circuit conductors. The minimum size shall be as outlined in Table 250.122 of the National Electrical Code, unless indicated otherwise.

   B. Metallic conduit systems shall have equipment grounding wires as well as being equipment grounding conductors themselves.

7. Manufacturers of grounding materials shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

8. Bond bare No. 4/0 AWG grounding cable in duct banks to grounding cable in vaults and to power equipment ground bus at ends of each duct bank.

9. Bond strut and other metal inside of electrical manholes and vaults to bare No. 4/0 AWG grounding cable carried in duct bank.

10. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values for connectors and bolts. Where manufacturer's torqueing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

11. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible while following building lines to minimize transient voltage rises. Protect exposed cables and straps where subject to mechanical damage.

12. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed and are subjected to corrosive action.

PART 3 -- EXECUTION

3.01 GROUNDING

1. General: When sizes are not specifically indicated on the Drawings, grounding cable shall be sized by the Contractor in accordance with all applicable code requirements, but not smaller than No. 4/0. The location of ground rods shall be as indicated. The lengths of rods forming an individual ground array shall be equal and shall be of the quantity required to obtain a ground resistance of no more than 5 ohms. City shall witness ground resistance test. Contractor shall provide a test report and shall record the information on the As-Built Panel Drawings. The grounding system shall be in strict accordance with Article 250 of the N.E.C.

2. Equipment Ground: Ground continuity throughout the facility shall be maintained by means of a ground conductor run in all conduits. Grounding conductors run in conduit shall be insulated copper conductors, sized in accordance with the N.E.C. and the Drawings. Conductors shall meet the requirements of Section 16120 - Wire and Cables.

   A. Metal equipment platforms, which support any electrical equipment, shall be bonded to the nearest ground bus or to the nearest grounding loop. This grounding requirement is in addition to the raceway grounding required in the preceding paragraph. If not indicated otherwise, provide No. 2 AWG conductor in 3/4-inch conduit.

   B. Copper bonding jumpers shall be used to obtain a continuous metallic ground for equipment such as control panels.

3. Grounding Electrode System: The Contractor shall install the grounding electrode system

with all required components in strict accordance with National Electrical Code Article 250.

A. Connection to ground electrodes and ground conductors shall be exothermic welded where concealed and shall be bolted pressure type where exposed. Bolted connectors shall be assembled wrench tight to manufacturer's requirements.

B. Insulated grounding bushings shall be employed for all grounding connections to steel conduits in switchboards, in motor control centers, in pull boxes, and elsewhere where conduits do not terminate at a hub or a sheet metal enclosure. Where insulated bushings are required, fasten with double locknuts.

C. Copper bonding jumpers shall be used to obtain a continuous metallic ground across non- conductive structural members.

D. Within buildings, the grounding cable shall, where possible, be embedded in or installed beneath the slabs.

E. Wiring from ground electrodes connecting to system components, listed in paragraph 2.01.1, from the ground plane shall be contained in ¾ inch conduit.

4. Shield Grounding

A. Shielded instrumentation cable shall be grounded at one end only; this shall typically be at the "receiving" end of the signal carried by the cable.

B. Termination of each shield drain wire shall be on its own terminal screw. All grounding screws in one rack shall be jumpered with No. 16 solid tinned bare copper wire; connection to ground shall be accomplished with a No. 12 green insulated conductor to the main ground bus.

5. Ohm Test: Contractor shall perform an Ohm test to ensure that grounding is adequate. Testing shall be performed during normal dry weather conditions with at least 5 non-rain days elapsing prior to test. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms or less by driving additional ground rods; then retest to demonstrate compliance

END OF SECTION

SECTION 16460

ELECTRIC MOTORS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. General: The Contractor shall provide electric motors, accessories, and appurtenances complete and operable, in conformance with the individual driven equipment specifications and the Contract Documents.

2. The provisions of this Section apply to all low voltage AC squirrel cage induction motors except as indicated otherwise.

3. The Contractor shall assign to the equipment supplier the responsibility to select suitable electric motors for the equipment. The choice of motor manufacturer shall be subject to review by the City. Such review will consider future availability of replacement parts and compatibility with driven equipment.

4. Electrical Codes, Ordinances, and Industrial Standards: The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment, and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable State and local requirements. UL listing and labeling shall be adhered to under this Contract. Any equipment that does not have a UL, FM, CSA, or other listed testing laboratory label, shall be furnished with a notarized letter signed by the supplier stating that the equipment furnished has been manufactured in accordance with the National Electrical Code and OSHA requirements. Any additional cost resulting from any deviation from codes or local requirements shall be borne by Contractor.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be in accordance with Section 01300-Contractor Submittals.

2. Complete motor data shall be submitted with the driven machinery Shop Drawings. Motor data shall include:

   A. Machine name and specification number of driven machine

   B. Motor manufacturer

   C. Motor type or model and dimension drawing. Include motor weight.

   D. Nominal horsepower

   E. NEMA Design

   F. Enclosure

G. Frame Size

H. Winding insulation class and temperature rise class

I. Voltage, phase and frequency ratings

J. Service factor

K. Full load current at rated horsepower for application voltage

L. Full load speed

M. Guaranteed minimum full load efficiency and nominal efficiencies at 1/2 and 3/4 load.

N. Type of thermal protection or over temperature protection, if included

O. Wiring diagram for devices such as motor leak detection, temperature, or zero speed switches, as applicable

P. Bearing data. Include recommendation for lubricants of re-lubricatable type bearings.

Q. If utilized with a variable frequency controller, verify motor is inverter duty type. Include minimum speed at which motor may be operated for the driven machinery.

R. Power factor at 1/2, 3/4, and full load

S. Recommended size for power factor correction capacitors to improve power factor to 0.95 (lagging) when operated at full load.

PART 2 -- PRODUCTS

2.01 GENERAL REQUIREMENTS

1. Electric motors driving identical machines shall be identical.

2. Maximum motor loading shall in all cases be equal to nameplate horsepower rating or less, exclusive of service factor and be verifiable from the submittal data of the driven machinery.

3. Minimum motor HP: The Contractor shall size motors to continuously carry the maximum load imposed through the full range for driven equipment operation; however, power ratings shall not be less than the specified values, when indicated in the specification. If the specified values are less than those required from the first criterion above, then the Contractor shall provide greater capacity motors. In addition, increases in circuit breaker, magnetic starter, conductor, and conduit size capacities related to increased motor size shall also be provided.

4. Exempt Motors: Motors which are for submersible pumps or motors which are an integral part of standard manufactured equipment, i.e., non-NEMA mounting, common shaft with driven element, or part of domestic or commercial use apparatus may be excepted from these specifications to the extent that such variation reflects a necessary condition of motor service or a requirement of the driven equipment.

2.02 DESIGN REQUIREMENTS

1. General: Electrical Motor design and application shall comply with current ANSI, IEEE, NEMA, and AFBMA standards and with the NEC where applicable. They shall be squirrel cage induction motors rated 60 hertz, continuous duty for use in 40 degrees C ambient temperature. Motors shall comply with NEMA MG1-1993, Rev. 1, Part 31, Definite Purpose Inverter-Fed Motors whether used with variable frequency drives or not.

   A. The motors shall be sized within their rated loads under the specified conditions without utilizing the top 15 percent of the 1.0 or 1.15 service factor. Motor sizing measured at the motor output shaft shall include all loadings on the motor. Motor loadings shall include the maximum or specified load condition of the driven equipment plus all drive losses of components, located between the motor and the driven equipment.

   B. The motor winding temperature rise shall be NEMA Standard for the class of insulation used at the rated service factor load.

   C. The motors shall be capable of handling unfiltered voltage peaks of up to 1600 volts and rise times of 0.1 micro-seconds.

2. NEMA Design: Electric motors shall be NEMA Design B, unless otherwise indicated. In no case shall starting torque or breakdown torque be less than the value specified in said ANSI/NEMA MG 1. Motors shall be suitable for the indicated starting method.

3. Motor Voltage Ratings: Motors shall have voltage ratings in accordance with the following, unless otherwise indicated:

   A. Motors below 1/2-HP shall be rated 115 volts, single-phase, 60-Hz. Dual voltage motors rated 115/230-volts, 115/208-volts, or 120-240 volts are acceptable, provided all leads are brought out to the conduit box. All 115/208-volt motors shall be pre-approved by the City of Cape Coral.

   B. Motors 1/2-HP and larger shall be rated 230 volts or 460 volts, 3-phase, 60-Hz. Dual voltage motors rated 230/460 volts are acceptable, provided all leads are brought out to the conduit box.

4. Insulation: All 3-phase motors shall be provided with Class F insulation, rated to operate at a maximum ambient temperature of 40 degrees C and at the altitudes where the motors will be installed and operated, without exceeding Class B temperature rise limits stated in ANSI/NEMA MG 1-12.44. Single phase motors shall have Class F insulation with temperature rise not to exceed the insulation class. Motors to be operated from adjustable frequency drives shall be provided with insulation systems to

withstand 1600-volt spikes, with dV/dt as defined in NEMA MG 1-31.

5. Motors 50 HP or smaller located in non-hazardous areas shall be totally enclosed, fan cooled (TEFC) with a Service Factor of 1.15 unless otherwise indicated.

6. Motors for use in hazardous locations shall meet NEC Class 1, Division I, Group D, requirements with T2A temperature rating. Such motors shall be U.L. listed and be stamped as such.

7. High Efficiency Motors:

   A. Motors with a nameplate rating of 1 HP and larger shall be "high efficiency" units. Motors shall be stamped with the efficiency on the nameplate with the caption "NEMA High Efficiency" or "NEMA Nom. Eff." Such motors shall have efficiencies determined by the test as set forth in ANSI/IEEE 112 -Standard Test Procedure for Polyphase Induction Motors and Generators, Method B.

   B. High Efficiency motors shall conform to the following guaranteed minimum efficiency requirements which are full load values:

OPEN DRIP-PROOF (ODP)								
FULL-LOAD EFFICIENCIES OF ENERGY EFFICIENT MOTORS								
OPEN MOTORS								
	2 POLE		4 POLE		6 POLE		8 POLE	
HP	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1.0	--	--	82.5	80.0	80.0	77.0	74.0	70.0
1.5	82.5	80.0	84.0	81.5	84.0	81.5	75.5	72.0
2.0	84.0	81.5	84.0	81.5	85.5	82.5	85.5	82.5
3.0	84.0	81.5	86.5	84.0	86.5	84.0	86.5	84.0
5.0	85.5	82.5	87.5	85.5	87.5	85.5	87.5	85.5

8. All integral horsepower motors shall have oversize conduit boxes with clamp-type grounding terminals inside which are effectively connected to all noncurrent-carrying motor parts.

9. Multispeed motors are to be supplied with separate windings for each speed. The cost to change starters for motors supplied with reconnectable windings will be the responsibility of equipment (motor) supplier and must be coordinated with ENGINEER.

10. Special duty and severe environment application shall have motors which are designed.

11. specifically, to meet the special conditions as specified.

2.03 ACCESSORY REQUIREMENTS

1. General: Horizontal motors 3 HP and larger, and all vertical motors, shall have split-type cast metal conduit boxes. Motors less than 3 HP shall have the manufacturer's standard conduit boxes. Motors other than open drip-proof shall be gasketed.

2. Lifting Devices: Motors weighing 265 lb. (120 Kg) or more shall have suitable lifting eyes for installation and removal.

3. Special Requirements: The Contractor shall refer to individual equipment specifications for special requirements such as motor winding thermal protection or multi-speed windings.

4. Grounding Lugs: Provide motor grounding lug suitable to terminate ground wire, sized as indicated.

5. Nameplate: Motors shall be fitted with permanent stainless-steel nameplates indelibly stamped or engraved with NEMA Standard motor data, in conformance with NEMA MG-1- 10.40.

6. Where motors are indicated by elementary schematics or specifications to have zero speed switches, the switches shall be factory mounted integral to the motors. Switches shall close contact when the motor is at zero speed.

2.04 MOTOR THERMAL PROTECTION

1. Single Phase Motors: Single phase 120, 208, or 230-volt motors shall have integral thermal overload protection or shall be inherently current limited.

2. Thermostats: Winding thermostats shall be snap action, bi-metallic, temperature-actuated switch. Thermostats shall be provided with one normally closed contact. The thermostat switch point shall be pre-calibrated by the manufacturer.

2.05 MOTOR BEARINGS

1. General: Bearings shall conform to Section 11000 - Equipment General Provisions, except as indicated herein.

2. Motors greater than 2 HP shall have bearings designed for 17,500 hours (belted) or 100,000 hours (coupled) L-10 life.

3. Fractional Horsepower: Motors with fractional horsepower through 2 HP shall be provided with Lubricated-for-Life ball bearings.

4. Horizontal Motors Over 2 HP: Motors larger than 2 HP shall be provided with relubricatable ball bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

5. Vertical Motors Over 2 HP: Vertical motors larger than 2 HP shall be provided with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

2.06 Manufacturers, or City Approved Equal

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

PART 3 -- EXECUTION

3.01 INSTALLATION

1. Motor installation shall be performed in accordance with the motor manufacturer's written recommendations and the written requirements of the manufacturer of the driven equipment.

2. Related electrical work involving connections, controls, switches, and disconnects shall be performed in accordance with the applicable sections of Division 16.

3.02 FIELD TESTING

1. The Contractor shall perform the following field tests:

   A. Inspect each motor installation for any deviation from rated voltage, phase, or frequency and improper installation.

   B. Visually check for proper phase and ground connections. Verify that multi-voltage motors are connected for proper voltage.

   C. Check winding and bearing temperature detectors and space heaters for functional operation.

   D. Test for proper rotation prior to connection to the driven equipment.

   E. Test insulation (megger test) of all motors in accordance with NEMA MG-1.

   F. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.

3.03 INSTALLATION CHECK

1. Installation Check: Manufacturer shall provide the services of a factory-trained representative to check the installation of all equipment installed in this Section. The services shall be as noted in Section 01600. Equipment supplier's representative shall revisit Site as often as necessary until all trouble is corrected and equipment installation and operation is satisfactory to ENGINEER.

2. Manufacturer's representative shall provide all necessary tools and testing equipment required including noise level and vibration sensing equipment.

3. Inspection Report: A written report of the installation check shall be submitted to ENGINEER. The report shall be as noted under Section 01600 certifying that the equipment:

   A. Has been properly installed and lubricated;

   B. Is in accurate alignment;

   C. Is free from any undue stress imposed by any connection or anchor bolts;

   D. Has been operated under full load condition and that it operated satisfactorily to ENGINEER; and

   E. That OWNER's representative has been instructed in the proper maintenance and operation of the equipment.

   F. Furnish OWNER a copy of all test data recorded during the installation check including noise level and vibration readings.

END OF SECTION

SECTION 16480

PUMP CONTROL PANEL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

1. The Contractor shall furnish, install and test all single-phase and three-phase, pump control panels as required, all in accordance with the requirements of the Contract Documents. In addition, if motors furnished are different from those shown and specified, then the installation of raceway, conductors, starters, VFD's, overload elements, and branch circuit protection shall be adjusted as required to control and protect the motor furnished.

2. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of 5 years' experience in the fabrication of pump control panels.

1.02 CONTRACTOR SUBMITTALS

1. General: Submittals shall be in accordance with the requirements of Section 01300 "Contractor Submittals."

2. Contractor shall submit shop drawings and technical information for all materials and equipment required for construction and installation of the pump control panel. Manufacturer's cut sheets showing materials, dimensions and operating systems shall be submitted as part of the shop drawings. Shop drawing submittals shall include the following:

3. Shop Drawings

   A. Enclosure NEMA rating, dimensions, material, and color

   B. Arc Flash warning signs as required by OSHA and per Article 110.16 of the NEC, most recent edition.

   C. Bus ampacities, voltage rating and interrupting capacity. Include materials of construction

   D. Ground bus size and material of construction

   E. Conduit entrance provisions

   F. Main incoming line entry provision (top or bottom)

   G. Control unit nameplate schedule

   H. All circuit breaker types, frames and settings

I. All starter NEMA sizes, auxiliary contact provisions, coil voltage, VFD

J. information (Including sizing calculations for operation on a single-phase supply).

K. Relays, timers, pilot devices, control transformer VA and fuse sizes

L. Elementary schematic ladder diagrams for each compartment. Custom schematics shall be furnished. Diagrams shall include all remote devices. Submittals with drawings not meeting this requirement will not be reviewed further and will be returned to the Contractor stamped "REJECTED-RESUBMIT." Once schematics have been either “APPROVED” or “APPROVED AS NOTED”, Contractor shall laminate and mount schematics to inside of the exterior door to the control panel. Schematics shall be posted in accordance with OSHA requirements.

M. Short circuit rating of the complete assembly

N. Replacement parts lists and operation and maintenance procedures

1.03 QUALITY ASSURANCE

1. General: Each pump control panel shall be the product of a single manufacturer, meeting the experience requirements of Section 1.01.2. All materials and parts in this unit shall be new and unused, of current manufacture, and of the highest grade, and free from all defects that may affect performance.

2. Unit Responsibility: Each pump control panel and all appurtenant equipment specified herein shall be provided by a single manufacturer/vendor, establishing one source of responsibility for the equipment performance and assuring high standards of quality, coordination, reliability and service.

3. Factory Test: Prior to delivery at the job site, each pump control panel and appurtenant equipment shall be tested at the manufacturer’s testing facility to verify that the equipment is free of any defects. All cabinets shall bear UL label, as applicable. Provide factory test report at time of delivery.

1.04 WARRANTY

1. Warranty: Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under the terms of the manufacturers and supplier’s standard warranty. In no event shall it be for a period of less than five (5) years from date of final acceptance of the system and shall include labor, materials and travel costs for necessary repairs at the job site.

PART 2 -- PRODUCTS

2.01 GENERAL

1. Each pump control panel shall be built in accordance with the details as required by the Contract drawings and/or as specified herein. Square D by Schneider Electric, Cutler

Hammer/Eaton, Allen Bradley or City approved equal, shall manufacture all major components of the pump control panels such as control devices and custom fabricated equipment including:

A. Molded case circuit breakers

B. Disconnect switches

C. Magnetic motor starters

D. Control and timing relays rated at 600 volts AC

E. Pushbuttons, lights, and selector switches, including remote mounted control stations

F. Meters, including ammeter, voltmeter, and solid-state metering devices

G. Pulse-width modulated variable frequency drives

2. The pump control panel construction shall comply with applicable requirements of NEMA 250 and UL Standards 50 and 508.

3. Wiring of pump control cabinets shall utilize stranded copper conductor rated for 600- volts and UL listed as specified in Section 16120 Wires for annunciator and indication circuits shall be No. 16 AWG minimum. All others shall be No. 14 AWG minimum. All incoming and outgoing status or signals shall be terminated on master set of terminal blocks. All wiring from the master terminals to internal components shall be factory- installed and shall be contained in 4-inch wide by 4-inch-high plastic wireways having removable covers. Wiring to door mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.

4. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers. Wiring on the rear of the inner door shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage.

5. Terminal points of all terminal strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All terminal points shall be shown on electrical schematic diagrams.

2.02 PUMP CONTROL PANEL

1. Main circuit breaker and enclosure for each pump control panel shall be marked as "Suitable for Use as Service Equipment" as required by the local or national electric codes. Arc Flash warning signs shall be provided as specified in 1.02.3.B.

2. The pump control panel shall be housed in a NEMA 4X 316 American made stainless steel enclosure with 30 % extra mounting space for additional equipment. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. The control panel enclosure shall be Underwriters Laboratories (UL) 50.

3. There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" x 12" pocket for log sheet storage. The nameplate shall contain the following information, voltage, phase, rated horsepower, speed, date manufactured and pump and control panel manufacturer's name, address and telephone number, pump data, including impeller data, operating point and head, kW input, and amps at the operating point and at least two other points on the pump curve.

4. Power supply to the control panel shall be 120/208 volts, 120/ 240 volts, or 277/480 volts, 3- phase, 4- wire; or 120/240 volts, 1-phase, 3-wire, as shown on the Contract Drawings. Service shall be as indicated on Drawings.

5. A non-fusible service disconnect switch in a NEMA-4X American made stainless steel enclosure and surge arrestor shall be installed between the meter and the control panel. Additionally, in conformance to LCEC Service Requirements, a non-fusible service disconnect switch in a NEMA-4X American made stainless steel enclosure and surge arrestor shall be provided on the input to the meter for 480 volts only.

6. The pump control panel containing motor starters shall be combination circuit breaker type; unit shall have panel mounted control devices as specified herein. Metal dividers shall be provided in the interior panels to isolate electrical components having different functions.

7. Full voltage starter shall be NEMA Rated, Size 1 minimum. IEC (International Electrotechnical Commission) or dual rated starters will not be acceptable.

8. Each starter unit shall have its own 120-24-volt control transformer, feeding the circuitry for the float switches. Panel shall have fused control transformers where indicated.

9. Each starter shall be provided with a 3-pole Motor Circuit Protector, furnished by Square D or City approved equal. Refer to Section 16420 for additional requirements.

10. The panel shall contain two motor starters, except as described below. Local Power Company Regulations shall govern. Selector switches shall be installed on the face of the inner door unit. Selector switch shall be a heavy-duty oil tight "Hand-Off-Auto" three-position switch to control the operation mode of each pump motor starter.

    A. Where supplied from the utility with single phase, 120/240 V power, the panel shall include a quantity of two (2) pulse width modulated, 240 V variable frequency drives (3 phase) for operation from the utility source. The drives shall be operated on 240 V, single phase input power, and shall deliver 240 V, 3 phase output to the 3-phase pump motor. The VFD single phase protection shall be disabled. Motors shall be ramped up to full speed each time the VFD is called upon to start. VFD shall be as manufactured by Eaton Electrical, or City approved equal. Submit sizing calculations to show that the drive is properly sized for the single-phase input and 3 phase output for the motor actually connected. Refer to Section 16151 for additional requirements.

11. A plug-in solid-state alternator shall be provided to change the pump starting sequence after each pumping cycle. The alternator shall be provided with a three-position

alternator test switch to control the alternation operation. Switch positions to include the "Auto" position to provide normal automatic sequence, "Off" position to disable alternator, and "test" position with a spring return to allow the alternating of the pump sequence to check alternator operation. The pump alternator shall be MPC 008-120-13N or Diversified ARA-120-ACA.

12. Circuit breakers shall conform to the circuit breaker criteria as specified below:

    A. The control panel shall consist of a main utility circuit breaker and a generator breaker with mechanical interlock, an emergency power receptacle, a circuit breaker and VFD or magnetic starter for each pump motor, and 15 ampere, 120-volt circuit breakers as required.

    B. Circuit breakers shall be factory-assembled, molded-case circuit breakers with permanent instantaneous magnetic and thermal trips in each pole, sealed trip units, and with fault- current limiting protection, ampere ratings as indicated. Construct with over center, trip- free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Provide push-to-trip feature for testing and exercising circuit breaker trip mechanism. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with AL/CU-rated mechanical screw type removable connector lugs. The breaker contact material shall be a non-weldable silver alloy. The breakers shall have arc-extinguishing chutes.

13. Pump Control Operation with Liquid Level Float Switches

    A. In the Auto Mode, the control panel shall respond to liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high wet well levels. The control panel shall operate two (2) submersible pumps at the power characteristics stipulated. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump shall automatically start to handle this increased flow. As the flow decreases, pumps shall be cut off at the Low-Level Float elevation as shown on the Drawings. Pumps shall alternate positions as lead pump at the end of each cycle. A failure of the alternator shall include a safe, convenient method of manual alternation and also have provisions to prevent automatic alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation and provide a visual indication of the regulator failure. Pumps shall always operate at full speed, regardless of the starting means employed.

    B. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle. A five-float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps and shall operate from a 24-volt circuit. The functions of the five float switches shall be Off (Low Level), Start Lead Pump, Start Lag Pump, and High Level (Alarm) and High Level (Alarm) to RTU.

14. Lights and Alarms

A. Indicator Lights: There shall be installed on the face of the inner door unit, heavy duty oil tight indicator lights as shown on the Drawings.

B. High Level Alarm: A vapor proof, red flashing light shall be furnished and mounted on the side of the panel for high-level alarm.

15. Control Devices

A. Products of the same type shall be of the same make. This requirement applies to all control devices and, insofar as practical, to equipment manufactured on a production basis. It also applies without exception to equipment custom fabricated for this project.

1) Selector Switches: Selector switches shall be rated 10 amperes at 600 volts, shall be heavy-duty, corrosion resistant Type 4/4X shall have the number of positions and poles shown. They shall be Square D Class 9001 Type SKS, or City approved equal. Each shall have a factory-engraved legend plate as shown.

2) Indicating Lights: Indicating lights shall be 120 volt, full-voltage, push-to-test type, and shall be heavy-duty, corrosion resistant Type 4/4X, as specified above for selector switches. Each shall be nickel-plated with a screwed-on glass prismatic lens approximately one-inch in diameter. Indicating lights shall be Dialco 803-1710, Littlelfuse 930407X, or City approved equal.

3) Magnetic Relays: Magnetic relays shall be general-purpose miniature plug-in- type relays with 115-volt AC coils and 10-amp contacts, unless otherwise shown. Relays shall be socket-mounted to a common mounting channel. Mounting dimensions and drilling for AC and DC relays shall be identical. All AC relays shall be Potter and Brumfield Type KRPA-11AN, Eagle Signal 22 series, or City approved equal.

4) Control Relay: The level control relays shall operate from 24VAC. They shall be enclosed, plug-in 8-pin type with octal-style screw terminal sockets, including retainer clip.

5) Phase Monitor: For all 3-phase, stations, a phase monitor shall be provided for protection of electrical components due to phase loss, low voltage or phase reversal. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the eight-pin phase monitor with the eight-pin alternator. Phase monitors shall be by MPC, Time Mark Model 2652, or City approved equal.

6) Elapsed Time Meters: Elapsed time meters (ETM) shall be non-reset type; shall totalize pump running time for each pump, in hours and tenths of

hours to 99999.9 hours; shall have flush panel-mount case not less than 3 inches square; shall be suitable for operation at 115 volts, 60-Hz, ac; and shall be Hecon TO 621134, or City approved equal.

7) Terminal Blocks: Terminal blocks for control wiring shall be molded type with barriers, rated not less than 600 volts. White or other light-colored marking strips shall be provided for circuit designation. Each connected terminal of each block shall have the circuit designation or wire number imprinted on the marking strip with permanent marking fluid. Terminal blocks shall be Square D 9080 type GRG, Marathon Series 200, or City approved equal.

8) Strobe Light Assembly: Strobe Light Assembly shall be rated 120 volts, Ingram ALVLRX- 40, 40-watt bulb.

9) Fuses: Fuses shall be used in the primaries and secondaries of control transformers. Fuses shall be manufactured by Bussman, Shawmut, or City approved equal.

10) Float Switches: Float Switches shall be 2-wire Roto-Float or City approved equal.

11) A motor automatic megger furnished by Automeg, or City approved equal shall monitor motor insulation on 3-phase, 120/208- and 277/480-volt stations.

12) Moisture and Temperature Indicator: Indication of moisture or temperature failure shall be provided by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

13) The wet well hatch intrusion alarm switch shall be **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST** and shall meet an electrical classification of Class I, Division I, Group C and D.

14) The control panel and RTU intrusion alarm switch shall be a spring contact switch.

16. Voltage Surge Arrester:

A. Voltage surge arresters shall be furnished and installed for protection of motors and controls. It shall be suitable for use with a 120/240 volt, 1-phase, 3-wire, grounded neutral system or a 120/208-volt, 120/240 volt, or 277/480 volt, 3-phase, 4- wire, grounded neutral system, as applicable. Surge protectors shall be U.L. listed and installed per power company requirements and manufacturers' specifications, surge protectors shall be attached to the main disconnects. Surge arresters shall be manufactured by **SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST.**

17. Breakers and Receptacles:

A. Panels shall be provided with three 120-volt GFI duplex receptacles, one mounted on the RTU panel inner door, and two mounted in the control unit, fed from dedicated single-pole 20-amp circuit breakers.

B. Panels shall be provided with a main circuit breaker and a circuit breaker on each individual branch circuit distributed from the panel. Main breaker and branch breaker sizes shall be coordinated such that a fault in a branch circuit will trip only the branch breaker but not the main breaker.

18. Nameplates:

A. Nameplates shall be fabricated from white-letter, blackface-laminated plastic engraving stock, Formica type ES-1, or City approved equal. Each shall be fastened securely, using fasteners of American made stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style of adequate size to be read easily at a distance of 6 feet with no characters smaller than 1/8-inch high.

19. Manufacturers of Pump Control Panels:

SEE CITY OF CAPE CORAL QUALIFIED PRODUCT LIST

2.03 EXTERIOR CONTROL PANEL REQUIREMENTS

1. Service disconnects shall be provided as shown on drawings and shall be NEMA 4X 316 SS Enclosure. Furnish and install disconnect switch for 277/480-volt, 3-Phase installations on the utility side and ahead of the meter box immediately adjacent to the meter socket. The disconnecting switch shall be rated not less than the load to be carried and must have an interrupting rating at system voltage sufficient for the current to be interrupted and a fault current rating greater than the system fault current. The disconnecting switch for 277/480V service shall be readily accessible to LCEC personnel and shall accept an LCEC lock. The Contractor shall coordinate with LCEC as regards to the required interrupting rating. For all other installations (120/208-volt, 3-Phase, 120/240-volt, 1-Phase, & 120/240-volt, 3- Phase), the Contractor shall furnish and install a non-fusible disconnect switch and surge arrestor on the load side of the meter as shown on the contract drawings.

2. Furnish and install Electrical Meter NEMA 3R Aluminum Box (no bolt). Meter box shall be Landis and Gyr HQ7.

3. Step-down Electrical Transformer (See Specification 16480 Section 2.02.7).

PART 3 – EXECUTION

3.01 GENERAL

1. The Contractor shall install and test all pump control panels in accordance with manufacturer's published instructions. Conduit installation shall be coordinated so that all conduit stub-ups are within the area allotted for conduit as indicated on the drawings.

3.02 INSTALLATION

1. Each pump control panel shall be set level within 1/32-inch per horizontal foot. After leveling and shimming, the Contractor shall anchor control panel to concrete pad and shall grout in place so that no space exists between the pad and support beams. Installation shall be above 100-year flood level as indicated on the drawings.

2. The Contractor shall:

   A. Tighten all sheet metal and structure assembly bolts.

   B. Inspect all protective devices to verify operation under normal conditions. Verify that overload devices are proper for equipment installed; make necessary changes in overload devices as required for motors.

   C. After equipment is installed, touch up scratches and verify that nameplate and other identification is accurate and in compliance with these Specifications.

3.03 WARRANTY

1. The manufacturer shall furnish a five- (5) year warranty against defects in materials and workmanship covering parts and labor on all items supplied under this section.

END OF SECTION

SECTION 17251

REMOTE CELLULAR TELEMETRY UNITS AND APPURTENANCES

PART 1 -- GENERAL

1.01 GENERAL

1. The Contractor shall furnish and install the new Remote Telemetry Unit (RTU) equipment as specified and as shown on the Contract Documents. It is the intent of these specifications to have a single Contractor be responsible for all hardware, software, system integration, programming, testing, and startup of all control systems. The Contractor shall supply a single copy of start-up software under this Contract.

2. All remote telemetry units shall be of first-class workmanship and shall be entirely designed and suitable for outdoor services. All material shall be new.

3. The delivered equipment shall include all tools, diagnostic equipment, and documentation to install and maintain all future expansion capabilities. Each RTU shall be completely functionally interchangeable with any existing RTU in the existing SCADA system without modification.

1.02 SUBMITTALS

1. General: Prior to release for fabrication, the Vendor shall submit for approval shop drawings and other information for all equipment proposed in accordance with Section 01300 – Contractor Submittals.

2. Operations and Maintenance Manuals: The Vendor shall submit operation and maintenance manuals for all equipment proposed.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

1. All equipment parts shall be properly protected in accordance with manufacturer requirements so that no damage or deterioration will occur.

2. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the City.

3. Each box or package shall be properly marked to show its contents.

PART 2 -- PRODUCTS

2.01 REMOTE TELEMETRY UNITS AND APPURTENANCES

1. The Remote Telemetry Units shall be microprocessor based, user programmable, which shall serve as an interface for monitoring and control between the RTU and the City's SCADA system.

2. All components shall be off-the-shelf, readily available from more than one vendor.

3. The RTU shall have sufficient battery backed RAM, and EEPROM nonvolatile backup memory to provide all status, monitoring and control functions and shall be industrial quality.

4. On-board LED indicators shall be provided to verify the presence of power supply output voltages, and power delivered to each I/O board or module. A power control assembly shall be provided to monitor the supply voltage and battery charge condition. Upon detection of power drop or voltage loss, power shall be automatically switched to the battery bank. The RTU shall include internal alarms for low battery voltage and line power failure.

5. The RTU logic processor shall be microprocessor based. Operating system and RTU system code shall be stored in nonvolatile memory. The RTU shall be equipped with a 10/100 Ethernet port.

6. The RTU shall be designed to operate in an industrial environment. The RTU shall be capable of operation in an ambient temperature range of 0° to 60° C and a relative humidity of 5-95 percent, non-condensing. The RTU shall operate on 24VDC supply voltage.

7. All components of the RTU shall be of the same manufacturer who is regularly engaged in the manufacture of programmable controllers. The manufacturer shall have fully tested units similar to that being furnished in an industrial environment with associated electrical noise. The processing unit shall perform the operations functionally described herein based on the program stored in memory and the status of the inputs and outputs.

8. Each RTU shall be configured to provide the I/O and data communications equipment as indicated on the Drawings. In addition, all RTUs shall be sized with adequate spare memory and I/O design capacity to meet future I/O expansion.

9. All RTU's shall be powered from a UPS with alarm output to the RTU on loss of supply power. Power supply shall be of sufficient capacity to provide power to all RTU equipment, discrete and analog IO under full load, communications interface equipment, modems, radios, and associated equipment. Batteries shall be sized to provide a minimum of 30 minutes of full load backup in the event of AC power loss.

10. RTU shall be Allen-Bradley Micro 800 series, or engineer-approved equal.

11. RTU inputs shall include control panel door intrusion switch to report an event/alarm when the door has been opened.

2.02 RTU COMMUNICATIONS INTERFACE

1. Primary communication to the City's SCADA system is ethernet over IP via cellular modem.

2. Future secondary communication to the City's SCADA system is ethernet over IP via fiber.

2.03 CELLULAR MODEM AND APPURTENANCES

1. An industrial cellular gateway is used for remote connectivity to the existing SCADA system.

Modem shall have the following features:

- Support for Verizon M2M communication
- LTE band
- 10/100 Ethernet Port, Ethernet/IP, Modbus TCP/IP
- 24VDC
- Operating temperature of 0C to 60C

2. Provide an LTE antenna. Antenna shall include a diversity connection.

3. The complete communications subsystem including all interconnecting cables shall contain lightning, surge, and transient protection.

4. Modem shall be Prosoft or City approved equal.

2.04 PANELS

1. The RTU shall be mounted in the same panel as the pump control panel.

2. The temperature inside each enclosure containing an RTU shall be continuously monitored and shall generate an alarm input to the associated RTU input-output subsystem if the temperature rises to an adjustable, preset high temperature.

2.05 ELECTRICAL TRANSIENT PROTECTION

1. All electrical and electronic elements shall be protected against damage due to electrical transient induced in interconnecting lines from lightning discharges and nearby electrical systems.

2. All surge suppressor devices shall be manufactured by a company that has been engaged in the design, development, and manufacture of such devices for at least 5 years.

3. Provide surge suppressors to all devices located outside of the electrical room or enclosure.

2.06 24 VDC SUBSYSTEM

1. Provide a 24 VDC subsystem which includes a 120 VAC to 24 VCD power supply and a backup battery. The 24 VDC system will power critical communication including the PLC, network switch, modem, IO, and control relays.

2. The preferred signal voltage is 24 VDC.

2.07 Operator Interface Terminal (OIT)

1. The Contractor shall program the OIT and add the related screens and programming to

interface with the RTU for monitoring and control.

PART 3 – EXECUTION

3.01 GENERAL

1. The City's INSTRUMENTATION PERSONNEL will check the complete installation and the Contractor will make all necessary adjustments for satisfactory operation of the new RTUs.

2. The Contractor shall program the RTUs and add the related screens and programming to the City SCADA system for monitoring and control.

3. Cabinets and panels shall provide mounting for power supplies, control equipment, input/output subsystems, panel mounted equipment, and appurtenances. Ample space shall be provided between equipment to facilitate servicing and cooling.

4. Terminal blocks shall be factory assembled on a miniature mounting channel and the channel bolted to the steel strap. Terminals shall be miniature screw type unless otherwise required and shall be rated at least 300 volts, 20A, Square D type G, or City approved equal.

5. The terminals shall be marked vertically with a permanent, continuous marking strip from top to bottom. One side of each terminal strip shall be reserved exclusively for field incoming conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal. Subject to the approval of the City, a vendor's pre-engineered and prefabricated wiring termination system will be acceptable.

6. Wiring shall comply with accepted standard instrumentation and electrical practices and codes. For each pair of parallel terminal blocks, the field wiring shall be between the blocks.

7. All wiring shall be bundled and run open or enclosed in vented plastic wireways, as required. All conductors run open shall be bundled and bound at regular intervals, not exceeding 12 inches, with nylon cable ties. Care shall be taken to separate electronic analog signals, discrete signals, and power wiring. A copper ground bus shall be installed the full length of each panel. Interior panel wiring and field wiring shall be tagged at all terminations with machine-printed plastic sleeves.

8. Panels shall be provided with a 120-volt receptacle. Outdoor receptacles shall be GFI rated.

9. The Contractor shall be responsible for providing all conduit and wire between the RTU and the Local Control Panel, and antenna.

END OF SECTION