Water and Wastewater Systems Standard Specifications and Details

Coral Springs Improvement District

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ECKLER ENGINEERING, INC.

WATER AND WASTEWATER SYSTEMS

STANDARD SPECIFICATIONS AND DETAILS

for the

CORAL SPRINGS IMPROVEMENT DISTRICT

Prepared By

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General Intent

The purpose of this Manual is to provide standardized specifications and details for the construction of utility system improvements within the Coral Springs Improvement District (CSID) Utility Service Area. This Manual covers the requirements for improvements or additions to the Coral Springs Improvement District's existing potable water system, wastewater collection system, lift stations, force main system, and miscellaneous items.

It shall be the responsibility of the user of this document to coordinate all necessary requirements for each specific project with the appropriate Coral Springs Improvement District Utility Division personnel. The standard details included herein shall be used with prior approval from the Coral Springs Improvement District.

The omittance of any item that is specifically required to properly complete the construction of an improvement to any of these systems as described shall be provided by the end user even if the specific item is not specified or shown by the standard details.

If there is a conflict between the requirements of the Standard Specifications and Details and the applicable regulatory requirements set forth by the Florida Department Environmental Protection, Broward County Environmental Protection Department, or the Broward County Health Department, the most stringent of these requirements shall prevail.

Current Edition

The current edition is Water and Wastewater Systems Standard Specifications and Details, September 28, 2017.

Standard specifications and details shall be updated on a yearly basis.

Industry Standards, Reference Specifications, Regulations, and Codes

This Manual shall assume compliance with all applicable references as latest revision published.

Standard Specifications

The Standard Specifications section of this document contains written specifications describing the components as graphically depicted by the Standard Detail Drawings. The Standard Specifications are listed by the individual Utility System. If a component is utilized in more than one of the utility systems such as ductile iron pipe, this component will be specified in each utility system where utilized.

These Standard Specifications may be reproduced by the end user for Coral Springs Improvement District projects only.

Standard Details

These Standard Details may be reproduced by the end user for Coral Springs Improvement District projects only.

Please be advised that the Standard Detail files are in Adobe .pdf file format that cannot be altered by the end user. Due to this fact, any reuse of these files will be at the user's sole risk without liability or legal exposure to the Coral Springs Improvement District or Eckler Engineering, Inc. The user shall indemnify and hold harmless the Coral Springs Improvement District and Eckler Engineering, Inc. from all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from the use of the digital standard detail(s) files.

Additionally, it is the responsibility of the user to select and use the appropriate Standard Details, Standard Specifications, and digital files that meet the requirements of the specific installation or installations regarding all regulatory agencies, rules, and regulations.

Specific project requirements shall be confirmed with the Coral Springs Improvement District.

Design Guidelines

The Design Guidelines section contains basic lift station layout, sections, and configuration of lift station sewer elements; additionally, one-line diagrams and electrical riser Class I, Div 1 or Div 2, Group D Hazardous Area Diagrams. These design guidelines are intended to provide the specific project Consulting Engineer of Record to lift station design criteria only and are not intended to be used as typical details.

Also, it is the responsibility of the user confirm all project design requirements with CSID, regulatory authorities and local building Official and to select appropriate Standard Details based on the design guidelines to properly address installation requirements.

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1.0 POTABLE WATER SYSTEM

1.01 Ductile Iron Pipe

A. Ductile Iron Pipe Water Main: Pipe materials shall conform to the requirements of ANSI/AWWA C151/A21.51, latest revisions, and unless otherwise noted herein this specification or the drawings, all ductile iron pipe shall be as follows:

Nominal Diameter	Minimum Pressure Class	Special Cases Thickness Class
3" thru 12"	350 Psi	–
14" thru 36"	250 Psi	–
42" thru 54"	200 psi	–
Flanged Pipe (all diameters)	--	53 (Min)

B. Cement: Cement for mortar lining shall conform to the requirements of ANSI/AWWA C104/A21.4, latest revision; provided that cement for mortar lining shall be Type II or V. Fly ash or pozzolan shall not be used as a cement replacement.

C. Push-on pipe joints (non-restrained type) shall be "Fastite" as manufactured by American Cast Iron Pipe Company, "Tyton" as manufactured by U.S. Pipe and Foundry, or equal approved by the Coral Springs Improvement District. Push-on joints shall meet the requirements of ANSI/AWWA C111/A21.11, latest revision.

D. Push-on joints (restrained type), 24-inch and smaller, shall use "Fast-Grip" gasket system by American Cast Iron Pipe Company, "Field Lok" gasket system by U.S. Pipe and Foundry, or equal approved by the Coral Springs Improvement District.

Push-on joints (restrained type) greater than 24-inch, shall be "LOK-Ring" restrained joint by American Cast Iron Pipe "TR Flex" restrained joint by U.S. Pipe and Foundry, or equal approved by the Coral Springs Improvement District.

E. Buried pipe shall have smooth dense exterior and interior surfaces and shall be free from fractures. The outside coating shall be an asphaltic coating at least 1 mil thick and applied to the pipe after lining has been placed. Paint exterior of pipe Alaskan Blue along the entire length of pipe with the following pattern:

PIPE DIA.	MINIMUM NO. OF STRIPES	COMMENTS
4" to 8"	2	One must be on top of installed pipe.
10" to 16"	3	One must be on top of installed pipe.
20" +	4	One must be on top of installed pipe.

All stripes must be at least 3 inches wide.

F. Exposed piping and fittings shall be shop primed with a catalyzed rust inhibitive epoxy primer. Minimum dry film thickness shall be 2-3 mils. Surface preparation shall be white metal blast cleaning in accordance with Steel Structures Painting Council No. 10 (SSPC-SP10). Primer shall be compatible for use with final coatings as specified. See WM-20 for final coating information.

1.02 Not Used

1.03 Ductile Iron Mechanical Joint (MJ) Fittings

A. Mechanical joint fittings (3-inch through 24-inch) shall be ductile iron compact fittings manufactured in accordance with ANSI/AWWA C153/A21.53, latest revision, with a pressure rating of 350 psi. Fittings shall have mechanical joints in accordance with ANSI/AWWA C111/A21.11, latest revision.

B. Mechanical joint fittings (30-inch and larger) shall be ductile iron fittings manufactured in accordance with ANSI/AWWA C110/A21.10, latest revision, with a pressure rating of 250 psi. Fittings shall have mechanical joints in accordance with ANSI/AWWA C111/A21.11, latest revision.

C. Fittings shall be coated and lined as specified for the applicable pipe application.

1.04 Not Used

1.05 Mechanical Joint Restraints (DIP)

A. Restrained mechanical joints shall be utilized for all fittings and valves.

B. Restraint of mechanical joints shall be accomplished by using a Megalug Series 1100 restraining follower gland as manufactured by EBAA Iron Sales, Inc. or equal approved by the Coral Springs Improvement District.

C. Mechanical joints for fittings and valves shall meet the requirements of ANSI/AWWA C111/A21.11, latest revision.

1.06 Valve Boxes

A. Valve boxes shall be of the two-piece adjustable screw type, cast iron, with 5-1/4-inch shaft of appropriate length for the installation. Extension pieces, if required, shall be the manufacturer's standard type. Valve box tops shall have raised letters saying "WATER". Valve boxes shall be as manufactured by Tyler Union, or equal approved by the Coral Springs Improvement District.

1.07 Gate Valves (MJ)

A. Resilient-seated gate valves must be wedge type conforming to ANSI/AWWA C509, latest revision, and UL262 for 3-inch and larger buried service. Resilient-seated gate valves, wedge-type, shall have a cast or ductile iron body and bonnet, rubber-

coated cast iron disc, mechanical joint ends, non-rising stem, O-ring seals, bronze stem nut, flanged bonnet and 2-inch square operating nut. All ferrous surfaces, interior and exterior, shall receive a minimum 8 mil fusion-bonded epoxy coating conforming to AWWA C550, latest revision.

B. All valves must be UL Listed and FM approved. AWWA, UL-FM designation must be cast into valve body.

C. Valves shall be as manufactured by American Flow Control, Mueller, Clow, or equal approved by the Coral Springs Improvement District.

1.08 Butterfly Valves (MJ)

A. All butterfly valves shall conform to the requirements of AWWA C-504, latest revision. Valves shall have ductile iron or cast iron bodies per ASTM A 126 C1 B, latest revision, with integrally cast trunions. Discs shall be of cast iron ASTM A 126 C1B, latest revision, or ASTM A 48 C1 40, latest revision, or of ductile cast iron ASTM A 536, latest revision, Grade 65-45-12. Disc edges shall be type 316 stainless steel or monel. Valve shafts shall be one or two piece, type 304 or 316 stainless steel and shaft diameter shall meet minimum requirements established by AWWA Standard C504, latest revision, for class 150B. Disc-shaft connection shall be solid and operator shall connect to the shaft with the use of keys and keyways. The use of compression or friction connections is not acceptable. Valve seats shall be EPDM material for water with chloramines. Valve seats shall be located in the valve body and shall be simultaneously molded, vulcanized and bonded to the body or retained by mechanical means without the use of retaining rings, segments, screws or hardware of any kind in the flow stream. Seats shall be adjustable and replaceable in valves 24" and larger without removing the disc and/or shaft. Valve shaft bearings shall be sleeve-type, self-lubricating and corrosion-resistant. Valves shall be as manufactured by DeZurik, Mueller, or equal. All interior and exterior ferrous surfaces shall be epoxy coated. Epoxy coatings shall be compatible for service fluid as applicable. Coating for use with potable water processes shall be NSF approved for contact with potable water. Epoxy coating application shall be manufacturer's standard unless otherwise specified.

B. Buried service butterfly valves 24 inches and smaller have ANSI/AWWA C111/A21.11 Class 150B, latest revision, integrally cast mechanical joint ends and enclosed buried service geared operators as per AWWA C-504, latest revision.

Operators shall be equipped with a square operating nut and be fully gasketed and grease packed to withstand an external groundwater pressure of 10 psi, minimum. Extension stems and a ground lever valve position indicator shall be furnished for installation in each valve box. The indicator shall be hermetically sealed for installation inside a cast iron valve box and shall show valve disc position, direction of rotation, and number of turns from fully open to fully closed. This indicator shall be provided by the valve manufacturer, complete.

1.09 Valve Stem Extensions

A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, operating extension stems shall be provided to bring the operating nut to a point 6 inches below the surface of the ground and/or valve box cover. Extension stems shall have 2-inch standard operating nut and steel alignment washer. Extension stems shall be by the General Engineering Company (GENECO), or equal approved by the Coral Springs Improvement District.

1.10 Buried Valve Identification Tags

A. Buried Valves: Underground valve identification markers shall be 3-inch diameter, 1/8-inch thick, solid hard brass, with 1/4-inch tamper-proof straight end rod anchor. Surface to be engraved with 1/4-inch to 3/8-inch capital letters, approximately 0.015-inch deep. Hand punched lettering is not acceptable surface of marker ground smooth and epoxy coated to prevent tarnishing. Markers shall be Wagco markers or equal approved by the Coral Springs Improvement District.

1.11 Tapping Sleeves and Valves

A. Tapping sleeves shall be mechanical joint type with flanged outlet, cast iron, Grade B or ductile iron meeting ASTM A536 Grade 65-45-12, latest revision. Outlet flange drilling shall conform to the requirements of ANSI B16,1 Class 125, latest revision. Working water pressure of sleeve shall be 200 psi. Test plug tap shall be provided in sleeve neck under flange outlet.

B. Tapping valves shall conform to AWWA C509, latest revision, resilient seated gate valves, except as modified for passage and clearance of tapping machine cutters. The opening through the valve shall be a minimum 1/4-inch larger than nominal valve diameter. Valves shall have a flanged end to meet the tapping sleeve. The opposite end shall be mechanical joint.

C. Tapping sleeves and valves shall be manufactured by American Flow Control, or equal approved by the Coral Springs Improvement District.

D. Stainless steel sleeve Style CST-EX, extra heavy, as manufactured by Cascade Waterworks, may be substituted for specified ductile iron sleeve.

1.12 Not Used

1.13 Not Used

1.14 Water Service Components (1" through 2")

A. All components are specified in the Standard Details.

B. All brass components that come in contact with potable water shall meet NSF/ANSI Standard 61, Annex G and/or NSF/ANSI Standard 372 as applicable. Brass alloy shall not contain more than 0.25% lead by weight.

1.15 Backflow Preventers (1" through 2")

A. Reduced pressure principle type. Zurn/Wilkins Model 975 XL2, or equal approved by Coral Springs Improvement District.

1.16 Water Service Components (4" through 8")

A. Backflow preventer shall be Zurn/Wilkins Model 375A, or equal approved by Coral Springs Improvement District.

B. Backflow preventer shall be furnished and installed by Contractor.

C. Flanged large user compound meter to be provided by Coral Springs Improvement District. Contractor shall be invoiced for cost of meter. Meter to be paid for and installed by Contractor.

D. Ductile iron fittings, pipe and accessories shall be as specified herein.

E. Valves and accessories shall be as specified herein.

1.17 Fire Line Service Components (4" through 10")

A. Backflow preventer shall be AMES 3000SS or approved equal.

B. Backflow preventer shall be furnished and installed by Contractor.

C. Fire service meters shall be the Tesla 4 meter as manufactured by RG3 provided by Coral Springs Improvement District. Contractor shall be invoiced for cost of meter. Meter to be paid for and installed by Contractor. (Only required on dual domestic/fire service lines)

D. Ductile iron fittings, pipe and accessories shall be as specified herein.

E. Gate valves shall ge outside stem and yoke..

1.18 Fire Hydrants

A. Nominal 5-1/4-inch main valve opening with 6-inch bottom connections. Equip with two (2) 2-1/2-inch hose nozzles and one (1) 4-1/2-inch pumper nozzle. Operating nut shall be 1-1/2-inch National Standard Pentagon nut. The main valve shall be equipped with O-ring seals and shall open when turned to the left (counterclockwise). Hydrants shall be of the break-flange or safety-top type. Hydrants shall conform to AWWA C502, latest revision, and this Specification. The

depth of bury shall be as shown. Nozzle threads shall be American National Standard. The inlet connection shall be mechanical joint.

B. American Flow Control Series 2100, ductile iron, resilient seated check valve with mechanical joint by plain end connection points shall be included and installed in the fire hydrant assembly.

C. Hydrants shall be:
   1. Mueller Centurion, Model A-423
   2. American B84B
   3. Clow Medallion

1.19 Fire Hydrant Paint

A. Hydrants shall be thoroughly cleaned and painted in accordance with ANSI/AWWA C502, Section 4.2, Painting, latest revision.

   A. Private hydrants shall be painted red above the ground line.
   B. Coral Springs Improvement District hydrants shall be painted yellow above the ground line.

1.20 Water Distribution/Fire System Component Painting

B. All exposed water distribution system components shall be shop primed as specified herein and finish coated as follows:

Surface Preparation: (Shop Primed)	Piping, fittings, and valves shall be shop primed per applicable specifications.
Surface Preparation: (Existing)	Remove all dirt, oil, grease, chemicals by high pressure water blasting. Remove all rust and loose damaged paint by abrasive blast cleaning per SSPC-SP7 (Brush Off Blast) or by SSPC-SP2 and 3 Hand & Power Tool Cleaning.
Spot Prime:	Spot prime all bare metal areas with an epoxy mastic (Tnemec Series 135, ChemBuild) at 5.0 mils DFT.
Prime Coat:	Epoxy Mastic (Tnemec Series 135, ChemBuild) 5.0 mils DFT.
Sealant:	Apply single component sealant at locations where two pieces of steel overlap, between flanges, at bolts, etc.
Top Coat:	Polyurethane (Tnemec Series 73 Endura-Shield), 3.0 mils DFT.

MDFT: 8.0 mils for the two (2) coat system.

C. Do not paint exposed stainless steel, threads, aluminum or brass.

D. Color coding shall be as follows:

Location or Component	Generic Color	Tnemec Color Designation
Above grade domestic water service and BFP	Blue	SC06
Above grade fire line and BFP	Red	SC09
Exposed portions of aerial canal crossings	Blue	SC06

2.0 WASTEWATER COLLECTION SYSTEM

2.01 Precast Concrete Manhole

A. Precast manholes shall consist of a precast reinforced base, cast monolithically with a minimum 4 foot barrel section, additional barrel sections and roof slabs or eccentric manhole cones. Precast manholes shall conform to the dimensions and details shown on the Drawings with all necessary openings for sewer pipe and castings.

B. Precast concrete manholes shall conform to the requirements of ASTM C478, latest revision, except the minimum wall thickness shall be 8 inches minimum.

C. Joints shall be of such design as will permit effective jointing by using a continuous round compression ring of elastomeric material. The compression ring shall be uniformly compressed in an annular space between the joining surfaces to form a closing seal which will be, and will remain, watertight.

D. Precast sanitary sewer manhole sections shall be protectively coated as specified herein under Manhole Coatings (Interior) and Manhole Coatings (Exterior).

E. Manhole steps shall not be provided.

F. Where required, interior drop channels and connections shall be constructed in accordance with the standard details shown on the Standard Details (SAN-03).

2.02 Manhole Ring/Cover

A. Frames and covers shall be cast from close-grained, grey cast-iron, conforming to ASTM-A48 Class 30, gray cast iron. Castings shall be free from blow holes, shrinkages or other imperfections not true to pattern. Round frames and covers in

roadway or traffic areas shall have machined wearing surfaces so that fitting parts will not rattle or rock under traffic.

B. Manhole frames and covers shall be USF 240 with A1 cover, or 540 with A1 cover as manufactured by U.S. Foundry Manufacturing Corporation, Miami, Florida, or equal approved by the Coral Springs Improvement District. Cover shall have "SANITARY SEWER" inscribed thereon.

2.03 Flexible Manhole Connections (New)

A. PVC pipe entering or leaving new precast concrete manholes and wetwells shall have an Elastomer; EPDM lock joint flexible manhole sleeve. Sleeve shall conform to the requirements of ASTM C-923, latest revision. Flexible manhole sleeve be by Interpace Corporation or equal approved by the Coral Springs Improvement District.

2.04 Existing Manhole Connections

A. PVC pipe entering or leaving existing manholes and wetwells shall have an epoxy and sand-coated PVC manhole coupling. Coupling shall be by Johns-Manville or equal approved by the Coral Springs Improvement District.

2.05 Manhole Coating (Exterior)

A.	Surface Preparation:	All curing oils, form oils, laitence, soluble salts and loose concrete must be removed. Concrete must be dry and thoroughly clean before coating.
B.	Surface Profile:	ICRI CSP1
C.	Prime Coat:	None required.
D.	Top Coat:	Two (2) coats polyamide coal tar epoxy (Series 46H-413 Tneme-Tar, Sherwin Williams TarGuard, or equal approved by the Coral Springs Improvement District) at 8.0 mils DFT per coat.
E.	MDFT:	16 mils DFT for two (2) coat system. Allow minimum 24 hour drying time between coats.
F.	Color:	First Coat - Red Second Coat - Black

2.06 Manhole Coating (Interior)

A.	Surface Preparation:	All curing oils, form oils, laitence, soluble salts and loose concrete must be removed. Concrete must be dry and thoroughly clean before coating.

B.	Surface Profile:	ICRI CSP4
C.	Prime Coat:	None required.
D.	Top Coat:	Two (2) coats polyamide coal tar epoxy (Series 46H-413 Tneme-Tar, Sherwin Williams TarGuard or equal approved by the Coral Springs Improvement District) at 8.0 mils DFT per coat.
E.	MDFT:	16 mils DFT for two (2) coat system. Allow minimum 24 hour drying time between coats.
F.	Color:	First Coat - Red Second Coat - Black

2.07 Manhole Drop Piping

A. Drop pipe and fittings shall be standard service sanitary collection pipe as specified herein, Sanitary Collection Pipe (Standard Service).

2.08 Sanitary Collection Pipe (Standard Service)

A. Provide polyvinyl chloride pipe conforming to the requirements of ASTM D 3034, latest revision, Class SDR 35 shall be used. Material for PVC pipe shall conform to the requirements of ASTM D 1784, latest revision, for Class 12454-B or 12454-C as defined therein.

B. Joints of PVC sanitary sewer collection pipes and fittings shall be accomplished by a factory fabricated, continuous, flexible rubber compression ring or gasket permanently attached to the bell of the pipe or fitting. Joints shall meet the requirements of ASTM D 3212, latest revision and ASTM F 477, latest revision.

Sanitary sewer collection pipe and fittings shall be as manufactured by JM Eagle, or equal approved by the Coral Springs Improvement District.

C. All fittings for PVC sanitary sewer collection pipe shall conform to the requirements of ASTM D 3034, latest revision. The ring groove and gasket ring shall be compatible with PVC pipe ends.

2.09 Sanitary Collection Pipe (Pressure Standard)

A. PVC pressure pipe shall conform to the requirements of AWWA C900, latest revision, PVC pressure pipe shall be made from Class 12/454-A or Class 12454-B virgin compounds as defined in ASTM D1784, latest revision. Pipe shall have a minimum wall thickness of DR Series 18.

B. Pipe shall be green and marked “Sanitary”.

C. Pipe shall be Blue Brute C900 as manufactured by JM Eagle, or equal approved by the Coral Springs Improvement District.

2.10 Lateral Connection Components (New)

A. Lateral pipe and fittings shall Sanitary Collection Pipe (Standard Service) as specified herein.

2.11 Lateral Connection Components (Existing Unlined VCP)

A. Lateral pipe and fittings shall be Sanitary Collection Pipe (Standard Service) as specified herein.

2.12 Lateral Connection Components (Existing Lined VCP)

A. Existing lined vitreous clay pipe shall never be cut radially or laterally which would allow the liner to “snap-back” (shrink).

B. New lateral connections to existing lined VCP which do not require manholes may be constructed by fusion welding an approved PE saddle onto the U-liner in conformance with the specified procedures per Detail SAN-10A and SAN-10B.

C. New manholes in existing lined VCP shall only be installed by placing a “doghouse” manhole section over the pipe without disturbing it. The procedure to install a “doghouse” manhole is outlined per Detail SAN-11A and SAN-11B.

D. No connections to existing lined VCP will be allowed which require lateral or radial cuts in an existing U-liner.

E. Lateral pipe and fittings shall be Sanitary Collection Pipe (Standard Service) as specified herein.

2.13 Lateral Connection Components (Existing Unlined PVC)

A. Couplings shall be Fernco Strong Back RC Series repair couplings with four (4) stainless steel clamps and stainless steel shear ring, or equal approved by the Coral Springs Improvement District.

B. Lateral pipe and fittings shall be Sanitary Collection Pipe (Standard Service) as specified herein.

2.14 Not Used

3.0 LIFT STATIONS

3.01 Wetwell, Wetwell Top Slab, Valve Vault, and Valve Vault Top Slab

A. Wetwell, wetwell top slab, valve vault, and valve vault top slab shall be sized as indicated by the Engineering Drawings and constructed in accordance with ASTM C478, latest revision and ACI codes.

B. Minimum wall thickness shall be as shown on drawings, but no less than 8-inches (wetwell), 6-inches (valve vault), and concrete shall obtain a compressive strength of 4,000 psi at 28 days.

C. Concrete materials shall be as specified herein.

D. Interior/exterior coating of precast concrete wetwell and valve vault shall be as follows:

1. Exterior wetwell shall be coated as specified herein Manhole Coating (Exterior).

2. Interior of wetwell (including underside of top slabs) shall be as provided by Spectrashield, Jacksonville, Florida, GML Coatings, Lakewood Ranch, Florida, or equal, as approved by the Coral Springs Improvement District.

E. Tremie (caisson) method of wetwell installation is acceptable with ENGINEER's approval. Submit signed and sealed engineering drawings with wetwell shop drawings engineering calculations showing buoyant forces, weight forces, soil friction forces and volume of concrete tremie base required to counteract buoyant forces, dimensional details, floor slab dimensions and reinforcing requirements. Calculations shall be signed and sealed by a Florida Registered Engineer. Buoyancy calculations should assume total submergence of an empty wetwell and a minimum safety factor of 2.0.

3.02 Submersible Pumps and Motors (C-Type)

A. Pump Design Configuration

1. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

B. Pump Construction

1. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

2. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

C. Cooling System

1. Each unit shall be provided with an adequately designed cooling system. The water jacket shall encircle the stator housing; thus, providing heat dissipation for the motor regardless of the type of installation. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the water jacket. The cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provisions for external cooling and seal flushing shall also be provided. The cooling system shall provide for continuous pump operation in liquid temperature of up to 104 DEGREES F.

D. Cable Entry Seal

1. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The cable entry junction chamber and motor shall be separated by a terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

E. Motor

1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.The stator shall be heat-shrink fitted into the cast iron stator housing. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 15 evenly spaced starts per

hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

2. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

3. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

4. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

F. Bearings

1. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single roller bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces.

G. Mechanical Seal

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment

nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. For special applications, other seal face materials shall be available.

2. The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

3. Each pump shall be provided with an lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

4. Seal lubricant shall be FDA Approved, nontoxic.

H. Pump Shaft

1. Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel - ASTM A479 S43100-T.

I. Impeller

1. The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Impeller(s) shall be keyed to the shaft, retained with an Allen head bolt and shall be capable of passing a minimum 3-inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

J. Wear Rings

1. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet.

2. Pump shall also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.

K. Volute

1. Pump volute(s) shall be single-piece grey cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

L. Protection

1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.

2. A leakage sensor shall be used to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber.

3. The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.

M. Modifications

1. Explosion-proof Pumps (X) shall be provided for Class I, Division 1 or 2, Group D installation environments.

N. Pumps and motors shall be as manufactured by Xylem/Flygt.

3.03 Submersible Pumps and Motors (N-Type)

A. Pump Design Configuration

1. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

B. Pump Construction

1. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

2. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

C. Cooling System

1. Each pump motor shall be sufficiently cooled by the surrounding environment or by submergence in the pumped media.

D. Cable Entry Seal

1. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

E. Motor

1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.The stator shall be heat-shrink fitted into the cast iron stator housing. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

   The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

2. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

3. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

F. Bearings

1. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two row angular contact ball bearing. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

G. Mechanical Seals

1. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

2. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

3. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

4. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

H. Pump Shaft

1. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel - ASTM A479 S43100-T. Shaft sleeves will not be acceptable.

I. Impeller

1. The impeller shall be of (ASTM A-48, Class 35B gray iron or ASTM A-532 (Alloy III A) 25% chrome cast iron) dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the gray iron impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

J. Volute/Suction Cover

1. The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of (ASTM A-48, Class 35B gray iron or ASTM A-532 (Alloy III A) 25% chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

K. Protection

1. Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

   The thermal switches and float switch shall be connected to a Mini CAS control and status monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel.

L. Modifications

1. Explosion-proof Pumps (X) shall be provided for Class I, Division 1 or 2, Group D, Installation Environments.

M. Pumps and motors shall be as manufactured by Xylem/Flygt.

3.04 Guide Rails (Dual Type)

A. Provide schedule 40 dual type guide rail system for each pump to permit raising and lowering the pump. Dual guide rails shall be of adequate length to extend from the lower guide holder on the pump discharge connection to the upper guide holder mounted on the access hatch frame. Guide rails shall be constructed of Type 316 stainless steel. Guide rails shall be 2-inch or 3-inch diameter as recommended by manufacturer based on pump size.

   Provide intermediate guide rail supports to limit the distance between supports to a maximum of 10 feet. Construct intermediate guide rail supports using Type 316 stainless steel designed for attaching to the pump discharge piping. Provide type 316 stainless steel nuts, bolts, and washers for attachment.

3.05 Pump Status Monitoring Module

A. Furnish and install module to monitor the temperature and leakage detectors installed in each submersible pump. The module shall be capable of monitoring the thermal switches embedded in the stator end coils, the FLS (float switch type) water-in-stator-housing sensor, and the CLS (capacitive type) water-in-oil sensor. The module shall monitor both the series connected thermal switches and leakage sensor(s) by outputting 12 VDC on a single two wire circuit. When both CLS and FLS leakage sensors are specified they shall be connected in parallel with each other and then in series with the thermal switches.

B. The module circuitry shall operate on the current sensing principle whereby a change in temperature or leakage condition shall change the resistance of the associated sensor and thus alter the current in the sensing circuit. The module shall

contain two sets of form C dry contacts, one for overtemperature and one for leakage. The dry contacts shall change status upon occurrence of an over temperature or leakage condition so as to indicate that condition to other control components in the pump control panel. In the case of an overtemperature, and in keeping with pump warranty policy, the overtemperature dry contacts shall be used to trip the pump off line. The module shall be designed to be plugged into a standard 11-pin circular socket.

C. Pump status monitoring module shall be the MiniCas (Mini Control and Status) as manufactured by Xylem/Flygt.

D. Modules shall be provided to the control panel manufacturer for incorporation into the panel.

3.06 Pump Lifting Cables

A. Each pump shall be fitted with a Type 316 stainless steel lifting cable of adequate strength to lift double the pump's weight. Minimum cable size shall be 3/8". The lifting cable's combined length shall be equal to the wet well depth (top slab finished grade to wet well bottom) plus 2' to permit raising the pump for inspection and removal.

The lifting cable shall be attached to the lifting bail on the pump. Eyebolts will not be considered as an acceptable alternate to a lifting bail.

3.07 Cable Hangers

A. Cable hanger shall be constructed of Type 316 stainless steel. A minimum of two (2) cable hangers, width of access hatch opening with a minimum of six (6) hooks each are required per cable hanger detail.

3.08 Anchor Bolts

A. Provide all thread rod, nuts, and washers manufactured of Type 316 stainless steel. Minimum 5/8-inch diameter. Setting depth shall be as recommended by pump manufacturer, per the requirements of each installation.

3.09 Base Elbow

A. Base elbow assembly shall be designed to allow the submersible pump to be installed or removed without requiring personnel to enter the wetwell. Each pump shall be provided with a base elbow assembly including the pump coupling.

B. Stationary cast or ductile iron base elbow shall be pump manufacturer’s standard design.

C. A ½-inch thick, 316 stainless steel base plate, 6-inches larger than the size of the mounting plate on the base elbow shall be placed below the base elbow.

3.10 Access Hatches

A. Single and double access hatches shall be sized as indicated on the Drawings. Hatch leaf shall be 1/4-inch aluminum floor plate. The frame shall be an extruded aluminum channel (angle frame) section with a continuous integral anchor flange. Hinges shall be all stainless steel with tamper proof stainless steel nuts and bolts.

B. Access hatches shall be fully gasketed, watertight, and equipped with stainless steel accessories, cast aluminum drop handle, padlock staple and an automatic hold open arm with vinyl release handle grip. Slam Lock mechanisms shall be provided for all hatches equipped with spring-assist opening mechanisms.

C. The following options shall be provided for wetwell hatches.

1. Nut rails with stainless steel sliding nuts for attaching cable holders, brackets, and other hardware shall be provided on all four sides of hatch frame interior.

2. Frame skirt for easy casting into concrete slab. Skirt depth shall match wetwell top slab depth.

D. Parts of access hatch assembly which will be in contact with concrete shall be coated with one coat of coal tar epoxy (minimum 10 mils).

E. Loading (H20 or 300 psf) and spring assist requirements shall be as noted on drawings.

F. Access hatches shall be as manufactured by U.S.F. Fabrication, Inc., or equal, approved by the Coral Springs Improvement District.

3.11 Emergency Pumpout Connection

A. Pump-out connection fitting shall be aluminum 6-inch Kamlok Part No. 633F, or equal approved by the Coral Springs Improvement District.

B. Dust cap shall be 6-inch Kamlok part No. 634B, or equal approved by the Coral Springs Improvement District.

3.12 Pressure Gauges

A. Pressure gauges shall be 2-inch liquid filled gauges, lower connection stem mounting, as manufactured by U.S. Gauge, Marshalltown, or equal approved by the Coral Springs Improvement District. Pressure range shall be 0-60 psi. Provide stainless steel wetted components.

B. Tapped connection to check valve shall be ½" NTP as provided by gauge manufacturer and be fitted with a stainless steel ball valve.

3.13 Float Switches (L8)

A. Direct-acting float type consisting of a mercury free switch enclosed in a float and connected to a two-conductor, combination support and signal cable. The entire assembly shall form a completely watertight and impact-resistant unit. Floats shall be of chemical-resistant polypropylene material or other corrosion-resistant material. Cable shall be rugged and flexible with heavy neoprene or PVC jacket. The actuation/deactuation differential shall not exceed 1-inch. The switch shall be rated at 5 amps at 120 VAC. Units shall be pipe mounted or suspended type as noted and provided with 30 feet of cable unless otherwise noted. Each pipe mounted type shall be provided with a clamp to secure the cable to its support pipe, 2 feet of stainless steel support pipe and stainless steel pipe mounting clamps.

B. Each suspended type shall be provided with necessary brackets and clamps to suspend the unit from the top of a tank or vessel. The suspended type shall include an integral or attached weight assembly for stabilization and positive operation of the unit. All mounting clamps shall be PVC or Neoprene.

C. Units shall be Roto Float, normally closed, as manufactured by Anchor Scientific, or equal, approved by the Coral Springs Improvement District.

3.14 Combustible Gas Detector (A20)

A. Drager 4544610 Polytron 8700 combustible gas transmitter.

1. Power 10-30 VDC (3 Wire)

2. Output: 4-20 mA Hart

3. Cable Entry: 3/4 NPT Female

4. Enclosure: NEMA 4X

B. Drager 6811625 Polytron 8700 Status Indicator.

C. Drager 6811911 Polytron 8700 Splash Guard Drager 4557019.

D. Drager 4557019 Methane Calibration Gas, 103L Cylinder Capacity.

E. Drager 4594620 Calibration Gas Kit Includes: carry case for two gas cylinders and regulator; process adapter for EC sensors; 500 CC/Min cylinder regulator; nitrogen/zero gas cylinder; 100% N2; 103L @ 1000 psi.

F. Drager 6811 610 Polytron 8700 Calibration Adapter.

G. Combustible gas detector system shall be manufactured by Drager, or equal, approved by the Coral Springs Improvement District.

3.15 Control Panel Specifications (General)

A. General

1. Control panel layout and functions shall be as shown by the Standard Details.

2. Control panel(s) shall be provided with a UL label and be manufactured by a UL 508A panel manufacturer with a UL698A sublisting. Panel manufacturer shall submit proof of current enrollment in U.L.'s Custom Builder's Program for both listings.

3. Lift station control panels shall be manufactured and provided by CC Control Corporation, or equal approved by the Coral Springs Improvement District.

4. The specified RTU components shall be installed in the lift station control panel(s), completely ready for operation and programming. Programming shall be completed by Data Flow Systems.

B. Remote Terminal Unit (RTU)

1. The Remote Terminal Unit (RTU) shall be the pump-controller based Telemetry Control Unit with Integrated Radio (DFS model: TAC Pack TCU). The RTU shall be housed in the Motor Control Panel and powered by 120 VAC commercial power. The RTU shall provide local and automatic pump station control functions, monitor local statuses and transmit those statuses to the TAC II SCADA System central site when polled by the master radio. An Uninterruptible Power Source (UPS) shall be an integral part of the RTU. The TCU shall include an integrated radio as specified in paragraph C. The TCU shall incorporate the following features:

    1. On-Board 12-button operator interface keypad and 4x20-character LCD display. Configuration parameters shall be adjustable via the 12-button operator interface keypad or required RS-232 service port.

    2. The LCD display shall provide the elapsed runtime of each pump, the average runtime of each pump, the flow of each pump, the flow of the station and the time of day.

    3. Triplex/Duplex/Simplex configurable. The device shall have the capability of easily being configured for one, two or three pumps via the on-board keypad.

    4. Three (3) on-board HOA switches. Local manual control provided by the HOA switches. Each HOA switch shall be fail safe and operate in the OFF and HAND position without power. Alarms shall indicate that an HOA switch has been left in the HAND or OFF position.

5. Integrated pump alternation. The pump alternation function will operate based on the number of pumps configured. Automatic alternation around non-operational pumps shall be provided.

6. Pumps/Starter/Breaker Fault alarms shall be determined by the unit automatically. These alarms shall be activated when a pump is called to run, but fails to run, or if the pump is turned off by the TCU, but continues to run.

7. Multiple level control input options. The unit shall provide local automatic level control from float, transducer, or ultrasonic inputs. Redundancy of level control input shall be supported. An alarm shall be generated when floats are operating out of sequence.

8. On-board 240 / 480 VAC three-phase-power monitor. The phase monitor shall be transformer-isolated and detect loss of phase, phase reversal, low phase and high phase faults. All phase monitor adjustments shall be adjustable from the keyboard. Phase voltages from phase A to B and from phase A to C shall be transmitted to the central site computer.

9. Integrated Alarm Light output and Alarm Horn output, each capable of driving 120 VAC loads to ½ amp. An input shall be supplied for external alarm silence button, which shall be used to silence the Alarm Horn.

10. All inputs and outputs shall be optically or magnetically isolated and surge suppressed.

11. Multiple staged surge protection shall be provided for all power supply and power monitoring circuits. One stage of protection shall be equipped with both energy limiting and clamping circuits with slow blow fuses designed for overload conditions. This design shall provide a very high level of non-destructive transient immunity. With the exception of a direct lightning strike, the device shall protect the RTU power supply and power monitoring circuits from damage due to voltage transients. The surge protection shall provide circuit protection to withstand multiple transients in excess of 6,500 volts, 3,250 amps, without damage. Damage shall be limited to a blown fuse when exposed to larger transients. The surge protection shall be transient-tested to ANSI standard C62.41.

12. Supply voltage shall be 115 VAC. Ambient operating temperature shall be - 100C to 600C (140F to 1400F). The upper temperature limit is 500C (1220F) when using the backup battery. Unit shall be UL Listed and surge tested for EMI Susceptibility to IEC 61000-4-5 Surge Immunity Tests.

13. The TCU shall include a 2.6 amp-hour backup battery. The battery shall provide 12V nominal voltage. The TCU shall incorporate a battery charging system. The battery shall not be damaged by deep discharges.

14. A local RS-232 service port shall be provided for local access to all the functions of the unit.

15. A local RS-485 serial interface shall be provided for connection to external devices that support the serial Modbus RTU protocol. Standard 5 digit registers shall be used and formatted with 0XXXX for digital outputs, 1XXXX for digital inputs, 3XXXX for analog inputs, and 4XXXX for analog outputs. Packing Modbus digital input, digital output, and analog input registers into the 4XXXX range will not be permitted. Addressing of Modbus registers shall be contiguous in their associated address ranges. All analog points from the external device shall be 0-20ma signals spanned across 0-4095(12 bit) or 0-32767(15 bit) with a working range 4-20ma representing 0-100%. All analog outputs shall be 0-20ma signals spanned across 0-32767 with a working range of 4-20ma representing 0-100%.

16. The TCU shall be easily removed/replaced by removing two industry standard wire terminal connectors. Wire terminals shall be used as an interface between the TCU and field wiring. Fuses and voltage reducing resistors shall be used where required by the manufacturer. Wire terminals shall be housed in the same enclosure as the TCU.

2. Integrated Radio

   The Integrated Radio shall function as the interface between the TCU and TAC II central site. The Integrated Radio shall incorporate a radio transceiver and associated electronics. The Integrated Radio shall be mounted inside the TCU radio compartment. The combination of the TCU / Integrated Radio is referred to as model TAC Pack TCU. At a minimum, the Integrated Radio shall have the following features: Surge protected radio power, On board communications and functional firmware, Watchdog Timer, On board voltage regulation and radio power supply control, Radio current, receiver sensitivity and operating temperature are monitored for system diagnostics.

3. Rtu Monitor and Control Requirements:

   The RTU shall provide the following monitor and control capability.

   1. Monitor and Control Points

      i. The following points shall be monitored by the RTU. On, Off, or Fault condition shall be indicated locally at the RTU and remotely at any SCADA Workstation computer. Any monitoring point shall have the capability of being configured as an alarm in the SCADA software.

Any unused monitor points listed, i.e., there is no 3rd pump, shall be capable of being used to monitor other discrete devices.

1) Pump 1 Status
2) Pump 1 Start Fault
3) Pump 1 Stop Fault
4) Pump 2 Status
5) Pump 2 Start Fault
6) Pump 2 Stop Fault
7) Pump 3 Status
8) Pump 3 Start Fault
9) Pump 3 Stop Fault
10) Pump 1 HOA in HAND
11) Pump 1 HOA in AUTO
12) Pump 1 HOA in OFF
13) Pump 2 HOA in HAND
14) Pump 2 HOA in AUTO
15) Pump 2 HOA in OFF
16) Pump 3 HOA in HAND
17) Pump 3 HOA in AUTO
18) Pump 3 HOA in OFF
19) Low Well Level Float
20) Off Well Level Float
21) Lead Well Level Float
22) Lag Well Level Float
23) Lag2 Well Level Float
24) High Well Level Float
25) Float Sequence Fault
26) Well Level Transducer (4-20 mA)
27) Well Level Transducer Input Fault
28) Water Pressure Transducer (4-20 mA)
29) Water Pressure Transducer Input Fault
30) Auxiliary Discrete Input (discrete or pulse)
31) Phase Voltage Fault
32) Phase Sequence Fault
33) Phase AB Voltage
34) Phase AC Voltage
35) RTU Memory Fault
36) AC Power Fault
37) DC Bias Voltage Fault
38) Alarm Silence Button
39) Alarm Horn Status
40) Alarm Light Status

b) The following discrete control points shall be provided with the RTU. On or Off condition shall be indicated locally at the RTU and remotely at any SCADA Workstation Computer. Any unused control points

listed, i.e., there is no 3rd pump, shall be capable of being used as a general purpose discrete outputs.

1) Pump 1 Control
2) Pump 1 Disable
3) Pump 2 Control
4) Pump 2 Disable
5) Pump 3 Control
6) Pump 3 Disable
7) Total Station Disable
8) Alarm Horn Control
9) Alarm Horn Disable
10) Alarm Light Control
11) Alarm Light Disable
12) Auxiliary Output
13) Auxiliary Output Override
14) Auxiliary Output Disable

4. Antenna Subsystem

1. A high gain directional antenna shall be used to transmit and receive data at the RTU. It shall be supported on a mast/pole and have DC grounding for lightning protection. The antenna mast/pole shall be hot dipped galvanized for corrosion protection. All mounting hardware shall be made of stainless steel. The mast shall meet or exceed the quality and reliability of the G series as manufactured by Rohn.

2. The coax cable shall be the type that utilizes an inert semi-liquid compound to flood the copper braid. The coax cable shall be of the RG-8 construction type and have the RF loss characteristic of foam flex. The coax cable shall be RTC 400 as supplied by Data Flow Systems, Inc.

3. Type N connectors shall be utilized at both ends of the coax. The Type N connectors shall be sealed with 3-inch sections of Alpha FIT321-1-0 sealant shrink tubing. The coax cable shall be secured to the mast/pole with stainless steel cable ties. The cable ties shall meet or exceed the quality, reliability and performance of cable ties manufactured by Band-It.

4. The antenna shall be an all welded aluminum elements. The antenna shall have a single radiator element connected to a type N female connector. The antenna shall be the RTA series as supplied by Data Flow Systems, Inc.

5. A coaxial surge protector model IS-B50LN-C2 as manufactured by Polyphaser shall be supplied with the RTU.

5. Product Warranty

    1. The manufacturer shall warrant all hardware and software provided under this contract against all defects in material and workmanship for a period of one year. The TAC Pack TCU shall carry an additional 2-year return-to-factory warranty. The TAC Pack TCU warranty shall also cover damage due to lightning the entire three-year period.

C. M7 Miscellaneous Electrical

1. Circuit Breakers
    a. For overcurrent protection, circuit breaker shall be Square D with poles, voltage, rating and AIC as indicated on the Drawings.

    b. For control circuits, units shall be Square D with poles, voltage and ratings as indicated on the Drawings. Units shall interrupt the maximum prospective fault current available.

2. Pump Motor Breaker
    a. Square D, Class 680, MAG-Guard, Motor Protector Circuit Breaker.

3. Fuses
    a. Bussmann N600 volt, dual element type.

4. Indicating Type Fuses
    a. Bussmann Model MDA-2, 250V, 2A.

5. Control Relays
    a. Control relays shall be provided with test buttons and indicators.
    b. Omron or equal approved by the Coral Springs Improvement District.

6. Pushbuttons.
    a. Square-D Class 9001, Type K, pushbutton, black or equal approved by the Coral Springs Improvement District.
    b. Provide finger-safe wiring terminals.

7. Indicator Lights
    a. Square-D trans type 6 volt, Class 9001, type K, push to test, LED, or equal approved by the Coral Springs Improvement District.
    b. Lens color shall be as noted.
    c. Provide finger safe wiring terminals.

8. Ground Fault Interrupting Receptacle
    1. Leviton Duplex Receptacle or equal approved by the Coral Springs Improvement District.
    b. AC receptacle box shall be Steel City 58351-1/2 or equal approved by the Coral Springs Improvement District.

c. Covers shall be Steel City 58-C-5, or equal approved by the Coral Springs Improvement District.

9. Motor Starter w/thermal overload relay/module
   a. Square D class 8536 motor starters with NEMA rated contactors, sized per the horsepower of the load, minimum size 2.
      Square D, thermal overload relay 9065SD08 with series C overload module 9999S04.
   b. Provide auxiliary contacts as required.
   c. Reset buttons Square D 9066-RA1, or equal approved by the Coral Springs Improvement District.

10. Signal Isolator
   a. Signal isolator shall be plug-in type.
   b. AGM Electronics or equal approved by the Coral Springs Improvement District.

11. Phase Monitor
   a. Diversified with auto reset.
      I. SUA-440-ASA (480V)
      ii. SLA-230-ASA (230V, 3 phase)

12. Surge and Lightning Arrestors
   a. Transient voltage surge suppressor (TVSS).
      i. Transient voltage surge suppressors shall be Eaton/IT Protector, or equal approved by Coral Springs Improvement District.
         240 Volt, 3 phase = EQX-080N-3Y201
         480 Volt, 3 phase = EQX-080N-3Y201
   b. Surge Capacitor(SC)
      I. Surge Capacitor shall be Delta CA603R, or equal approved by Coral Springs Improvement District.
   c. Signal
      I. Panel surge arrestors (PSA) shall be Edco PC 642C Series, 2 channel or equal.
      ii. Field surge arrestors (PSA) shall be Edco SS64 Series, pipe style or equal.

13. Generator Receptacle
   a. Generator receptacles shall be Appleton, Model Numbers as follows:

Amps	Receptacle Model No.	W/Mounting Box Model No.	Angle Adaptor Model No.
100	AR20034	AJA20034-150	AJA200
200	AR20034	AJA20034-150	AJA200
Other	Consult with Coral Springs Improvement District		

14. Fluorescent Lamp
    a. 8 watt, 120v, 12", Grainger 2V809, or equal approved by the Coral Springs Improvement District.
    b. Bulb, 8w, 12", miniature, Phillips, or equal approved by the Coral Springs Improvement District.

15. Ground Lug
    a. #1/0 Wire Ilsco AU-O, or equal approved by the Coral Springs Improvement District.

16. Intrinsically Safe Relay
    a. Barrier relays shall be SAF-PAK as manufactured by GEMS Sensors, for use in hazardous areas with intrinsically safe-sensing circuit. Units shall be UL approved for use in Class I, Division 2, environments.

17. Time Delay Relays
    a. Time delay relays shall be programmable with adjustable ranges, DIP switch settable.
    b. Omron or equal approved by the Coral Springs Improvement District.

D. X1 Control Power Transformer

1. Square D, Type KF, Class 9070, 100VA, minimum or as indicated by the drawings.

E. Field Panel Construction

1. Field panels shall be UL Listed, modified, NEMA 3R, Type 316 Stainless Steel enclosure with closing mechanisms conforming to the requirements of the National Electrical Manufacturer's Association.

    a. Submersible panels shall have padlockable draw latches (minimum 3 required).

2. In addition to the NEMA 3R standard, the panel shall conform to the following requirements:

    a. Minimum metal thickness shall be 12-gauge.

    b. All doors shall be rubber-gasketed with continuous hinge.

    c. Provide Type 316 stainless steel drip shield.

    d. Provide aluminum dead front and back plate for component mounting as shown on drawings.

    e. Print pocket and one (1) set of reduced drawings shall be provided on interior side of door.

6. Minimum/maximum overall dimensions shall be as indicated by Drawings or as required by UL subjects 508A or 698A for industrial control panels.

7. Cabinet enclosure shall be designed to withstand pressures in accordance with ASCE 7 - (current edition) per Florida Building Code Section 1609. (Criteria shall be as noted on Drawings.) Panel manufacturer shall provide stiffeners and mounting angles as required.

8. Control panel diagrams and overload tables shall be laminated to the inside of cabinet door.

9. Provide ARC flash label per N.E.C.

10. Provide door hold open kits for outer cabinet door and dead front door. These door hold open kits shall allow both the outer door and deadfront door to be held open at greater than 90° without wind impact.

3. Cabinet enclosure shall be as manufactured by Hoffman, Wiegmann, Saginaw or equal approved by the Coral Springs Improvement District.

F. Panel Electrical

1. Wiring

a. Power wire shall be 600-volt class, PVC insulated stranded copper and shall be of the sizes required for the current to be carried, but not below 14 AWG.

b. Wiring for all discrete and analog signal circuits within panel shall be twisted shielded pairs not smaller than No. 16 AWG.

c. All panel wiring shall be labeled with T&B Shrink-Kon HVM marker system.

d. All wires shall be terminated at the lugs provided with the applicable device. Only one (1) wire per lug unless specifically allowed by manufacturer specifications.

2. Terminal Blocks

a. Terminal blocks shall be one-piece molded plastic blocks with screw type terminals and barriers rated for 600 volts. Terminals shall be double sided. Terminals shall have permanent typed, legible identification.

b. Wires shall be terminated at the terminal blocks with crimp type, preinsulated, locking forked-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated.

Only one (1) wire per lug unless manufacturer specifications allow more than one (1) per lug.

c. Allow 20% extra terminals for spares.

d. Terminals shall be Allen Bradley 1492 series or equal approved by the Coral Springs Improvement District.

e. Terminal numbers and wire numbers shall agree.

3. Power Supplies

a. Provide DC power supplies as required to power instruments requiring external DC power.

b. Power supplies shall convert 120V ac, 60-Hz power to DC power of the appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that the instruments being supplied can operate within their required tolerances.

c. Output overvoltage and overcurrent protective devices shall be provided with the power supply to protect the instruments from damage due to power supply failure and to protect the power supply from damage due to external failure. Provide NEMA 1 enclosure for all power supplies. Power supplies shall be mounted such that dissipated heat does not adversely affect other components.

4. Wire Ducts and Wire Management

a. Wire duct shall be Panduit, or equal approved by the Coral Springs Improvement District. All back plate wiring shall be run in wire duct.

b. Deadfront panel wiring shall be harnessed together and held in place with wire bundle clips. Clips shall be fastened to deadfront with screws.

c. Wire from deadfront across hinge to back panel shall be in protective strain relief harness.

d. Primary and load wiring does not require installation in wire duct.

5. Miscellaneous Features

a. Provide fluorescent courtesy light, convenience outlet, lightning arrestor (TVSS), surge arrestor, loop power supplies (with surge protection specified herein), circuit breakers and power supply.

b. Items required shall be as indicated on the drawings.

6. Safety Features

    1. Breaker standoff kits shall be fabricated from stainless steel threaded rod(s) and stainless steel plates. All nuts, bolts and washers shall be stainless steel.

    2. All exposed wire lugs shall be personnel protected by clear Lexan glass shields, or equal. Installation hardware shall be stainless steel. Shields shall be removable for component access.

    3. Interlocks between main and emergency power breakers shall be panel manufacturer's standard sliding lockout design. Interlock shall be fabricated from stainless steel.

    4. Intrinsically safe isolation barrier shall be sized per requirements of panel manufacturer. Barrier shall be fabricated from aluminum or stainless steel and be removable for component access. Barrier shall be labeled as such.

G. Nameplates, Name Tags, and Service Legends

1. Provide field and panel mounted components with permanently mounted name tags bearing the entire ISA tag number of the components. Panel mounted tags shall be plastic; field mounted tags shall be stamped stainless steel.

2. Circuit breakers and all dead front panel items shall be clearly labeled by name, not tag number. Nameplates are defined as inscribed laminated plastic plates mounted under or near a panel face mounted instrument. Service legends are defined as inscribed laminated plastic integrally mounted on a panel face mounted instrument.

3. Service legends and nameplates shall be engraved, rigid, laminated plastic. Service legends and nameplates shall be fastened to the panel by screws. Unless otherwise noted, color shall be black with white letters and letter height shall be 3/16-inch.

4. Field mounted tags shall be 16-gauge, 304 stainless steel with 3/16-inch high characters.

5. Each panel shall be provided with a cabinet face mounted laminated nameplate as specified above. Unless otherwise noted, color shall be black with white letters ½-inch high.

H. Spare Parts

1. Furnish the manufacturer's recommended spare parts including at least the following:

a. One (1) Float level switch as specified.

b. Two (2) sets of starter replacement contacts for each starter size specified.

c. One (1) control power transformer matching the one supplied with control panel.

d. Six (6) fuses of each size and type used.

2. All parts shall be furnished in containers which are clearly marked and identified as to the contents.

3.16 RTU Antenna Tower

A. Antenna tower and accessories shall be as manufactured by Rohn Products, or equal approved by the Coral Springs Improvement District. Model number shall be indicated by Standard Details.

3.17 Lift Station Piping (DI)

A. Ductile Iron Pipe: Pipe materials shall conform to the requirements of ANSI/AWWA C151/A21.51, latest revision and unless otherwise noted herein this specification or the drawings, all ductile iron pipe shall be as follows:

Nominal Diameter	Minimum Pressure Class	Special Cases Thickness Class
3" thru 12"	350 Psi	--
Flanged Pipe (all diameters)	--	53 (Min)

Epoxy Lining: PROTECTO 401 Ceramic Epoxy as manufactured by Vulcan Painters, Inc., or equal approved by the Coral Springs Improvement District.

B. Pump station piping shall be flanged in accordance with ANSI/AWWA C115/A21.15, latest revision and ANSI/AWWA C110/A21.10, latest revision. Pipe shall be epoxy lined as specified above.

C. Exposed (non-buried) piping and fittings shall be shop primed with a catalyzed rust inhibitive epoxy primer. Minimum dry film thickness shall be 2-3 mils. Surface preparation shall be white metal blast cleaning in accordance with Steel Structures Painting Council No. 10 (SSPC-SP10). Primer shall be compatible for use with finish coatings specified herein.

3.18 Ductile Iron Flanged Fittings and Accessories

A. Fittings for flanged pipe shall be short body ductile iron with flanged ends in accordance with AWWA/C110 with 125# flanges having a pressure rating of 250 psi.

B. Flanged joints meeting the requirements of ANSI/AWWA C115/A21.15, latest revision, shall be utilized at locations shown on the Drawings.

C. Gaskets for flanged joints shall be ring type gaskets, 1/8-inch thick, compatible for the service conveyed by the pipeline.

D. Bolts, nuts and washers shall meet the requirements of AWWA C115/A21.15, latest revision, and shall be 316 stainless steel.

3.19 Flange Coupling Adaptors (Restrained)

A. Flange adaptors shall be made of ductile iron conforming to ASTM A536, latest revision, and have flange bolt circles that are compatible with ANSI/AWWA C115/A21.15, latest revision.

B. Restraint for the flange adaptor shall consist of a plurality of individually actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of the gripping wedges.

C. The flange adaptors shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6" gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

D. The flange adaptor shall be the SERIES 2100 MEGAFLANGE adaptor as produced by EBAA Iron, Inc., or equal approved by the Coral Springs Improvement District.

3.20 Hose Bibb (HB)

A. HB: 3/4" brass quarter turn hose bibb, 125 lb. GWP to 100°F. NiBCO QT56X or equal approved by the Coral Springs Improvement District.

3.21 Plug Valves (V-50)

A. V-50: Eccentric plug valves 3 inches and larger shall be of the non-lubricated type with resilient faced plugs with end connections as shown on Drawings. Flanged valves shall be faced and drilled to the ANSI B16.1, latest revision, 125 pound standard. Mechanical joint ends shall be in accordance with the AWWA C111/A21.11-90, latest revision. Valve bodies shall be of ASTM A126, latest revision, Class B cast iron, 31,000 psi tensile strength minimum. All exposed nuts, bolts, springs and washers shall be zinc plated for above ground, non-submerged installations and 300 Series stainless steel for buried or submerged installations. Port areas on valves through 20 inches in size shall be at least 80% of full pipe area

and valves 24 inches and larger shall have a minimum port area of 70% of the full pipe area. Resilient plug facings shall be Neoprene or Buna N material on a single piece plug. The seats shall be in the body and shall be a minimum of 90% nickel. Threaded, adjustable seats shall not be allowed. Valve shaft seals or packing shall be adjustable and replaceable without removing the valve from service or interrupting service. Valves shall have a minimum pressure rating of 175 psi (3"-12") and 150 psi (14"-24") and provide drop-tight shut-off. Valves shall be by DeZurik, or equal approved by the Coral Springs Improvement District.

Valves for above ground, non-submerged, exposed installations or installation vaults, shall be equipped with fixed hand lever operators.

Valves for buried or submerged installations shall be provided with permanently lubricated, totally enclosed worm gear actuators with a 2-inch operating nut. Actuator shall be fully gasketed and capable of withstanding a minimum external groundwater pressure of 10 psi.

All interior and exterior ferrous surfaces shall be epoxy coated. Epoxy coatings shall be compatible for service fluid as applicable. Epoxy coating application shall be manufacturer's standard unless otherwise specified.

Plug Valve Installation Table:

Valve Designation	Valve Description
V-50Q	Quarter Turn Plug Valve
V-50L	Quarter Turn Plug Valve with fixed hand lever operator
V-50G	Plug Valve with Geared Actuator

3.22 Not Used

3.23 Not Used

3.24 Check Valves (V-76)

A. V-76: Horizontal swing check valves with outside lever and weight shall have an iron body, flanged ends, bronze disc to bronze seating assembly and shall meet the requirements of AWWA C508, latest revision. Seal at hinge shaft shall be accomplished with O-rings. Valves shall be Clow Style 11066W, Kennedy Figure 11066W,or equal approved by the Coral Springs Improvement District.

3.25 Protective Coatings for Pipe, Fittings, and Valves

A. Surface Preparation: (Shop Priming) — Piping, fittings, and valves shall be shop primed per applicable Specification herein.

B. Surface Preparation: (Field) — Remove all dirt, oil, grease, chemicals by pressure water blasting. Remove all rust and loose damaged prime paint by abrasive blast cleaning per

SSPC-SP7 (Brush Off Blast) or by SSPC-SP2 & 3 Hand & Power Tool Cleaning.

C.	Field Prime Coat:	Spot prime all bare metal areas with epoxy mastic (Tnemec Series 135 Chembuild, or equal, approved by the Coral Springs Improvement District) at 5.0 mils DFT.
D.	Sealant:	Apply single component sealant (Sikaflex 1A, or equal, approved by the Coral Springs Improvement District) at locations where two pieces of metal overlap between flanges, at bolts, etc.
E.	Intermediate Coat:	Epoxy Mastic (Tnemec Series 135 Chembuild, or equal, approved by the Coral Springs Improvement District) at 5.0 mils DFT.
F.	Top Coat:	Polyurethane (Tnemec Series 135 Chembuild, or equal, approved by the Coral Springs Improvement District) at 3.0 mils DFT.
G.	MDFT:	8.0 mils for the two coat system.
H.	Color:	Exposed ductile Iron = IN05 - Gray Wetwell Vent = IN05 - Gray Exposed Conduits = IN05 - Gray
I.	Wetwell and Valve Vault Piping (Interior)	Piping interior to wetwell and valve vault shall not be coated.

3.26 Lift Station Water Service and Backflow Preventer

A. Water service and backflow preventer components shall be specified in the Standard Details.

B. Service size shall be as noted on drawings.

3.27 Piping Supports

A. As specified in the Standard Details.

3.28 Ground Rods

A. All ground rod sections shall be 10 foot 5/8" copper clad steel, unless otherwise indicated.

B. Grounding shall be provided per Article 250 or the N.E.C.

C. Provide exothermic weld connections of ground wire to ground rods.

D. Test ground resistance in dry conditions, 3 days after rain. Submit test results to Coral Springs Improvement District.

E. Ground resistance shall not exceed 25 ohms per Article 250.56 of the NEC. Provide minimum of two (2) grounds spaced at 6' O.C. minimum.

3.29 Conduit

A. PVC conduit shall be rigid Schedule 80, sunlight resistant and used as per locations noted within these specifications unless otherwise noted, and shall be U.L. approved and comply with Federal Spec WC-1094 and NEMATC-1.

B. Liquid tight flexible metal conduit (Flex) shall be galvanized steel inside and outside with moisture and oil proof PVC jacket extruded over the outside with a continuous copper ground under the jacket.

C. PVC coated rigid galvanized steel conduit system shall be coated interior (minimum 2 mils) and exterior (minimum 40 mils) provided by Pearmacoat, Robroy or equal approved by the Coral Springs Improvement District.

3.30 Conduit Ends

A. Conduit E/P (Explosion-Proof) seal fitting.

1. Conduit E/P seal fittings shall be Killark EYS - copper free aluminum bodies, sealing fittings with Chico A sealing compound. Sealing fittings shall be selected per the following table:

Conduit Size	Catalog Number
½"	EYS-1
3/4"	EYS-2
1"	EYS-3
1-1/4"	EYS-4
1-1/2"	EYS-5
2"	EYS-6
2-1/2"	EYS-7
3"	EYS-8
3-1/2"	EYS-9
4"	EYS-0

2. Provide bonding bushings per Standard Details.

B. Conduit End (Strain Relief)

1. Shall be nonmetallic, liquidtight, strain relief connectors - straight, as manufactured by Thomas & Betts (T&B) or equal approved by the Coral Springs Improvement District.

3.31 Cable, Wire

A. 600 Volt Power Wiring

1. Cable shall be rated for 600 volts and shall meet the requirements below:

a. Conductors shall be stranded.

b. All wire shall be brought to the job in unbroken packages and shall bear the date of manufacturing; not older than 12 months.

c. Type of wire shall be THWN except where required otherwise by the contract drawings.

d. No wire smaller than No. 12 gauge shall be used unless specifically indicated.

e. Conductor metal shall be copper.

f. All conductors shall be meggered after installation and insulation must be in compliance with the National Electrical Code.

B. Instrumentation and Control Cable

1. Process instrumentation wire shall be 16 gauge twisted pair, 600 V., cross-linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed as manufactured by Belden or an approved equal.

C. Ground Wire

1. Bare, stranded copper conductors.

2. Provide tin plated copper at locations where grounding conductors are in direct contact with concrete.

3.32 Safety Disconnect Switches and Enclosed Circuit Breakers

A. Safety Disconnect Switches

1. Fusible and non-fusible disconnect switches shall be heavy-duty, NEMA type H, quick-make, quick-break, visible blades, 600 volt, 3 pole with full cover interlock. Switches shall have copper Lugs.

2. Where disconnects are installed outside, provide a NEMA 4X, stainless steel enclosure.

3. Switches shall be horsepower rated and as manufactured by the Square D Co., or equal approved by the Coral Springs Improvement District.

4. Auxiliary contacts shall be provided where required on plans.

5. Where indicated on drawings, provide auxiliary wire lugs for the surge capacitor (SC) and transient voltage surge suppressor (TVSS). These auxiliary lugs shall be on the load side of the switch. Lug sizes shall be coordinated with wire sizes required for these devices.

B. Enclosed Circuit Breakers

1. Provide a thermal magnetic circuit breaker, 480 volt (where applicable) or 240 volt, 3 pole molded case, per UL 489. All breakers shall have copper lugs.

2. Unless otherwise indicated, breakers shall be enclosed in a NEMA 4X, stainless steel enclosure.

3. Minimum breaker AIC shall be 65 KAIC unless otherwise indicated.

4. Units provided as main service disconnects shall be service entrance rated.

3.33 Electrical Equipment Supports

A. Furnish and install all supports, hangers, and inserts required to mount fixtures, conduits, cables, pullboxes, and other equipment furnished under this section or furnished for installation under this section.

B. Perforated straps and wire are not permitted for supporting electrical devices. Anchors shall be of approved types.

C. Framing channels for mounting disconnect switch, FPL meter, electrical equipment and the like shall be minimum 1-5/8-inch width type 316 stainless steel channels as manufactured by Unistrut, or equal approved by the Coral Springs Improvement District.

D. All vertical and horizontal members, pipe clamps, nuts, bolts, washers and other miscellaneous installation hardware shall be type 316 stainless steel.

E. Electrical equipment support plan and elevation per Standard Details.

3.34 Portable Generator

A. Portable generator shall be Coral Springs Improvement District standard at time of construction.

3.35 Concrete Mixes and Accessories

A. Materials
1. Cement

a. Portland cement Type I or Type II conforming to ASTM C 150, latest revision. In addition, the tricalcium aluminate content of Type I cement shall not exceed 12 percent.

b. Type I or Type II cement, at the Contractor's option, may be used for nonhydraulic structures.

c. Type II cement or Type I cement, in combination with pozzolan (fly ash) as hereinafter specified, shall be used for all hydraulic structures and sanitary sewer structures.

2. Water: potable, salt free conforming to ASTM C94, latest revision.

3. Fine Aggregate (Regular): salt free and clean, conforming to ASTM C33, latest revision.
Fine Aggregate (Pump): salt free and clean, conforming to FDOT 902.

4. Coarse Aggregate (Regular): salt free and clean, conforming to ASTM C33, latest revision, maximum size 1 ½-inch (3/4-inch for water retaining structures).

Coarse Aggregate (Pump): Salt free and clean, size #89, FDOT 901.

5. All aggregates: quarried/mined in fresh water only.

6. Screenings: Screenings meeting the requirements of FDOT 902-5 may be substituted for fine aggregates.

B. Mixes

1. Fillets, thrust blocks, sidewalks, curbs and miscellaneous non-structural slabs on grade.

a. 28 day compressive strength: 3000 p.s.i.
b. Admixture: As required below, use only specified product.
c. Slump: 5 inches, ± 1 inch.
d. Entrained air content (ASTM C 231): 0 percent.

2. Structural (locations noted on Drawings) and precast concrete:

a. 28 day compressive strength: 4000 p.s.i., minimum, or as illustrated on the Drawings.
b. Strengths noted on the Drawings take precedence over herein specified amounts.
c. Water-cement ratio: w/c $\leq$ 0.4.
d. Slump: 5 inches, ± 1 inch.
e. Entrained air Content (ASTM C231): 0 percent.
f. Admixture: As required below, use only specified products.

3. Pavement (Drives/Roadways):

    a. 28 day compressive strength: 4000 p.s.i.
    b. Water-cement ratio: w/c $\leq$ 0.5.
    c. Slump: 5 inches, ± 1 inch.
    d. Entrained air Content (ASTM C231): 0 percent
    e. Admixture: As required below, use only specified products.

4. Flowable Fill

    a. Cement: 50 to 100 lbs/Cy. (As indicated on drawings.)
    b. Pozzolan (Flyash): 0 to 600 lbs/Cy.
    c. Fine Aggregate: 2750 lb/Cy.
    d. Water: 500 lbs/Cy. (Maximum)

5. Curbs

    a. 28 day compressive strength: 3000 psi
    b. Slump: 2-inches, ± 1-inch.
    c. Entrained air Content (ASTM C231): 0 percent.
    d. Admixtures: As required below, use only specified products.

C. Admixtures

1. Water-Reducing

    a. All concrete shall contain a water-reducing admixture. The admixture shall conform to ASTM C 494, latest revision, Type A or Type D, except it shall contain no chlorides, shall be nontoxic after 30 days, and 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. Furnish a compliance statement that the admixture used satisfies all requirements of this Specification.

2. Pozzolan (Fly-Ash)

    a. The pozzolan to be used in combination with Type I cement, as previously specified for use in all hydraulic structures and sewers, shall be Class C or Class F fly ash conforming to ASTM C 618-78, latest revision, and furnish test data confirming that the fly ash in combination with the cement to be used meets all strength requirements, is compatible with air-entraining agents and other additives, and provides increased sulfate resistance equivalent to or better than Type II cement.

D. Curing Compounds

1. Normal placement without special finish; approved products:
    a. Master Builders Company: "Masterseal".

b. Sonneborn-Contech: "Kure-N'Seal".

E. Deformed Reinforcing Bars

1. ASTM A615: "Standard Specification for Deformed and Plain Billet-Steel Bars for concrete Reinforcement".
   a. Grade: 60
   b. Minimum yield strength: 60,000 p.s.i.

F. Welded Wire Fabric

1. Welded wire fabric shall conform to ASTM A1064, latest revision.

G. Expansion Joint Filler

1. Expansion joint filler shall be 1/2-inch thick, preformed asphalt-impregnated, expansion joint material conforming to ASTM D994, latest revision.

H. Accessories

1. Tie wires shall be 16-gauge, black, soft-annealed wire.

2. Bar supports shall be of proper type for us intended. Bar supports in beams and slabs exposed to view after stripping shall be galvanized or plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

3.36 Chain Link Fence and Gates (Thermally Fused Black/Green Chain Link Fence, Gates, Posts, etc.)

A. Materials

1. Materials shall be new and products of recognized, reputable manufacturers. Used, rerolled, or regalvanized materials are not acceptable.

2. All materials shall be hot-dip galvanized after fabrication. Posts and other appurtenances shall have a minimum zinc coating of 1.2 ounces per square foot of surface. All fabric, posts, post tops, top rails, fittings and gate frames shall be thermal fused vinyl-coated (color noted on drawings) after fabrication and galvanizing.

B. Components

1. Fabric: Chain link fence shall be woven No. 9 gauge wire in 2-inch diamond mesh pattern, selvages twisted and barbed, vinyl-coated after weaving. Knuckel top and bottom of fabric.

2. Line Posts: For fences up to 8 feet high, use 2-1/2-inch outside diameter, ASTM A 120, latest revision, Schedule 40 steel pipe, weight 3.65 pounds per

linear foot. For fences over 8 feet high, follow manufacturer's recommendations for sizes.

3. End, Corner, Angle and Pull Posts: For end, corner, angle and pull posts, use 2.875-inch outside diameter standard weight steel pipe, weight 5.79 pounds per linear foot.

4. Gate Posts: For single and double gates 3 feet wide to 13 feet wide, 4-inch outside diameter, 9.1 pounds per foot.

5. Post Tops: Post tops shall be pressed steel, or malleable iron designed as a weathertight closure cap for tubular posts. Provide one cap for each post, unless equal protection is afforded by combination post top cap and barbed wire supporting arm where barbed wire is required. Where top rail is used, provide tops to permit passage of top rail.

6. Bottom Rail: 1-5/8-inch outside diameter, weight 2.27 pounds per linear foot. Couplings to be outside-sleeve type and at least 6 inches long. Bottom rail to extend through line post bottoms to form continuous brace from end-to-end of each stretch of fence.

7. Top Rail: 1-5/8-inch outside diameter, weight 2.27 pounds per linear foot. Couplings to be outside-sleeve type and at least 6 inches long. Top rail to extend through bottom of line post to form continuous brace from end-to-end of each stretch of fence.

8. Braces: Horizontal brace rail shall be of the same material as the top rail and shall be installed midway between the top rail and fence bottom. Braces shall be securely fastened to the posts by heavy-pressed steel and malleable fittings, then securely trussed from line post to base of terminal post with a 3/8-inch truss rod and tightener.

   Braces shall also be provided between all line posts.

9. Fittings: Malleable steel, cast iron, or pressed steel, galvanized to meet the requirements of ASTM A 153, latest revision. Fittings to include 45-degree double extension arms for barbed wire, stretcher bars and clamps, clips, tension rods, brace rods, hardware, fabric bands and fastenings, and all accessories. Provide 45-degree bracket type supports to each post to accommodate three strands of barbed wire each, if required.

10. Barbed Wire: Four-point pattern with two strands of No. 12-1/2-gauge wire, and 1-inch barbs 5 inches apart. Zinc-coated barbed wire shall meet requirements of ASTM A 121, latest revision, Class 3; aluminum-coated barbed wire shall meet the requirements of ASTM A 585, latest revision.

11. Tension Bar Bands: Bar bands shall be heavy-pressed steel, spaced not over 15 inches on center to secure tension bars to tubular end, corner, pull and gate posts

12. Tension Bars: Tension bars shall be one-piece lengths equal to full height of fabric with a minimum cross-section of 3/16-inch by 3/4-inch. Provide one tension bar for each gate and end post and two for each corner and pull post.

C. Gates

1. Gates shall be swing type as indicated on the Drawings, complete with latches, stops, keepers and hinges.

2. Gate frames shall be constructed of tubular members welded at all corners or assembled with fittings. On steel, welds shall be painted with zinc-based paint. Where corner fittings are used, gates shall have truss rods of 5/16-inch minimum nominal diameter to prevent sag or twist. Gate leaves shall have vertical intermediate bracing as required, spaced so that no members are more than 8 feet apart. Gate leaves 10 feet or over shall have a horizontal brace or one 5/16-inch minimum diagonal truss rod. When fence has barbed wire top, the end members of the gate frames shall be extended one foot above the top horizontal member to which three strands of barbed wire, uniformly spaced, shall be attached by use of bands, clips or hook bolts.

3. Fabricate frames of standard weight pipe 1.90-inch outside diameter, weight 2.72 pounds per linear foot.

4. Gate fabric shall be the same type as used in the fence construction. The fabric shall be attached securely to the gate frame at intervals not exceeding 15 inches.

5. Gate hinges shall be of adequate strength for 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 capable of being opened and closed easily by one person.

6. Gate latches, stops and keepers shall be provided for all gates. Latches shall have a plunger-bar arranged to engage the center stop, except that for single gates of openings less than 10 feet wide, a forked latch may be provided. Latches shall be arranged for locking with padlocks. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger-bar of the latch of double gates. No stop is required for single gates. Keepers shall consist of a mechanical device for securing the free end of the gate when in the full open position.

7. Double Gates: Size and configuration shall be as indicated. Provide gate stops for all double gates, consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar.

Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.

3.37 Concrete Access Drives

A. Reference Specifications, Codes, and Standards

1. Commercial Standards: References in these specifications to "Standard Specifications" shall mean the "Standard Specifications for Road and Bridge Construction," Florida Department of Transportation, latest edition.

B. Subgrade and Concrete Slab

1. Subgrade shall be compacted to 98% AASHTO T-180.

2. Concrete shall be 4,000 psi mix. Finish shall be light broom.

4.0 FORCE MAIN SYSTEM

4.01 Ductile Iron Pipe Force Main

A. Materials

1. Ductile Iron Pipe: Pipe materials shall conform to the requirements of ANSI/AWWA C151/A21.51, latest revision and unless otherwise noted herein this specification or the drawings, all ductile iron pipe shall be as follows:

Nominal Diameter	Minimum Pressure Class	Special Cases Thickness Class
3" thru 12"	350 Psi	--
14" thru 36"	250 Psi	--
Flanged Pipe (all diameters)	--	53 (Min)

2. Epoxy Lining: PROTECTO 401 Ceramic Epoxy as manufactured by Vulcan Painters, Inc., or equal approved by the Coral Springs Improvement District.

B. Ductile Iron Pipe

1. General: Ductile iron pipe used in this project shall be in accordance with the requirements of ANSI/AWWA C150/A21.50, latest revision, ANSI/AWWA C151/A21.51, latest revision, and ANSI/AWWA C115/A21.15, latest revision, as applicable.

2. Ductile iron pipe for force mains shall be lined with a tightly bonded epoxy lining of nominal thickness 40 mils in accordance with AWWA C210, latest revision. Lining shall be compatible for sanitary service.

3. Paint exterior force main with 2" wide green stripes along full length of pipe (minimum 3 stripes).

C. Push-on Joints (Non-restrained Type)

1. Push-on pipe joints (non-restrained type) shall be "Fastite" as manufactured by American Cast Iron Pipe Company, "Tyton" as manufactured by U.S. Pipe and Foundry, or equal approved by the Coral Springs Improvement District. Push-on joints shall meet the requirements of ANSI/AWWA C111/A21.11, latest revision.

D. Push-on Joints (Restrained Type)

1. Push-on joints (restrained type), 24-inch and smaller, shall use "Fast-Grip" gasket system by American Cast Iron Pipe Company, "Field Lok" gasket system by U.S. Pipe and Foundry, or equal approved by the Coral Springs Improvement District.

2. Push-on joints (restrained type) greater than 24-inch, shall be “LOK-Ring” restrained joint by American Cast Iron Pipe “TR Flex” restrained joint by U.S. Pipe and Foundry, or equal approved by the Coral Springs Improvement District.

E. Pipe Finish (Exposed)

1. Exposed (non-buried) piping and fittings shall be shop primed with a catalyzed rust inhibitive epoxy primer. Minimum dry film thickness shall be 2-3 mils. Surface preparation shall be white metal blast cleaning in accordance with Steel Structures Painting Council No. 10 (SSPC-SP10). Primer shall be compatible for use with coatings specified.

4.02 Not Used

4.03 Ductile Iron Mechanical Joint (MJ) Fittings

A. Mechanical joint fittings (3-inch through 24-inch) shall be ductile iron compact fittings manufactured in accordance with ANSI/AWWA C153/A21.53, latest revision, with a pressure rating of 350 psi. Fittings shall have mechanical joints in accordance with ANSI/AWWA C111/A21.11, latest revision.

B. Mechanical joint fittings (30-inch and larger) shall be ductile iron fittings manufactured in accordance with ANSI/AWWA C110/A21.10, latest revision, with a pressure rating of 250 psi. Fittings shall have mechanical joints in accordance with ANSI/AWWA C111/A21.11, latest revision.

C. Fittings shall be coated and lined as specified for the applicable pipe application.

4.04 Mechanical Joint Restraints (DIP)

A. Restrained mechanical joints shall be utilized for fittings and valves at locations indicated on the drawings.

B. Restraint of mechanical joints shall be accomplished by using a Megalug Series 1100 restraining follower gland as manufactured by EBAA Iron Sales, Inc. or equal approved by the Coral Springs Improvement District.

C. Mechanical joints for fittings and valves shall meet the requirements of ANSI/AWWA C111/A21.11, latest revision.

4.05 Not Used

4.06 Valve Boxes

A. Valve boxes shall be of the two-piece adjustable screw type, cast iron, with 5-1/4-inch shaft of appropriate length for the installation. Extension pieces, if required, shall be the manufacturer's standard type. Valve box tops shall have raised letters saying "SEWER". Valve boxes shall be as manufactured by Tyler Union, or equal approved by the Coral Springs Improvement District.

4.07 Plug Valves (MJ)

A. V-50: Eccentric plug valves 3 inches and larger shall be of the non-lubricated type with resilient faced plugs with end connections as shown on Drawings. Mechanical joint ends shall be in accordance with the AWWA C111/A21.11-90, latest revision. Valve bodies shall be of ASTM A126, latest revision, Class B cast iron, 31,000 psi tensile strength minimum. All exposed nuts, bolts, springs and washers shall be 300 Series stainless steel for buried or submerged installations. Port areas on valves through 20 inches in size shall be at least 80% of full pipe area and valves 24 inches and larger shall have a minimum port area of 70% of the full pipe area. Resilient plug facings shall be Neoprene or Buna N material on a single piece plug. The seats shall be in the body and shall be a minimum of 90% nickel. Threaded, adjustable seats shall not be allowed. Valve shaft seals or packing shall be adjustable and replaceable without removing the valve from service or interrupting service. Valves shall have a minimum pressure rating of 175 psi (3"-12") and 150 psi (14"-24") and provide drop-tight shut-off. Valves shall be by DeZurik, or equal approved by the Coral Springs Improvement District.

Valves for buried or submerged installations shall be provided with permanently lubricated, totally enclosed worm gear actuators with a 2-inch operating nut. Actuator shall be fully gasketed and capable of withstanding a minimum external groundwater pressure of 10 psi.

All interior and exterior ferrous surfaces shall be epoxy coated. Epoxy coatings shall be compatible for service fluid as applicable. Epoxy coating application shall be manufacturer's standard unless otherwise specified.

Plug Valve Installation Table:

Valve Designation	Valve Description
V-50Q	Quarter Turn Plug Valve
V-50G	Plug Valve with Geared Actuator

4.08 Valve Stem Extensions

A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, operating extension stems shall be provided to bring the operating nut to a point 6 inches below the surface of the ground and/or valve box cover. Extension stems shall have 2-inch standard operating nut and steel alignment washer. Extension stems shall be by the General Engineering Company (GENECO), or equal approved by the Coral Springs Improvement District.

4.09 Tapping Sleeves and Valves

A. Tapping sleeves shall be mechanical joint type with flanged outlet. Sleeves shall be manufactured from gray cast iron meeting the requirements of ASTM A126, latest revision, Grade B or ductile iron meeting ASTM A536, latest revision, Grade 65-45-12. Outlet flange drilling shall conform to the requirements of ANSI B16.1, latest revision, Class 125. Working water pressure of sleeve shall be 200 psi. Test plug tap shall be provided in sleeve neck under flange outlet.

B. Tapping valves shall conform to AWWA C509, latest revision, resilient seated gate vales, except as modified for passage and clearance of tapping machine cutters. The opening through the valve shall be a minimum 1/4-inch larger than nominal valve diameter. Valves shall have a flanged end to meet the tapping sleeve. The opposite end shall be mechanical joint.

C. Tapping sleeves and valves shall be manufactured by American Flow Control, or equal approved by the Coral Springs Improvement District.

D. Stainless steel sleeve Style CST-EX, extra heavy, as manufactured by Cascade Waterworks Mfg. may be substituted for specified ductile iron sleeve.

4.10 Buried Valve Identification Tags

A. Buried Valves: Underground valve identification markers shall be 3-inch diameter, 1/8-inch thick, solid hard brass, with 1/4-inch tamper-proof hook-end rod anchor. Surface to be engraved with 1/4-inch to 3/8-inch capital letters, approximately 0.015-inch deep. Hand punched lettering is not acceptable surface of marker ground smooth and epoxy coated to prevent tarnishing. Markers shall be Wagco markers or equal approved by the Coral Springs Improvement District.

4.11 Not Used

4.12 Not Used

4.13 Automatic Sewage Air Release Valves (AARV)

A. Sewage Air Release Valve

1. Materials of construction shall be in accordance with the following A.S.T.M. Specifications:

Body & Cover	Cast Iron	ASTM A126-B
Internal Linkage, Stem, Concave Float	Stainless Steel	ASTM A240, T316
Orifice/Button	Stainless Steel and Buna	

B. Valve shall be specifically designed for use with sewage and waste media. Valve shall be designed to operate "OPEN" while pressurized allowing air to escape through the air release orifice.

C. Valve shall be H-Tec Model 986, or equal approved by the Coral Springs Improvement District. Valve may be equipped with H-Tec Universal Saddle Model 371 where height may of configuration may be an issue. Valve shall have a 2-inch N.P.T. inlet, ½-inch N.P.T. outlet and a venting orifice diameter of 3/16-inch. Working pressure shall be 10-150 psi.

D. The following optional items shall be included with the valve: Shut off, backflush and blowoff valves and all necessary attachments for backflushing.

4.14 ARV Accessories and Vaults

A. Shall be as shown in Standard Detail.

5.0 MISCELLANEOUS SPECIFICATIONS

5.01 Aerial Canal Crossing Components

A. Piping and fittings shall be ductile iron as specified in these standard specifications.

B. Air release valve shall be as specified in these standard specifications.

C. Pilings shall be 12 inch square prestressed concrete pile per FDOT Standard Index No. 20612.

D. Pipe cap concrete and reinforcement shall be as specified in these standard specifications.

E. Fangaurd shall be assembled of welded galvanized steel, per dimensions shown in the standard details.

F. Exposed piping shall be painted as specified herein per service conveyance.

5.02 Utility Jack and Bore Installation Components (Engineer Approval Required)

A. Steel Casings

1. Use steel casings meeting the requirements of ASTM A139, latest revision, for Grade B pipe with welded joints. The minimum dimensions of the pipe shall be as noted on the Drawings.

2. The CONTRACTOR may select a larger diameter or greater wall thickness than those specified for the method of work to be employed, site conditions or possible interference.

B. Carrier Pipe

1. Pipe shall be as indicated on the Drawings and as specified in the applicable specification section.

C. Casing Spacers

1. Band shall be two piece, 14-gauge, Type 304 stainless steel. Band liner shall be PVC with a minimum thickness of 0.90". Risers shall be 10-gauge, Type 304 stainless steel.

2. Studs, nuts and washers shall all be type 304 stainless steel.

3. Runners shall be 2-inch glass reinforced plastic. Number and configuration of runners required shall be as per manufacturer's standard recommendations.

4. Casing spacers shall be as manufactured by Cascade Waterworks Mfg., or equal approved by the Coral Springs Improvement District.

D. Brick and Mortar (End Seal)

1. Clay Brick: Clay brick shall comply with ASTM C 32, latest revision, grade SS, hard brick, except that the mean of 5 tests for absorption shall not exceed 8 percent by weight.

2. Concrete Brick: Concrete brick shall conform to ASTM C 139, latest revision.

3. Cement Mortar: Cement mortar shall consist of a mixture of Portland cement, sand and water. Cement and sand shall first be combined in the proper proportions and then thoroughly mixed with the required amount of water. Cement mortar shall be proportioned by loose volume in the proportion of one part cement to two parts sand. The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended. Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use.

5.03 Directional Drill

A. High Density Polyethylene Pipe (HDPE) and Fittings

1. Polyethylene pipe and fittings 4-40 inch diameter shall be in accordance with AWWA C906, standard code designation PE 4710. Pipe 4-30 inch diameter shall have a DR adequate for the size and length of pull with a minimum pressure rating of 250 psi. The manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements. The pipe sizing shall be in accordance with Ductile Iron Sizing System (DIOD).

2. Polyethylene pipe ½ -3 inch diameter for main line piping shall be polyethylene pipe (not tubing) in accordance with AWWA C901, standard code designation PE 4710, DR 9 (outside diameter based dimension ratio), PC 250.

3. Polyethylene pipe shall have the same or larger inside diameter as the ductile iron pipe at either end of the polyethylene pipe.

4. For connecting to other pipes such as DIP and PVC (ductile iron pipe standard), a mechanical flange type Polyethylene Flange Adapters shall be used. Polyethylene Flange Adapters shall be made with sufficient through-bore length to be clamped in a heat fusion joining machine without the use of sub-end holder. This assembly consists of a slip-on metal mechanical joint flange, a polyethylene mechanical joint adapter, bolts and mechanical joint rubber gasket. The polyethylene adaptor shall carry the same pressure rating as the pipe and is butt fused to the pipe end. A stub end must be the same DR rating as the pipe to which it is joined. The slip-on metal flange shall be made from ductile iron. The metal flange shall be drilled to ANSI B16.1/B16.5, Class 125/150 bolt circle pattern. Flange adapter shall be fitted with lap joint flanges pressure rated equal to or greater than the mating pipe. The lap joint flange bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be grade 2 or higher.

B. Directional Drilling Equipment Requirements

1. General: The directional drilling equipment consists of a directional drilling rig of sufficient capacity to perform the bore and pull back the pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the installation, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused, a magnetic guidance system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in good working order for the duration of this project.

2. Drilling Rig: The directional drilling machine consists of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. There shall be a system to detect electrical current from the drill string and an audible alarm which automatically sounds when an electrical current is detected.

3. Drill Head: The drill head must be steerable by changing it's rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

4. Mud Motors (if required): Mud motors must be of adequate power to turn the required drilling tools.

5. Drill Pipe: Construct of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

C. Guidance System

1. General: A Magnetic Guidance System (MGS) probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to one hundred feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate to ± 2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet and accurate with 1 foot horizontally.

2. Components: Supply components and materials to install, operate, and maintain the guidance system.

3. Utilize a proven type of Guidance System such as Share Well TruTracker MGS, or other proven guidance system. During set up and operation utilize qualified personnel trained and experienced with this system. The Operator shall be aware of any geo-magnetic anomalies and shall consider such influences in the operation of the guidance system.

D. Drilling Fluid (Mud) System

1. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to "molecularly shear' individual bentonite particles from the dry power to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be a minimum of 5000 gallons. Mixing system shall continually agitate the drilling fluid during drilling operations.

2. Drilling Fluids: Drilling fluid shall be composed of clean water and bentonite clay. Water shall be from an authorized source with a pH of 8.5 - 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal., No additional material may be used in drilling fluid without prior approval from ENGINEER. The bentonite mixture used shall have the minimum viscosities as measured by a March Funnel:

   Rock, Clay - 60 sec.
   Hard Clay - 40 sec.
   Soft Clay - 45 sec.
   Sandy Clay - 90 sec.
   Stable Sand - 80 sec.
   Loose Sand - 110 sec.
   Wet Sand - 110 sec.

   These viscosities may be varied to best fit the soil conditions encountered, as approved by the ENGINEER.

3. Delivery System: The mud pumping system shall have a minimum capacity of 35-500 GPM and be capable of delivering the drilling fluid at a constant minimum pressure of 1200 psi. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system or shall be removed by vacuum trucks or other methods acceptable to ENGINEER. A berm, minimum of 12 inches high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and recycling facilities or disposal.

4. Drilling Fluid Recycling System: The drilling fluid recycling system shall separate sand, dirt and other solids from the drilling fluid and render the drilling fluid reusable. Spoil separated from the drilling fluid will be stockpiled for later use or disposal.

E. Other Equipment

1. Pipe Rollers: Pipe rollers shall be of sufficient size to fully support the weight of the pipe while being hydrotested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

2. Pipe Rammers: Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of ENGINEER.

3. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the ENGINEER prior to commencement of the Work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

F. Personnel Requirements

1. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. Each person must have at least two years directional drilling experience.

2. In addition to the CONTRACTOR's supervisor, a competent and experienced supervisor representing the Drilling Subcontractor shall be present at all times during the actual drilling operations. A responsible representative who is thoroughly familiar with the equipment and type Work to be performed must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the job site during the actual Directional Bore operation. The CONTRACTOR and Subcontractor shall have a sufficient number of competent workers on the job at all times to insure the Directional Bore is made in a timely and satisfactory manner.

3. Personnel who are unqualified, incompetent or otherwise not suitable for the performance of this project shall be removed from the jobsite and replaced with a suitable person.

5.04 Valve Box Adjustment Rings

A. Valve box and adjustment rings shall be as manufactured by U.S. Foundry, or equal approved by the Coral Springs Improvement District.

5.05 Manhole Adjustment Rings

A. Manhole adjustment rings shall be as manufactured by U.S. Foundry, or equal approved by the Coral Springs Improvement District.

5.06 Bollards

A. Pipe shall be 4" steel..

B. Concrete shall be as specified herein.

C. Bollard shall be painted as specified herein. Color shall be safety yellow or other color as selected by the Coral Springs Improvement District.

6.0 FLUSHING, TESTING, AND DISINFECTION

6.01 Flushing

A. Upon completion of the pipe installation for any service, the mains shall be cannon flushed to remove dirt and any other foreign matter by achieving a minimum velocity of 5 feet per second on pipe sizes up to and including 12-inches and 2.5 feet per second on pipe greater than 12-inches. The duration of the flushing shall be sufficient to provide a minimum flush volume equal to three times the internal volume of the pipeline being flushed. Temporary fittings, pipe, etc. may be used to facilitate cannon flushing.

1. Prior to the actual line flushing operation, the Contractor shall notify the Coral Springs Improvement District of the intended water use. No flushing shall take place without a Coral Springs Improvement District representative present.

2. Flushing will not be scheduled until the Coral Springs Improvement District has approved preliminary record drawings, unless it is required to facilitate construction of water mains.

3. The Contractor shall exercise due care so as to ensure that the water used in flushing does not cause a nuisance or inflict property damage.

B. Poly-pigging (2X) is required for all water mains or force mains.

C. No existing valve shall be operated except by Coral Springs Improvement District personnel.

6.02 Water Main Testing

Water mains shall be tested in accordance with ANSI/AWWA Standard C600 latest revision.

A. Hydrostatic Tests:

1. After a new water main has been laid and backfilled, it shall be pumped to a pressure of 150 PSI and all visible leaks stopped by approved methods. During the test, the pressure cannot drop more than 5 PSI below the starting pressure point.

2. A leakage test shall then be conducted at the above mentioned pressure and no installation will be acceptable by the Coral Springs Improvement District until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = (S \times D \times \sqrt{P})/148{,}000$$

in which L equals the allowable leakage in gallons per hour; S is the length of line in feet being tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch. The test is usually maintained for two hours but it may be continued for one additional hour if it becomes apparent that the leakage is equal to or greater than the amount allowable. Water supplied to the main during the test to maintain the required pressure shall be measured by a 5/8-inch meter installed on the discharge side of the test pump, or by pumping from a calibrated container.

3. Each section of main being tested shall be limited to a maximum length of 2000'. When testing against closed mainline valves, an additional leakage per closed valve of 0.0078 gal/hr/in, of nominal valve size shall be allowed. Any questions pertaining to procedures used during the test shall be directed to the Coral Springs Improvement District.

4. No allowable leakage shall be permitted for fire hydrants.

B. Bacteriological Tests (Contractor Pays Testing laboratory):

1. After the water mains have satisfied the leakage testing requirements they shall be flushed through openings of the required size as detailed in ANSI/AWWA Standard C651 latest revision. The main shall then be disinfected in accordance with the provisions of the applicable sections of the above named AWWA Standard. On main breaks, cut-ins, etc. a liberal application of sodium hypochlorite shall be made; 50 ppm Chlorine during a 24 hour period.

2. Mains shall not be put into domestic service until the necessary bacteriological samples have been approved by the applicable regulatory agencies.

6.03 Water Service Lines

A. Hydrostatic Testing

1. Hydrostatic testing of water service lines shall be done in conjunction with the testing of the lateral or main line. No additional leakage allowance will be made for service lines or fire hydrants.

B. Disinfection

1. Disinfection of service lines shall be done in conjunction with the disinfection of the lateral or main line. Sufficient sampling points shall be taken from service line connections to assure uniform results throughout the system being tested.

6.04 Force Main Testing

Force mains shall be tested in accordance with AWWA Standard C600 latest revision.

A. Hydrostatic Tests:

1. After a new force main has been laid and backfilled, it shall be pumped to a pressure of 150 PSI and all visible leaks stopped by approved methods. During the test, the pressure cannot drop more than 5 PSI below the starting pressure point.

2. A leakage test shall then be conducted at the above mentioned pressure and no installation will be acceptable by the Coral Springs Improvement District until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = (S \times D \times \sqrt{P})/148{,}000$$

in which L equals the allowable leakage in gallons per hour; S is the length of line in feet being tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch. The test is usually maintained for two hours but it may be continued for one additional hour if it becomes apparent that the leakage is equal to or greater than the amount allowable. Water supplied to the main during the test to maintain the required pressure shall be measured by a 5/8-inch meter installed on the discharge side of the test pump, or by pumping from a calibrated container.

3. The section of main being tested shall be limited to a maximum length of 2000'. When testing against closed valves, an additional leakage per closed valve of 0.0078 gal/hr/in, of nominal valve size shall be allowed. Any questions pertaining to procedures used during the test shall be directed to the Coral Springs Improvement District.

6.05 Gravity Sewer Main Testing

A. Infiltration, Exfiltration Gravity Sewer Main Line

1. The allowable limits of infiltration or exfiltration for the entire system, or any portion thereof, shall not exceed a rate of 5 gallons per inch of inside pipe diameter per mile of pipe per 24 hours. No additional allowance will be made for house service lines. The allowable limits of infiltration or exfiltration of manholes shall not exceed a rate of four gallons per manhole per 24 hours.

2. Any part or all of the system may be tested for infiltration or exfiltration, as directed by the Coral Springs Improvement District. Prior to testing for infiltration, the system shall be pumped out so that no infiltration conditions exist at the time of testing.

3. The exfiltration test will be conducted by filling the portion of the system being tested with water to a level equal to the lowest part of the manhole frame.

4. Tests shall be conducted on portions of the system not exceeding three manhole runs or maximum of 1200' (feet) whichever is greater unless otherwise directed by the Coral Springs Improvement District. Tests shall be run continuously for two hours.

5. Where infiltration or exfiltration exceed the allowable limits specified herein, the defective pipe, joints, or other fault construction shall be located and repaired by the Contractor. If the defective portions cannot be located, the Contractor shall remove and reconstruct as much of the work as is necessary in order to conform to the specified allowable limits.

6. The Contractor, at no expense to the Coral Springs Improvement District, shall provide all labor, equipment and materials and shall conduct all testing required, under the direction of the Coral Springs Improvement District.

B. Air Testing

1. Air testing is a method of testing the integrity of the pipeline and the structures that may be used in lieu of the method prescribed in paragraph A. (above). Also, the Coral Springs Improvement District may direct the use of air testing under certain circumstances.

2. Testing procedures shall be in accordance with the following requirements. The results of the testing will be evaluated by calculating the allowable times in accordance with charts created by the Coral Springs Improvement District.

3. At the start of the test, the pipelines are stabilized by pumping the lines with air to achieve a constant test pressure (for piping above the ground water table, it is necessary to achieve a constant 3.5 PSI; do not exceed 5 PSI).

Maintain the test pressure for 5 minutes and do not permit the pressure to drop more than 0.5 PSI below the test pressure.

4. The test period begins when the pressure is adjusted to exactly 3.5 PSI (for piping above the water table) and the pressure supply is shutoff. When the pressure bleeds to 3.0 PSI, start the test timing. Stop the time when the pressure bleeds to 2.5 PSI. Determine the time differential and compare it to the applicable charts (when calculating the allowable times).

5. If the bleed down time exceeds the allowable time per the chart, then the line passes. If the line reaches 2.5 PSI prior to reaching the allowable time, then it fails.

6. For piping that is below the water table, the above procedures are the same, except that all pressures shall be adjusted (+) 0.433 psi/ft below the water table.

6.06 Gravity Sewer Lateral Testing

A. Infiltration/Exfiltration Gravity Sewer Laterals

1. Infiltration and exfiltration testing (Two feet of Head for exfiltration; zero head for infiltration) of service connection lines shall be done in conjunction with the testing of the lateral and/or main line sewer. No additional leakage allowance will be made for service lines.

2. Infiltration testing of service lines will not be permitted unless a minimum 2' (feet) static head of ground water exists over the shallow end of the service line at cleanout.

6.07 Visual Inspection Gravity Sewer Main Lines

A. On completion of each block or section of gravity sewer, or such other times as the Coral Springs Improvement District may direct, the block or section of sewer is to be cleaned, tested and inspected. Each section of the sewer is to show, in examination (lamping) from either end, a full circle of light between manholes. Each manhole or other appurtenance to the system, shall be of the specified size and form, be water tight, neatly and substantially constructed, with the top set permanently to exact position and grade. All repairs shown necessary by the inspection are to be made; broken or cracked pipe replaced; all deposits removed and the sewers left true to line and grade entirely clean and ready for use.

6.08 T.V. Inspection Gravity Sewer Main Lines

A. After all other testing has been successfully completed, a television inspection of all lines shall be completed by Contractor. Any defective work or necessary corrections found during this inspection must be corrected by the Contractor, at his expense, before the lines can be accepted for operation and maintenance by the

Coral Springs Improvement District. All mud, sand, debris and other deposits shall be removed by approved methods prior to TV inspection.

B. Review and approval of the tapes must be completed by Coral Springs Improvement District Personnel.

C. The percent of standing water at a sag in a sewer main will determine if the pipe is acceptable or not.

1. Sags that make up 5% or less of the pipe area are approved.

2. Sags that are between 5-10% of the pipe area are at the discretion of the Coral Springs Improvement District to accept or reject.

3. Sags that are more than 10% of the pipe area are unacceptable and should be rejected unless justified by the Engineer of Record to the Coral Springs Improvement District. Acceptance is not final until agreed to by the Coral Springs Improvement District. A letter of credit or a performance bond will be required for sags such as this; warranty extensions without this protection are not acceptable.

6.09 Testing Backfill

A. Compaction and Densities Testing

Methods of control and testing of backfill construction to be employed in this work are:

1. Maximum density of all backfill material shall be determined by ASSHTO T-180 (ASTM D 1557).

2. Laboratory and field density tests, which, in the opinion of the Coral Springs Improvement District are necessary to establish compliance with the compaction requirements of these specifications, shall be made at such depths and locations as selected by the Coral Springs Improvement District.

3. Trench backfill which does not comply with the specified densities, as indicated by such tests, shall be reworked and recompacted until the required compaction is secured, at no additional cost to the Coral Springs Improvement District.

4. The first test shall be 12” above the top of pipe or the water table, and in 6” lifts thereafter.

5. Backfill testing fees shall be paid by Contractor (Testing Lab shall be approved by Coral Springs Improvement District).

7.0 MINIMUM EASEMENT REQUIREMENTS

ITEM	EASEMENT REQUIREMENT
Water Mains and Sewer Force Mains	10 foot minimum width with no less than 5 feet on each side of the main. Minimum width may be reduced if the easement is parallel to and contiguous to a public right of way. The easement must extend 10 feet beyond the terminus of the main.
Sewer Gravity Mains <8'depth	15 foot minimum width with no less than 7.5 feet on each side of the main. Minimum width may be reduced if the easement is parallel to and contiguous to a public right of way. The easement must extend 10 feet beyond the terminus of the main.
Sanitary Gravity Mains >8' depth	20 foot minimum width with no less than 10 feet on each side of the main. Minimum width may be reduced if the easement is parallel to and contiguous to a public right-of-way. The easement must extend 10 feet beyond the terminus of the mains.
Water Main and Sewer Gravity Main In Same Easement	30 foot minimum width based on 7.5 feet for the water main, 12.5 feet for the sewer gravity main and 10.0 feet separation between the two mains. Minimum width may be reduced if the easement is parallel to and contiguous to a public right of way. The easement must extend the greater of 12.5 feet beyond the terminus of the sewer gravity main or 7.5 feet beyond the terminus of the water main.
Fire Hydrant	7.5 feet on each side of the hydrant. Easement may be combined with minimum water main easement.
Backflow Preventer, Large User Meter	10 foot minimum on each side of meter vault or backflow preventer. Easement may be combined with minimum water main easement.
Lift Stations, Pump Stations	30 feet by 30 feet. Under some circumstances Coral Springs Improvement District may approve a smaller easement but it is unusual for the easement to be less than 25 feet by 25 feet.
All Others	Check with Coral Springs Improvement District.

Easement descriptions are to be written clearly on 8 ½“ x 11” paper with a point of beginning and a point of termination. A sketch drawn to scale and on 8 ½“ x 11” paper shall accompany the description. The sketch is to reflect the description and shall carry additional information to facilitate construction of the worded description. Street corners are to be shown and the description/sketch should relate the property being described to the streets. The scale shall be such to enable the direction of lines to be clearly observed. Where warranted, the sketch is to be on more than one sheet with the proper match lines shown for each sheet. Coral Springs Improvement District reserves the right to approve the description and sketch.

Easement descriptions and sketch must meet minimum technical standards and be signed/sealed by a Florida registered land surveyor.

Water and Wastewater Systems

Standard Specifications and Details

Date: October 4, 2017


CORAL SPRINGS
IMPROVEMENT DISTRICT