SPECIFICATION 333003: WASTEWATER PUMPING STATION

PART 1.0 GENERAL

1.1 DESCRIPTION

1.1.1 The following specification sets forth the general requirements for the design, installation, inspection, testing, and acceptance of wastewater pumping stations. The work included in this section consists of furnishing all labor, equipment, tools, materials, and performing all operations required for the construction and installation of the pumping station complete and ready for operation as shown on the Drawings and described herein.

1.1.2 Work under this division must be coordinated with the requirements of all Contract Documents and constructed at locations indicated on the Drawings in order to provide a complete functional installation. Any labor, materials, equipment, and apparatus not specifically mentioned herein or shown on the Drawings, which may be found necessary to complete any portion of the work in a substantial manner and in compliance with the requirements stated or implied by the Contract Documents, must be furnished by the Contractor without additional compensation.

1.1.3 The latest edition of all national standards and related documents referenced must be used unless otherwise specified by Hillsborough County Public Utilities Water Resources Department (WRD).

1.1.4 Construction

- 1.1.4.1 Coordinate and interface with work of other trades as required for completion of the site, Work.
- 1.1.4.2 Mechanical and electrical Drawings are diagrammatic in character but should be adhered to as closely as possible, consistent with construction of the pumping station.
- 1.1.4.3 All work must be executed in a workmanlike manner by skilled personnel and the work must present a neat appearance when completed.
- 1.1.4.4 The term *provide* means to furnish and install completely, including restoration.
- 1.1.4.5 The Drawings are not intended to show in complete detail every fitting which may be required; however, wherever reasonably implied by the nature of the work, such materials or equipment must be provided as required to complete the work.
- 1.1.4.6 Temporary utility services must be provided under this section as needed to accomplish the work. The Contractor must provide, furnish, and install all temporary utilities for the construction period. At job completion, all temporary utilities must be removed.
- 1.1.4.7 In general, electrical materials and apparatus must comply with all applicable tests, ratings, specifications, and requirements of the appropriate standards listed in Part 1.2 herein. Underwriter's Laboratories, Inc. (UL) listed electrical components or assemblies must be used and must bear the approved device label of UL. Motors must comply with all applicable referenced standards and they must be designed for continuous submerged service in accordance with the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards.
- 1.1.4.8 All work must comply with applicable requirements and recommendations of standards published by listed agencies and trade associations, except to the extent more detailed and stringent requirements are indicated or required by local governing regulations.
- 1.1.4.9 Installation must comply with the latest editions of the NEC, National Fire Protection

Association (NFPA) 70, NFPA 79, the National Electrical Safety Code (NESC), and all applicable state, municipal, and local codes. Work must be subject to inspection and approval requirements of the local authority having jurisdiction.

1.1.4.10 During construction, and until Hillsborough County accepts the pump station, the Contractor is required to post "Emergency Contact" signage at the site listing their contact information. This information must cover operations for 24 hours/day, 7 days/week, 365 days/year.

1.1.5 The Developer/Contractor must furnish to the County a two-year warranty on the materials, fabrication, and workmanship of any and all items furnished and installed. The Developer/Contractor must guarantee all work and rectify any defects due to faulty materials or workmanship during the warranty period. The Developer/Contractor must also pay for damage to other work resulting from faulty materials or workmanship which occurs within said period. Warranty periods typically commence upon written acceptance of the component or appurtenance by the County for ownership and operation. Section 1.6.4 of the Hillsborough County Public Utilities Water Resources Department (WRD) Technical Manual describes the requirements and duration of a Warranty Bond for all contributed assets

1.1.6 All construction plans, project submittals, and record drawings must comply with the requirements of Section 1 and Section 2 of the Hillsborough County Public Utilities Water Resources Department (WRD) Technical Manual.

1.2 REFERENCE DOCUMENTS

- American Concrete Institute (ACI)
- American National Standards Association (ANSI)
- American Petroleum Institute (API)
- American Society of Mechanical Engineers (ASME)
- American Society for Testing and Materials (ASTM)
- American Water Works Association (AWWA)
- American Wood Protection Association (AWPA)
- Electronic Industries Association (EIA)
- Florida Department of Transportation (FDOT)
- Insulated Cable Engineers Association, Inc. (ICEA)
- International Electrotechnical Commission (IEC)
- International Society for Automation (ISA)
- Institute of Electrical and Electronics Engineers, Inc. (IEEE)
- National Association of Pipe Fabricators (NAPF)
- National Electrical Code (NEC)
- National Electrical Contractors Association. (NECA)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- Occupational Safety and Health Agency (OSHA)
- Underwriters Laboratories, Inc. (UL)

1.3 SHOP DRAWINGS AND SUBMITTALS

1.3.1 Standard structural, mechanical, and electrical details are available on-line at

HillsboroughCounty.org, under Businesses/Land-Development/Technical-Publications. If used, these details must be included in the signed and sealed construction plan set.

1.3.2 The electrical detail sheets must include an electrical load summary, a circuit breaker coordination study, and a short circuit analysis which must be completed, signed and sealed by an Electrical Engineer registered in the State of Florida.

1.3.3 The pumping station site layout sheets of the construction drawing set must include a to-scale site plan of the pump station slab with all lot grading details and elevations. See Part 2.1 for elevation and drainage design criteria.

1.3.4 For County-run projects, shop drawings and related manufacturer's product certification must be made in accordance with the General and Special Conditions of the Contract for approval prior to construction, purchase or fabrication of the material by the manufacturer. Additional shop drawings may be required by the Contract, but the following items that will require shop drawings are brought to the Contractor's attention: For all other pump station projects, this list may be used by the Engineer of Record as guidance for the materials and products they should be reviewing and approving before purchase and installation.

- 1.3.4.1 Pump materials, performance curves, pump dimensions, motor winding diagram, and other related details.
- 1.3.4.2 Wet well submittals and related details.
- 1.3.4.3 Valve manufacturer, model numbers, materials, and fabrication details.
- 1.3.4.4 Certifications from pipe and fitting suppliers certifying the materials specifications. **Shop drawing submittals for items listed in Appendix B, the Approved Products List, and Appendix D, Pump Station Control and SCADA Requirements, do not require material certification**.
- 1.3.4.5 Restrained pipe joint details.
- 1.3.4.6 Backflow preventer, pressure gauge, air release valve, and pipe support details.
- 1.3.4.7 Coating specifications.
- 1.3.4.8 Independent laboratory certification of all stainless components.
- 1.3.4.9 Control cabinet shop drawings, cut sheets, and manufacturer’s literature on all control cabinet components.
- 1.3.4.10 Cut sheets and manufacturer’s information on service entrance disconnect, area light and other miscellaneous electrical equipment.

1.3.5 Operation and maintenance manuals and spare parts lists must be provided for each item of equipment. Maintenance manuals must include motor winding diagrams and pump dimensions. One complete hard bound set and one USB 3.0 flash drive (preferred) or CD/DVD are required.

1.3.6 Submit a copy of any design exception prior to installation. Design exceptions are issued by the Manager of the Utility Design Team. Any deviation from the specifications requires a design exception.

1.4 TOOLS AND SPARE PARTS

1.4.1 Tools and spare parts must be furnished as specified herein.

1.4.2 Spare parts must be marked with parts numbers and the equipment the spare parts are for. Spare parts must be packed in suitable containers also marked with the parts numbers and equipment for which intended.

1.4.3 Prior to final acceptance of the work, the Contractor must turn over to the County all specified spare parts. The Contractor must prepare a listing of all such spare parts and include a copy of the list in the operation and maintenance manuals.

1.4.4 Prior to final acceptance of the work, the Contractor must turn over to the County all special and/or proprietary hand tools necessary for the complete dismantling and maintenance of the pump and motor assembly.

1.4.5 Spare parts must be as specified in Part 2.8, 3.2, and 3.5.

1.5 AS-BUILT/RECORD DRAWINGS & ASSET DATA SPREADSHEETS

1.5.1 An **As-Built survey** must be furnished to the inspector at time of final inspection and must be made a part of the documents submitted to the County as part of the As-Built package. The survey must be the same as required for by a mortgage company, with all property corners staked and the survey indicating the location of improvements in relation to the lot lines with field measurements.

1.5.2 A set of as-built drawings must be maintained during construction showing any deviations from the original design drawings.

1.5.2.1 All changes and dimensions for structural, mechanical and electrical installations must, at the completion of the project, be transferred to a set of plans for a permanent set of record drawings.

1.5.2.2 Record drawings must comply with the requirements of the Public Utilities Technical Manual, Section 1 and Section 2.

1.5.3 Record drawings and Construction Feature information (Asset Data Spreadsheets) per the Hillsborough County Public Utilities Technical Manual Section 2.4 must be submitted to the County.

1.5.3.1 Each print of the record drawing set must be signed and sealed by a professional engineer registered in the State of Florida.

1.5.3.2 The electrical record drawings must be signed and sealed by an Electrical Engineer registered in the State of Florida who prepared or who provided responsible supervision, direction and control over the preparation of the record drawings.

1.5.3.3 Pumping station record drawings, including electrical sheets and the Construction Feature information (Asset Data Spreadsheets) must be submitted as part of the Utility Record Drawings. Final submittals must meet all the requirements of Section 2.4 of the Public Utilities Technical Manual.

1.6 RELATED WORK

- All Specifications of Division 03
- All Specifications of Division 33
- Hillsborough County Land Development Code
- Hillsborough County Transportation Technical Manual
- Hillsborough County Public Utilities Technical Manual
- Hillsborough County Utility Accommodation Guide

PART 2.0 DESIGN AND CONSTRUCTION STANDARDS

2.1 SITING REQUIREMENTS

2.1.1 Pump Stations must be sited to consider the potential for damage or interruption of operation because of flooding.

2.1.1.1 Pump station structures and electrical and mechanical equipment must be designed to be protected from physical damage by the 100-year flood.

2.1.1.2 Pump stations must be designed to remain fully operational and accessible during the 25-year flood unless lesser flood levels are appropriate based on local considerations, but not less than the 10-year flood. [62-604.400(2)(e), F.A.C.]

2.1.2 For **design purpose**s a master pump station is defined as serving three thousand (3,000) or more equivalent dwelling units (EDU).

2.1.2.1 The distance requirements from the master pump station (concrete pad) are **20 feet to the edge of the lot and 50 feet to any surrounding residential structures or building envelopes**.

2.1.2.2 The pump station pad must be set back a minimum of 30 feet from the Back of Curb (BOC). See also Specification 333006, Exhibit S-13A.

2.1.3 A master pump station is also required to have uninterrupted pumping capability. Hillsborough County requires an in-place, independently controlled, diesel-driven auxiliary pump.

2.1.4 For **design purposes** a neighborhood pump station is defined as serving less than 3,000 EDU.

2.1.4.1 Distance requirements for a neighborhood pump station are established as follows: The distance requirements from the pump station (concrete pad) are **20 feet to the rear or side residential or commercial lot line and 30 feet to any surrounding residential structures or building envelope**s.

2.1.4.2 Other accessory structures, such as swimming pools, must not be constructed within this thirty-foot distance.

2.1.4.3 The distance from the pump station to the front lot line must not be less than the front setback of the nearest adjacent lot.

2.1.4.4 The pump station pad must be set back a minimum of 30 feet from the Back of Curb (BOC). See Specification 333006, Exhibit S-13A.

2.1.4.5 Neighborhood pump stations have two subsets than have additional design requirements: Grinder and in-fill.

2.1.4.6 **Grinder and In-fill pump stations must be sited on an inside lot to a subdivision**.

2.1.5 The pumping station site layout sheets on the construction drawing set must include a to-scale site plan of the pump station slab with all lot grading details and elevations.

2.1.5.1 The slab elevation must be set based on adjacent lot pad elevations. In the absence of adjacent lot pads, the slab elevation must be set based on a minimum rise of 2% from the edge of pavement or minimum one foot above crown of road, whichever is greater.

2.1.5.2 Exceptions to the above siting criteria will be reviewed on a case-by-case basis.

2.1.5.3 All driveway and site drainage must be directed away from the station slab. Also, there must be no standing or ponding of water on the pump station site.

2.1.5.4 Any proposed landscaping around the pump station must be shown, in detail, on the site plan, and must be pre-approved by the WRD. The County does not maintain landscaping. Therefore, the Home-Owner Association or Community Development

District must coordinate access to enter the County property and accept-responsibility to maintain and landscaping prior to pump station acceptance.

2.1.5.5 No trees may be planted within 20 feet of the pump station access driveway or concrete slab.

2.2 HORIZONTAL SEPARATION

Wastewater gravity/force mains must be laid at least ten (10) feet horizontally from any existing or proposed potable water main. A three-foot horizontal separation must be maintained between a wastewater gravity/force main and all other pipelines. The distance must be measured face-to-face. In cases where it is not practical to maintain a ten-foot separation, a design exception must be obtained from the Utility Design Section Manager prior to construction.

2.3 CROSSINGS

2.3.1 Vertical separation between wastewater mains crossing other pipelines and utilities must be a minimum vertical distance of 18 inches between the outside of the other pipelines or utilities and the outside of the wastewater main. This must be the case where the other pipeline is either above or below the wastewater main.

2.3.2 Potable water main crossings below wastewater line(s) should be avoided whenever possible. If the potable water main must cross under a gravity sewer, the crossing must be arranged so that the wastewater main joints will be equidistant and as far as possible from the potable water main joints

2.3.3 If the above vertical separation is not possible, a design exception must be obtained from the Utility Design Section Manager.

2.4 FLOW

2.4.1 Wastewater pumping stations must be designed to accommodate the full development flow from all contributing areas at peak flow. No future flow is allowed for grinder pump stations serving up to 100 homes.

2.4.2 Flow estimates for design must be calculated based on full or projected ultimate development. The average daily flow (ADF) for single-family or master-metered residences must be the per unit demand factors contained in the most current Hillsborough County Utility Rate Resolution. Industrial and commercial design flows for sanitary wastewater must be no less than the values given in Table 1 of the County's Utility Rate Resolution.

2.4.3 Wastewater gravity collection systems, pumping stations, and force mains must be designed for average daily flow times the appropriate peaking factor. Refer to Section 4 of the Public Utilities Technical Manual for flow criteria and peaking factors.

2.5 TOTAL DYNAMIC HEAD (TDH)

2.5.1 Each pump must have the capability of pumping the design peak flow at the maximum computed Total Dynamic Head (TDH). The TDH Total Dynamic Head must not exceed 100 feet anywhere within the system without prior approval of the PUD Planning Team.

2.5.2 Pipe friction losses must be calculated using the *Hazen-Williams* formula and maximum values of *C* as follows: 120 for PVC and lined ductile iron pipe; 100 for unlined steel and unlined ductile iron pipe. Static heads must be calculated utilizing the low wet well water elevation for the lead pump.

2.6 SYSTEM HEAD VERSUS PUMP CAPACITY ANALYSIS

2.6.1 System head versus pump capacity curves must be prepared and analyzed to determine the system operating capability at the following conditions: Non-manifolded County Pumping Station
- 2.6.1.1 One pump running, if duplex pumping station.
- 2.6.1.2 One pump and two pumps running if triplex pumping stations, etc.
- 2.6.1.3 If force main profile results in a siphon condition, curves must show operation at start-up (to high point only) as well as full flow conditions.

2.6.2 Manifolded County Pumping Stations: All conditions outlined under Part 2.6.1 and the following additional conditions:
- 2.6.2.1 Simultaneous operation of all pumping stations on manifolded system.
- 2.6.2.2 Operation while all remaining stations are off.

2.6.3 Variable Speed County Pumping Stations: All applicable conditions under Parts 2.6.1 and 2.6.2, in addition to operating point, specifying RPM's at peak, average, and minimum flows.

2.6.4 Privately Owned Pumping Stations: The Developer must submit pump and system response curves for all private pump stations at the time of construction plan submittal.

2.7 ELECTRICAL CLASSIFICATION

2.7.1 Pumping stations must be designed to meet Class 1, Group D, Division 2 criteria. If the WRD determines there is a higher risk at an individual pumping station, it may require Class 1, Group D, Division 1 requirements be met and a placard must be provided identifying the facility as such.
- 2.7.1.1 NEC Articles 500 and 501 are applicable for wiring methods associated with these areas. Where the WRD determines that a pumping station is subject to Class 1, Group D, Division 1 requirements. NEC Article 504 is also applicable.

2.7.2 All wastewater pumping stations must have 480/277 volt, three-phase, four-wire, 60 hertz service.

2.7.3 The arc-flash classification must be determined by the Engineer of Record for each control panel, and each panel door must be labeled with the appropriate rating.

2.7.4 The electric load calculations, short circuit analysis, and a breaker coordination study must be done for each pump station and the information included on the electrical drawings.

2.8 PUMPS

2.8.1 Each pumping station must have a minimum of two pumps for peak flows of 1000 gallons per minute (GPM) or less. When the flow exceeds 1000 GPM then three or more pumps will be required. Standby pumping capability must be provided such that if any one pump is out of service the remaining pumps must be capable of pumping out estimated peak flows.

2.8.2 All pumps must be submersible type pumps located within the wet well.

2.8.3 The pumps must be of the type that can be removed without entering the wet well.

2.8.4 Front rail withdrawal systems must be required.

2.8.5 When a motor over-temperature condition occurs, an alarm will be activated within the SCADA system. The alarm will be indicated on the OPI and also reported back to the central SCADA system. The over-temperature alarm light must be a latching-type alarm and must remain latched until an alarm reset is initiated, either via local OPI or remotely via telemetry. However, the affected motor must be automatically restored to operation when the motor's bi-metallic thermal switch automatically resets after the motor temperature falls below the switch reset temperature.

2.8.6 A seal sensor module with integral alarm light must be furnished. When a seal failure occurs, an alarm will be activated within the SCADA system. The alarm will be indicated on the local OPI and also reported back to the central SCADA system. The affected pump must not be shut-off.

2.8.7 Spare Parts: The following spare parts and tools must be furnished for each pump:

2.8.7.1 For standard centrifugal pumps:

a) One set of ceramic stationary seal and rotating carbon seal.
b) Two sets of spare gaskets and O-rings including hydraulic sealing flange gasket
c) Manufacturer specified impeller pullers.
d) Manufacturer specified special wrenches needed for breakdown of pumps.

2.8.7.2 For grinder pump stations:

a) One set of mechanical seals.
b) Manufacturer specified impeller pullers.
c) Manufacturer specified wrenches for breakdown of pumps.

2.8.8 For peak flows up to 60 GPM, grinder pumps must be used. Peak flows over 60 GPM but less than 80 GPM will be reviewed on a case-by-case basis by the WRD Utility Planning Team. Design flows over 80 GPM require the use of non-clog pumps.

2.9 WET WELLS

2.9.1 Wet well design must provide sufficient capacity for a holding period of five minutes at the maximum rate of the largest pump.

2.9.2 The high-water alarm level should not exceed the invert elevation of the influent pipe. For drop inverts the high-water alarm level must not exceed the upper invert elevation.

2.9.3 Control elevations must be set so that the Low Water Level (all pumps off) will be at least three inches above the top of the pumps to ensure the pumps will remain submerged.

2.9.3.1 The top of the pump is defined as the highest point such as the housing or the electrical cable connector.

2.9.3.2 The distance between Low Water Level and the invert elevation(s) must be less than two feet. Otherwise, a drop connection is required.

2.9.4 The wet well should be designed to prevent vortexing, or air binding.

2.9.5 The wet well depth must not exceed 25 feet, from top of grade to the bottom of the wet well.

2.9.6 The wet well inside diameter must be a minimum of six feet. Neighborhood grinder pump stations must be limited to 6 feet in diameter.

2.9.7 The wet well floor must have a grout fillet with a minimum slope of one-to-one toward a hopper bottom with the horizontal area of the bottom being no greater than necessary for proper installation and function of the pump suction.

2.9.8 The wet well must be designed to have a floatation safety factor of no less than 1.15.

2.10 PIPING DESIGN

2.10.1 All discharge piping valves must be located above ground with a clear space above the pad between 24 and 30 inches.

2.10.2 Isolation valves must be installed on the above ground discharge header piping, at the pump station right-of -way, and at the point of connection to the County force main.

2.10.3 All piping and fittings must have a minimum design working pressure of 200 psi.

2.11 STATION ACCESS

2.11.1 The pump station must have a concrete-paved access driveway to the site from the street constructed per the requirements of the Hillsborough County Standard Drawings and Part 4.6.

2.11.2 The driveway minimum dimensions must be 15 feet wide, 30 feet long, and six inches thick for a standard Master or Neighborhood pump station. For an In-fill Pump Station the minimum dimensions must be 12 feet wide, 30 feet long, and six inches thick.

2.11.3 Driveways in excess of 30 feet may be approved for construction using the same material as the adjacent roadway. However, the last 30 feet to the pump station slab must be concrete construction.

2.11.4 The County reserves the right, based on field conditions and safety considerations, to require a concrete-paved turnaround when maintenance vehicles cannot safely stop on the roadway and back into a driveway. The County requires a neighborhood grinder pump station to be accessed from and inside residential road. Access must not be limited by a median. The County will consider proposed alternative driveway and site configurations, but safe ingress and egress or maintenance vehicles and crews, as well as safe conditions for residents, is of prime importance.

2.11.5 Layouts of a typical turnaround driveway can be found in Specification 333006, Exhibits S-14A and S-14B.

2.12 MAIN DISCONNECT

2.12.1 The main disconnect must be in a 316 SS (stainless steel) NEMA 4X enclosure with watertight hubs, a solid neutral assembly, and an equipment ground kit, suitable for use as service entrance equipment.

2.12.2 Circuit breaker must be of the thermal magnetic, molded case type with a minimum 25,000 ampere interrupting rating at the operating voltage and must be lockable in the off position.

2.12.3 The disconnect enclosure door must be lockable in the closed position.

2.13 PHASE PROTECTION

2.13.1 Motor starters must have 120V coils and block type manual reset overload relays.

2.13.2 The main, emergency generator, pump, and odor control circuit breakers must be of the thermal-magnetic, molded case type with a minimum 25,000 amperes interrupting rating at the operating voltage.

2.13.3 The main and emergency generator circuit breakers must be provided with a mechanical interlock to permit connection to either the utility service or the emergency generator receptacle, but not to both at the same time.

2.14 IN-FILL PUMP STATIONS

2.14.1 All the following must be met when designing to the in-fill pump station design criteria. If these criteria cannot be met, then the pump station must be designed as a standard grinder pump station.

2.14.2 The in-fill pump station is a small grinder pump station that serves 50 homes or less; and no additional wastewater flow may be introduced to the in-fill pump station system beyond the original subdivision's permitted flow.

2.14.3 An in-fill pump station is not allowed within a phased subdivision, and no commercial flow is allowed.

2.14.4 The pump station must be accessible from inside the subdivision. There must be sufficient area and pavement to allow for a service vehicle to be off the road and sidewalk while maintaining the station.

2.14.5 An in-fill pump station will be designed with a 6-foot wet well; the riser piping will be 316 stainless steel; and an auxiliary suction pipe is required.

2.14.6 The electrical connection/feed to an in-fill pump station must be 460-volt, 3-phase.

2.14.7 The driveway is to be 12 feet wide (min.). The fencing must be the standard wooden shadowbox design with the 14 feet wide entrance gates. The entrance gates must swing outward. See the Standard Pump Station Mechanical drawings for layout requirements.

2.14.8 The Driveway length will be 30 feet, a portion of which will be inside the gate/fencing.

2.14.9 The control panel will be a 48-inch wide panel utilizing a 4-float system. The SCADA will be handled utilizing the High Tide telemetry system. Breaker Coordination will be required by the Engineer of Record. See the Standard Pump Station Electrical drawings.

2.14.10 In-fill pump stations are considered a subset of a grinder pump station.

PART 3.0 PRODUCTS

3.1 WET WELL

3.1.1 The wet well must consist of a base cast monolithically or integrally with the bottom barrel section; vertical pipe barrel sections; and top slab.

3.1.2 Wet well base, barrel sections, and top slab must conform to the requirements of ASTM C478, *Specification for Precast Reinforced Concrete Manhole Sections* and ACI 350, *Code Requirements for Environmental Engineering Concrete Structures*.

3.1.2.1 Cement must meet the requirements of ASTM C150, *Specification for Portland Cement*, Type II.

3.1.2.2 The required 4000 psi minimum strength of the concrete must be confirmed by making and testing a minimum of four standard cylinders. The Manufacturer must submit all test results to the Engineer of Record.

3.1.2.3 The barrel sections must be custom-made with openings to meet indicated pipe alignment conditions and invert elevations. The Contractor must submit shop drawings, consisting of manufacturer's standard details of various sections, to the Engineer of Record for approval, before placing order for the wet well.

3.1.3 The base of the wet well must be cast monolithically or integrally with the bottom barrel section. The base must be set in a leveling course of crushed stone with the sub-base compacted to not less than 98% of maximum dry density as determined by the Modified Proctor Test ASTM D 1557.

3.1.4 Joint contact surfaces must be formed with mechanical castings. They must be exactly parallel with two-degree slope and nominal 1/16-inch clearance with the tongue equipped with a proper recess for the installation of an O-ring or wedge type gasket, conforming to ASTM C 443, *Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets*.

3.1.5 Wet Well Coating

3.1.5.1 The interior of the wet well must be protected with a pre-approved, corrosion-resistant coating as listed in Appendix B. The coating must cover the underside of the top slab, the sidewalls, and extend to half-way down the grout fillet (as a minimum the coating must extend one foot below the low water line). Rigid liners and cementitious coatings are not acceptable within the wet well.

3.1.5.2 The joint between the top slab and top barrel section must contain not less than one-half inch of grout and the entire joint section must be filled with grout to provide a watertight joint. The grouted joint must be coated on the interior.

3.1.5.3 Only coatings with applicators certified through factory training are acceptable. A well-defined surface preparation and application procedure produced by the manufacturer is required. All coating must come with a 10-year service guarantee.

3.1.6 A grout fillet around the bottom of the wet well, as specified in Part 2.9, must be 4,000 psi concrete, except the maximum aggregate size must be 3/8 inch. The fillet must be coated as specified in Part 3.1.5.

3.1.7 In order to permit the County to inspect for damage, the exterior surface of the wet well must not be coated.

3.1.8 The exterior of the wet well must be grouted and wrapped at the joints. Refer to the Standard Pump Station drawings for details.

3.1.9 A flexible wet well connector must be used to join pipes to the wet well barrel and must consist of an elastomeric connector compounded from a poly-isoprene blend material meeting the requirements of ASTM C923, *Specification for Resilient Connectors between Concrete Manhole Structures, Pipes, and Laterals*.

3.1.9.1 The connectors must be installed by the wet well supplier.

3.1.9.2 Connector components for new connections to an existing wet well must be flexible connectors.

3.1.10 Any drop inlet piping assembly for the wet well must be of ANSI/AWWA C900 PVC pipe and fittings as shown in the Standard Pump Station drawings.

3.2 DISCHARGE PIPING AND APPURTENANCES

3.2.1 All welded components within the wet well must be fabricated of 316L stainless steel.

3.2.2 All four-inch and larger pump discharge piping and fittings above the low-water level and within the wet well, must be Class 125, flanged, 316L stainless steel, per ANSI/AWWA C220, up to the first exterior joint.

3.2.2.1 Pump discharge piping and fittings above the low water level and within the wet well must be seamless 316L Schedule 40, per ANSI/AWWA C220, for four- and six-inch discharge pipe. For sizes greater than six inches, seamless 316L Schedule 10 piping may be used.

3.2.2.2 Fully submerged piping and fittings between the pump discharge and low water level must be either the specified ductile iron, or the specified 316L stainless steel.

3.2.2.3 Exterior, above ground, discharge piping and fittings must be flanged DIP with a factory-applied protective ceramic epoxy interior coating. Flanged joints must include a flat-face elastomeric gasket. Above ground DIP and fittings must be painted. See Appendix B for a listing of pre- approved exterior coatings for the piping.

3.2.2.4 Flanged DIP must meet the requirements of AWWA/ANSI C115/A21.15. The pipe barrel itself must conform to the requirements of ANSI/AWWA C151/A21.51 CL 53.

3.2.2.5 DI fittings must meet or exceed the requirements found in ANSI/AWWA C153/A21.53 and contain a pre-approved, factory-applied, protective, interior ceramic epoxy coating. A listing of pre-approved DIP fittings and coatings can be found Appendix B.

3.2.3 Pump discharge piping and fittings less than four inches in diameter, must be Class 125, flanged, 316L, Schedule 40, stainless steel per ANSI/AWWA C220. A quick disconnect, flanged coupling must be installed on discharge piping and located within reach of the top hatch opening.

3.2.4 Discharge piping in the wet well must be supported at mid-length with a 316L stainless steel bracket fashioned and fastened to the wet well wall, as shown in the Standard Mechanical Drawings.

3.2.5 Valves

3.2.5.1 All valves must be the manufacturer's standard design for the service intended and must be cast with the manufacturer's name and pressure rating on the body and, if applicable, the valve type, size, and a flow direction arrow.

3.2.5.2 Valves must open left (counterclockwise) with an opening directional arrow cast in the metal of the operating hand wheel or operating nut.

3.2.5.3 Only valve types listed are acceptable for use in Hillsborough County. See Appendix B for a listing of pre-approved valves.

3.2.5.4 Plug Valves

a) Plug valves must be fully bidirectional and meet the requirements of ANSI/AWWA C517 and ANSI/AWWA C550.
b) For valves 12 inches and smaller in diameter the valve port area must be a minimum of 80 percent of the full pipe area. Valves larger than 12 inches in diameter must be 100% full port.
c) All plug valves must have mechanical joint ends and must be furnished complete with joint accessories.
d) All plug valves must be coated prior to assembly of the valve with an epoxy coating not less than 10 mils thick applied to both the exterior and the interior surfaces.

3.2.5.5 Gate Valves

a) Gate valves must only be used for above ground service.
b) Gate valves must be of the resilient seat type meeting the requirements of ANSI/AWWA C509 or ANSI/AWWA C515, with an internal coating meeting the requirements of ANSI/AWWA C550.
c) All gate valves must be coated prior to assembly of the valve with an epoxy coating not less than 10 mils thick applied to both the exterior and the interior surfaces. The valves must be non-rising stem (NRS), flanged joint type, must be furnished with a hand wheel, and must open when turned counterclockwise.
d) Valve hardware must be 304 stainless steel.

3.2.5.6 Check Valves

a) Valves must be suitable for horizontal installation.
b) Check valve minimum working pressure must be 175 psi for valves with diameters of two through 12 inches; and, 150 psi minimum working pressure for valves 14 through 24 inches in diameter.
c) Check valves must permit full flow area equal to that of the connecting pipe.
d) Valve ends must be flanged for above ground installation.
e) Check valves must conform to ANSI/AWWA C508 and must be iron body, swing non-slam type, and equipped with removable inspection covers. See Appendix B for a listing of pre-approved check valves.
f) Check valves four inches and larger in diameter must be equipped with an external backflow actuator & mechanical indicator (preferred); or an outside lever and adjustable weight (OLW).
g) OLW valve designs 12-inch and less must be metal to metal seat (bronze to bronze). OLW Valves 14-inch and greater than 12 inches in diameter must incorporate a rubber-faced bronze clapper disc seated by a bronze clapper arm against a bronze seat ring (resilient to metal). The clapper arm must be secured to a stainless hinge pin which turns in bronze bushings. The bushings must be provided with O-ring seals.
h) All check valves must be coated prior to assembly of the valve with an epoxy coating not less than 10 mils thick applied to both the exterior and the interior surfaces.

3.2.5.7 Metal Ball Valves

a) Ball valves must be non-lubricated, free-floating ball type. See Appendix B for a listing of pre-approved metal ball valves.
b) Port areas must be full-bore (free area through valve must not be less than the inside area of a pipe of the nominal valve size).
c) Bodies must be precision-machined, type 316, stainless steel meeting ASTM A351,

type CF8M, suitable for a minimum 1000 (WOG) psi water working pressure. The ball and stem must also be precision-machined, Type 316, stainless steel.

d) Valves must be capable of seating in both directions. Seats must be reinforced Teflon.
e) Valves must also contain a machined lip in the body cavity in order to provide a failsafe secondary metal seat.
f) Valves must use upstream line pressure for effectively seating the valve.
g) Valves must have a blowout-proof stem. Stem packing must be manually adjustable under pressure.
h) Ball valves must conform to API 598, have 300 series stainless steel handle, nuts, and washers. They must have a vinyl handle grip, lockable handle, and be vacuum rated to 29 inches of mercury.
i) Discharge piping gauge port isolation ball valves and ARV isolation ball valves must have FIP-threaded inlets and outlets, threaded in accordance with ANSI B1.20.1.
j) Grinder pump station discharge piping isolation ball valves must be ANSI Class 150, flanged, and must have a static grounded ball and stem.

3.2.6 The guide rail, guide rail brackets, cable holder, lifting bale, support, and associated hardware must be 316L stainless steel.

3.2.7 Front rail withdrawal system must be required.

3.2.7.1 Guide rails must at a minimum be fabricated from two-inch diameter pipe. Guide rails for grinder pumps must at a minimum be 3/4-inch diameter pipe.

3.2.7.2 The pump guide rails will be supported by 316L stainless steel brackets.

a) When guide rails exceed 20 feet in length, intermediate guide rail brackets must be located at mid-length of guide rail.
b) Guide rail bracket bolt holes must be slotted to enable alignment.

3.2.8 All suspension hooks for control cables, lift cables, and lift cable rings must be 316L stainless steel.

3.2.8.1 The minimum inner diameter of the suspension hooks must be 1-3/4 inch.

3.2.8.2 Minimum lift cable diameter must be 3/8-inch with four-inch diameter 316L lift rings located every five feet.

3.2.9 Access hatches must be a minimum of 24-inch by 36-inch single leaf for grinder duplex stations; 36-inch by 48-inch with double doors for the standard non-clog duplex station; and 40-inch by 78-inch with triple doors for the triplex station.

3.2.9.1 If Hydromatic S4T or S4B pumps are used in a duplex station, the hatch must be a minimum of 44-inch by 64–inch with double doors, and the wet well diameter must be no less than 8 feet.

3.2.9.2 Hatches must be so sized that pump passing through hatch opening must have a minimum of one-inch clearance between the back of the pump volute and the door. The front hatch frame must have a minimum eight-inch clearance from the front of the pump volute.

3.2.9.3 The doors and frames are to be made of aluminum, have a minimum 300 PSF load rating, be suitable for easy removal and replacement of the pumps, hinged on the discharge piping side, and be capable of being secured in the open position. All hatch hardware must be stainless steel.

3.2.9.4 Pre-approved hatches are listed in Appendix B.

3.2.10 Spare Parts: The following items must be furnished with each station: one stainless steel, silicone-filled pressure gauge and diaphragm seal unit; and one spare check valve flapper (as needed, include

a separate flapper bolt and hinge pin). These items must be furnished with each station.

3.3 WASTEWATER PUMPS

3.3.1 Pumps and motors must meet the applicable discharge, head, horsepower, and RPM requirements. Soft starts must be installed on all motors with Size 3 starters and larger. Variable Frequency Drives (VFDs) must be installed for all motors 75 hp and larger. Refer to Appendix D for required soft starts and VFDs.

3.3.2 Pumps and motors must be capable of continuous operation without damage, submerged or dry.

3.3.3 All lifting bails for wastewater pumps must be provided by manufacturer for size of pump installed.
- 3.3.3.1 Eight (8) inches clearance in height between the lifting bails and the top of the pump motor conduit box must be provided.
- 3.3.3.2 The lifting bail must be attached securely to the pump at two (2) points of connection and in such a way that the weight of the pump is evenly distributed and will not cause the carrier assembly to cock and bind on the guide rails.

3.3.4 Pump motors must be oil or glycol cooled.
- 3.3.4.1 Air filled motors will not be accepted.
- 3.3.4.2 The motors must be NEMA Design B, 230/480 volt, 3-phase, 60 hertz, with a service factor of 1.15.
- 3.3.4.3 Motor must have Class "F"-155 C insulation or better and certified as such by the vendor.
- 3.3.4.4 The service factor of the motor must not be used to achieve the operating performance of the pump.
- 3.3.4.5 Additionally, the rated horsepower of the motor listed in the motor nameplate data must not include horsepower available from the service factor rating of the motor.
- 3.3.4.6 Motor must be non-overloading over the full range of its operating curve.
- 3.3.4.7 Over-temperature conditions of the motor stator windings must be sensed by two bi-metallic thermal switches contained in the motor.
  - a) The leads for these switches must be brought out through a waterproof connection such that the switches may be connected into the motor control circuit shown in the Electrical Drawings.
  - b) The motor's bi-metallic thermal switch must automatically reset after the motor temperature falls below the switch reset temperature
- 3.3.4.8 Motors used with variable frequency drive units must be inverter-duty rated per NEMA MG 1.

3.3.5 Each pump must have a stainless nameplate indicating the hp, amps, volts, phase, rpm, service factor, insulation Class, serial number, model number, gpm, TDH, and impeller number or size. A self-adhesive aluminum tag containing the same information as the stainless nameplate must be mounted inside the outer door of the control cabinet for each pump installed.

3.3.6 Standard centrifugal non-clog pumps must be capable of handling raw, unscreened sewage.
- 3.3.6.1 They must have a cast iron impeller.
- 3.3.6.2 All openings and passages must be large enough to permit the passage of three-inch diameter spheres.
- 3.3.6.3 The pumps must be of the non-clog type, must have double carbon/ceramic mechanical seals, and must be oil lubricated.
- 3.3.6.4 A seal failure in the pump must be sensed by two moisture sensors contained in the oil

chamber of the pump. The leads for these sensors must be brought out through a waterproof connection such that the sensors may be connected to the sensor module located in the control cabinet.

3.3.6.5 The pumps must be as specified by PUD. Pre-approved pumps manufacturers are listed in Appendix B.

3.3.6.6 A separate mounting plate must be furnished for each standard centrifugal non-clog pump.

3.3.6.7 For standard centrifugal non-clog pumps sized six inches and less, the discharge of the pump must be fitted with a diaphragm-type hydraulically operated sealing flange.

a) The complete weight of the pump must rest on the discharge elbow.
b) When pump is idle, pressure must be removed from diaphragm so that pump can be removed from sump with no mechanical contact of sealing flanges
c) Sealing diaphragm must be removable and must be mounted on pump discharge flange.
d) Diaphragm material must be Buna N rubber.

3.3.7 Grinder Pumps must be capable of handling raw, unscreened sewage.

3.3.7.1 They must have a cast iron, brass or stainless impeller.

3.3.7.2 The pumps must be grinder pumps with double mechanical seals.

3.3.7.3 An oil or glycol filled chamber must be provided between the pump and the motor.

3.3.7.4 The pumps must be as specified by WRD. Pre-approved pump manufacturers are listed in Appendix B.

3.4 POTABLE WATER SERVICES

3.4.1 In addition to valves and fittings, the water service assemblies within the pump station must contain a service meter, and a reduced-pressure principle backflow preventer. This service is considered a commercial connection and must be a two-inch connection with a two-inch gate valve at the point of connection. If the point of connection is a far-side connection to the pump station, an additional near-side two-inch gate valve must be installed in a safe and accessible location at the pump station right of way line.

3.4.2 The water service assembly must be provided as indicated in the Standard Pump Station Drawings. The assembly must be located as indicated on the Drawings.

3.4.3 A two-inch service line must be run in a three-inch casing under the pump station slab. The casing must start two feet outside the pump station slab and run to the faucet assembly. The service line from the isolation valve to the pump station must be two inches up through the locking ball valve on the water assembly.

3.5 PUMPING STATION CONTROLS

3.5.1 Pump station controls must be as specified herein and on the Hillsborough County Standard Pump Station Mechanical and Electrical Drawings found on the Hillsborough County website. Every attempt is made to ensure consistency between the County drawings and these specifications. From time-to-time, inconsistencies occur and it is incumbent on the Engineer of Record to resolve those inconsistencies by contacting and working with the WRD. These specifications may provide additional requirements not found on the County drawings.

3.5.2 Typically, the wet well and, as applicable, the odor control unit, are classified as Class I, Group D,

Division 2, electrically hazardous locations.

3.5.2.1 NEC Articles 500 and 501 are applicable for wiring methods associated with these areas.

3.5.2.2 WRD may determine that a particular pumping station meets Class 1, Group D, Division 1 requirements.

a) NEC Article 504 is also applicable if a pumping station is electrically classified as a Division 1 location.

b) A Division 1 design requires the float leads be installed as intrinsically safe (versus 24-volt) circuits, and a placard must be installed to alert operators of the Division 1 classification.

3.5.3 All standard pumping stations must have flow monitoring and recording equipment that must be incorporated into the SCADA control system. When variable frequency drives (VFD) are installed, additional appurtenances are required to install an inline flow meter.

3.5.4 Pump Control Panel (ME)

3.5.4.1 The Pump Control Panel (ME) must be wired by a UL listed shop, constructed in conformance to UL standards and must have a UL and NEMA rating label permanently attached to the panel by the supplier.

3.5.4.2 Outside feet or tabs must be provided for mounting the control panel.

a) Drilling of the control panel after fabrication for any purpose will not be allowed.

b) Control panel must be mounted on supports as shown on the Construction Drawings.

3.5.4.3 The top of the control panel must not be greater than six feet from the top of the finished concrete slab.

3.5.4.4 The outside of the panel doors must be labeled with the appropriate Arc-Flash classification.

3.5.4.5 The control panel must be of NEMA 4X weatherproof. The panel must have white powder coated sunshields installed on the sides, top, and front panels.

3.5.4.6 Panel must be fabricated out of 304L, white powder coated, stainless with a minimum thickness of 14 gauge.

3.5.4.7 All hardware on panel, door holdouts, chains, and handles must be 304 stainless.

3.5.4.8 The back-panel must be fabricated of copper-free (less than 0.3% copper) aluminum and must be at least 1/4 inch thick.

3.5.4.9 The dead front inner doors must be a high-quality aluminum with a minimum of .125 thickness, must be powder coat Iron Gray Texture (HBT2-C0009-C50), all holes must be in accordance with UL 508A to maintain proper fitting of devices, i.e., notches to prevent turning. All components exposed for access must have symmetrical cut outs with clean and deburred edges. All circuit breakers, control switches, indicator lights and other control devices must be identified permanently with etched engraving on the dead front cover of the control panel. The door must have a continuous 304 stainless steel piano type hinge with two twist type latches. Indicator lights must be color coded in accordance with NFPA 79.

3.5.4.10 The outer doors must have a three-point latch mechanism with roller bar and heavy-duty lockable handle to accommodate a Master #21 padlock. Both doors must be able to be held in the open position at 90 degrees (minimum) with mechanical latches.

3.5.4.11 A door pocket must be mounted at the center near the bottom, on the inside surface of the outer door. The door pocket must be fabricated of stainless steel and must be tack welded in place, size as shown in the Drawings.

3.5.4.12 Aluminum nameplates must be mounted inside the outer door of the control panel.

3.5.4.13 The control panel electrical schematic must be permanently affixed to the center top of

the inside of the outer door. The schematic must be laminated to prevent removal and discoloration from heat, gasses, and ultraviolet light.

3.5.4.14 Outer door handle must be heavy duty, 304 stainless steel with stainless bolts, nuts, and accessories.

3.5.4.15 The panel must be designed so that the control side is isolated from the power components.

3.5.4.16 Except for in-fill grinder pump stations (50 homes or less), control panels must be sized such that the RTU is incorporated into the panel.

3.5.4.17 Panel must be sized to provide adequate internal working clearances and wire bending radii per NFPA 70 and NFPA 79.

3.5.4.18 Wiring

a) All wiring must be bundled and run open or enclosed in vented plastic wireways. Vented Plastic wiring troughs must be used for routing internal control wiring.
b) All conductors run open must be bundled with nylon cable ties and bound at regular intervals not exceeding 12 inches.
c) Care must be taken to separate electronic analog signals, discrete signals, and power wiring. A copper ground bus must be installed in each panel.
d) Interior panel wiring and field wiring must be tagged at all terminations with machine-printed plastic sleeves which fully encircle the conductor. The wire number must be the ID number listed in the County drawing input/output schedules.
e) Phase, neutral, and equipment ground conductors must be color coded per the requirements of NEC/NFPA 70. 120-volt control wiring must be color coded differently than 24-volt control wiring. Intrinsically safe control wiring must be color coded light blue. Colored tape may be used for conductors sized AWG #8 and larger. All control wiring must have color coded insulation. Refer to Part 4.5 for wire color codes.

3.5.4.19 Stainless steel that is welded during fabrication must be low carbon, Type L.

3.5.4.20 The panels must be constructed so that no screws or bolt heads are visible when viewed from the front. Punch cut-outs for instruments and other devices must be cut, punched, or drilled and smoothly finished with rouged (polished) edges. No holes must be drilled in the top of the panel.

3.5.4.21 A means of detecting a high temperature condition inside the enclosure must be provided. A high temperature condition must be reported to, and recorded by the PLC.

3.5.4.22 Enclosures must be furnished with integral grounded RFI (radio frequency interference) shielding.

3.5.4.23 Power supplies must be rated at 200% of the calculated load.

3.5.4.24 Terminal Blocks

a) Terminal blocks must be factory assembled on a mounting channel and the channel bolted to the subpanel (back-plate). Terminals must be miniature screw type unless otherwise required and must be rated at least 600 volts, 20A.
b) Terminals must be marked vertically with a permanent, continuous marking strip from top to bottom. One side of each terminal strip must be reserved exclusively for field incoming conductors. Common connections and jumpers required for internal wiring must not be made on the field side of the terminal. Subject to the approval of the County, a vendor's pre-engineered and prefabricated wiring termination system may be acceptable.

3.5.4.25 Momentary contact push buttons required for the control panel must each have one normally open contact and one normally closed contact.

3.5.4.26 Provide an adequate service loop from the dead-front swing-out panel to control panel.

Protect the wire bundle from crimping or binding during door movement. Secure the service loop at both ends.

3.5.5 Junction Box (JB1): The junction box must be mounted on supports as shown on the Standard Pump Station Drawings. JB1 must be mounted with sufficient clearance to allow complete opening (180 degrees) of the door without contact with adjacent items.

3.5.5.1 Junction box JB1 must be a heavy duty NEMA 4X enclosure constructed of 304L, white powder coated, stainless steel.

3.5.5.2 Junction box must be sized to permit at least three inches of space between terminal strips, four inches between conduits entering the box bottom and the terminal strips, and three inches between the terminal strips and sides of the box.

3.5.5.3 Enclosure door must be gasketed and must have a stainless continuous (piano type) hinge. The hinge must be along the left side.

3.5.5.4 The door must be equipped with stainless steel door three-point latching mechanism to ensure a watertight seal and a heavy-duty lockable handle to accommodate a Master #21 padlock

3.5.5.5 The back-panel must be fabricated of .10-inch thick aluminum.

3.5.5.6 Enclosure must have watertight bushings and hubs at all outlets.

3.5.6 Local Alarm Assembly

3.5.6.1 The local alarm assembly includes an alarm horn, strobe light, and silence station pushbutton and enclosure (JB-3), all installed as shown on the Standard Electrical and Mechanical Drawings.

3.5.6.2 The alarm horn and strobe light must be located inside the pump station and mounted to a post on the electrical equipment rack.

3.5.6.3 The alarm silence station pushbutton (JB-3) must be located outside the security fence, mounted to the wood fence or a separate post.

3.5.6.4 A small aluminum or stainless sign must be provided near JB3 indicating the silence button operation and providing the WRD number to call for emergencies.

3.5.7 Transient Voltage Surge Suppressors: A transient voltage surge suppressor must be connected to the load side of the main circuit breaker with leads as short and straight as possible. The transient voltage surge suppressor must be mounted external to the control panel, on the side, near the top of the enclosure. Supplied TVSS units must meet or exceed UL 1449 requirements for transient voltage surge suppression

3.5.8 Spare Parts: Provide four spare fuses for each size and type used in the control panel. Provide one spare control relay per panel for each coil voltage (24V and 120V) and type (DC and AC). Provide one spare intrinsically safe isolator for any pumping station electrically classified as Class I, Group D, Division 1.

3.6 REMOTE TELEMETRY UNIT

3.6.1 Remote Telemetry Unit (RTU) definition and scope: The term RTU must generally refer to elements within the low-voltage side of Control Panel ME and associated, supplementary elements outside Control Panel ME. The RTU must be microprocessor-based, utilizing an on-site, user Programmable Logic Controller (PLC) to collect, process, and distribute information necessary to control and monitor the pump station. The PLC must freely interact with and through the County's cellular data network-based SCADA communications system, allowing for both the transmission and reception of acquired data and control commands. Other RTU elements include but are not

limited to: I/O devices and modules, wiring, surge protection, power supplies, fuses, cellular modems, antenna, connecting cables, and necessary interface and interconnecting devices. See the Standard Pump Station Electrical drawings on the Hillsborough County website for approved components.

3.6.2 Remote Telemetry Units (RTU's) for in-fill grinder pump stations, must comply with the Hillsborough County Standard Pump Station Electrical drawings.

3.6.2.1 The selected RTU for the in-fill grinder pump stations is a HighTide unit per the standard electrical drawings.

3.6.2.2 The selected controller is a MPE, Duplex Controller.

3.6.3 Programmable Logic Controller

3.6.3.1 Each PLC central processing unit (CPU) must be of solid-state design, (chassis wired logic is not acceptable), and the processor, backplane and I/O cards must be conformal coated such that it is capable of operating in a hostile industrial environment (i.e., subject to heat, electrical transients, RFI, vibration, H2S, etc.) without fans, air conditioning, or electrical filtering (up to 60 degrees C and 95 percent humidity, non-condensing).

3.6.3.2 The PLC must have non-volatile memory for program storage. Memory backed up by battery does not meet this requirement.

3.6.3.3 Although requests for logged data may be issued in shorter intervals, the unit may be required to regularly log site data, including all station events, alarms and all analog data, at a sampling rate of once every 60 seconds, for intervals up to 12 hours.

3.6.3.4 In the event of communication failure with the County network, the PLC must be capable of continuous data logging for a period of time of no less than 24 hours. Once communication is re-established, the logged data must be uploaded to the network. NOTE: The PLC analog data logging routine need only accommodate changing field values, i.e., an analog value must not be time-stamped and recorded unless the value differs from the previous value recorded or a preset refresh timer expires (default expiration/reset period = 10 minutes).

3.6.3.5 Each programmable controller must be capable of being programmed in a simple "ladder diagram" language, Sequential Functional Chart (SFC).

3.6.3.6 It must be easily reprogrammed locally with a portable lap top computer or from a remote location via the SCADA wireless network.

3.6.3.7 The PLC programming software must be MS Windows based and must be IEC 61131-3 compliant.

3.6.3.8 Data Communication: As a minimum, each programmable logic controller must be equipped with, or have access via linked backplane to, the following communication options:

a) One industrial standard, IEEE 802.3, 100 BaseT Ethernet communication port (RJ-45)
b) One software selectable RS-232/RS-485 serial port
c) One Mini B USB programming port

3.6.3.9 Communication protocol must be Modbus & TCP/IP.

3.6.3.10 All I/O modules must be isolated and conform to IEEE Surge Withstand Standards and NEMA Noise Immunity Standards.

3.6.3.11 There must be two station formats: constant speed and variable frequency.

3.6.3.12 Constant speed must support the following I/O count, at a minimum:

a) 8 analog inputs, 4-20 mA
b) 32 discrete inputs

c) 16 discrete outputs

3.6.3.13 Variable frequency must support the following I/O count, at a minimum:
a) 16 analog inputs, 4-20 mA
b) 32 discrete inputs
c) 16 discrete outputs
d) 4 analog outputs, 4-20 mA

3.6.3.14 Each PLC location must contain the I/O modules required to provide all of the I/O points, plus required spare. Circuit components for both remote input and output must be mounted on plug-in passive backplanes and keyed to prevent incorrect module insertion. All spare I/O must be wired from the PLC card to spare terminal for future use.

3.6.3.15 Discrete Input Modules: Defined as contact closure inputs from devices external to the programmable controller module. Individual inputs must be optically isolated from low energy common mode transients to 1500 volts peak from users wiring or other I/O Modules. The modules must have LED's to indicate status of each discrete input. Input signal level must be 24VDC. The input module must have a maximum of 16 points each.

3.6.3.16 Discrete Output Modules: Defined as contact closure outputs for ON/OFF operation of devices external to the programmable controller module. The output modules must be optically isolated from inductively generated, normal mode and low energy, common mode transients to 1500 volts peak. All output modules must have LED's to indicate status of each output point. Output contact rating must be 0.5A minimum per channel, 24VDC.

3.6.3.17 Analog Input Modules: Defined as 4 to 20 mA DC signals, where an analog to digital conversion is performed with a minimum of 16-bit precision and the digital result is entered into the processor. The analog to digital conversion must be updated with each scan of the processor. Analog input modules must have eight differential inputs each. Input modules must be source or sink to handle two-wire or four-wire transmitters respectively. The Contractor must provide current loop isolators as required to break ground loops.

3.6.3.18 Analog Output Modules: Defined as 4 to 20 mA DC signals, where a digital to analog conversion is performed with a minimum of 16-bit precision and the analog result is output from the I/O module. The digital to analog conversion must be updated with each scan of the processor. Analog output modules must have four outputs each.

3.6.4 PLC Power Supply: The PLC must operate in compliance with an electrical service of 120 VAC, single phase, in the frequency range from 47 to 63 Hz.

3.6.4.1 Power supply must be by the same manufacturer as the PLC and must be of the same product line. A single main power supply must have the capability of supplying power to the CPU and local input/output modules.

3.6.4.2 The power supply must provide surge protection, isolation, and outage carry-over up to two cycles of the AC line.

3.6.4.3 Design features of the PLC power supply must include diagnostic indicators mounted in a position to be easily viewed by the user.

3.6.4.4 The power supply must have fuse protection.

3.6.5 RTU Communications: Bi-directional communication of status, commands and cellular modem diagnostic between the RTU's and the County network must be provided by the RTU communications interface subsystem.

3.6.5.1 RTU communications must be via direct Ethernet connection between the Ethernet-ready cellular modem and an integral PLC Ethernet port. It must be possible to re-assign a

unique IP address to each RTU via the wireless communication network. The addressing scheme must allow a minimum of 255 RTU's for each network ID. Each cellular modem must be equipped with an integral RJ-45 Ethernet port. The communication protocol for the cellular modems must be Modbus/TCP.

3.6.5.2 RTU wireless communications link with the County network must support programming of the PLC over the wireless medium.

3.6.6 RTU Cellular System: Licensed, IP-addressable cellular modems capable of communicating to the County's existing network must be the primary component of the RTU cellular communication system. The cellular system must be capable of supporting the communication functions supplied by the PLC Modbus/TCP block. This must include support for:

3.6.6.1 Polling sequences as a primary means of communication: County network to field RTU. All polling timers must be operator adjustable.

3.6.6.2 Unsolicited messages by all RTU nodes from any RTU node

3.6.6.3 A non-deterministic communication environment (i.e., collision detection and avoidance)

3.6.6.4 Unique operator adjustable retry setpoints, timers and alarms in the event of communication loss for each RTU node.

3.6.7 Antenna: The Contractor must supply a cellular antenna mounted on the panel for all sites. See Standard Pump Station Electrical Drawings for approved antenna.

3.6.8 RTU Uninterruptable Power Supply (UPS): RTU must be supported by true on-line UPS units with alarm outputs to the RTU. The UPS must be of sufficient capacity to provide required DC power to the RTU equipment, discrete and analog input/output circuitry (under full load), communications interface equipment, RF modems, cellular router, and other interface/conditioning equipment and appurtenances, as required. UPS batteries must be sized to provide a minimum of 10 minutes of reserve power for typical load, less cooling equipment, in the event of AC (line) power loss. See Standard Pump Station Electrical Drawings for approved RTU.

3.6.9 Electrical Transient Protection

3.6.9.1 All electrical and electronic elements, including those in the communications subsystem, must be protected against damage by electrical transients induced or otherwise created by lightning discharges, nearby electrical systems, and other sources.

3.6.9.2 Supplied TVSS units must meet or exceed UL 1449 requirements for transient voltage surge suppression and must be installed as shown the Standard Pump Station Electrical Drawings.

3.7 CONDUIT SYSTEMS

3.7.1 Rigid Metallic Conduit

3.7.1.1 Unless otherwise noted on the Construction Drawings or in this document, all conduit and fitting installations must be rigid aluminum.

3.7.1.2 Waterproof fittings and hubs must be installed at all equipment interfaces.

3.7.1.3 Intermediate metal conduit (IMC) and electrical metallic tubing (EMT) are not acceptable.

3.7.2 Transition from the above-grade rigid metallic conduit, which includes the first 90° elbow, to the below grade nonmetallic conduit must be accomplished with a threaded adapter. All aluminum surfaces coming into direct contact with concrete must be coated/protected at the point of contact

to prevent corrosion.

3.7.3 Rigid Nonmetallic Conduit

3.7.3.1 Extra heavy duty (Schedule 80) PVC conduit must be used for below grade conduit installations

3.7.3.2 The conduit between JB1 and the wet well must be installed below the concrete slab as shown on the Construction Drawings.

3.7.3.3 Transition from the above-grade rigid metallic conduit, which includes the first 90° elbow, to the below grade nonmetallic conduit must be accomplished with a threaded adapter.

3.7.3.4 Extra heavy duty (Schedule 80) PVC conduit must be used for routing grounding electrode conductors from below to above grade.

3.7.3.5 All anchoring hardware must be 316 stainless steel.

3.7.4 All conduits must be arranged to present a neat mechanical appearance. All bends must be "long radius" to facilitate cable installation and removal. The wires for each pump must be in a separate conduit utilizing 3-foot radius sweeps (min). The wires for the level transducer lead must be in a separate conduit, where available, otherwise they must be run in the same conduit as the floats.

3.7.5 Provide conduit seals for those sections of conduit indicated on the Construction Drawings.

3.7.6 Sealing compound must be installed after successfully completing the final testing per WRD direction.

3.7.7 Provide duct seal in the end of the conduits at the wet well and in conduits entering JB1 from the wet well to minimize the passage of moisture and gases through the conduit.

3.8 WIRING SYSTEMS

3.8.1 All power and control wiring must be 600V rated THHN/THWN-2 stranded copper and sized per NEC.

3.8.2 All control wiring must be numbered at each end for identification.

3.8.2.1 Analog wire size must be AWG #16. Analog wire must be shielded, and when wired the shield must be grounded only at the device side.

3.8.2.2 Discreet and 120V wiring must be AWG#12 (minimum).

3.8.2.3 All wiring must be installed on the surface of the subpanel and routed in plastic raceways.

3.8.2.4 Numbering of wires must be from the meter box through the field side of the terminal strip in the junction boxes.

3.8.2.5 VFD Ethernet cables must be CAT 6 shielded cables from the VFD to the managed switch.

3.8.3 The pump motor power and control cable between JB1 and the submersible pumps must be the pump manufacturer's standard cable suitable for extra hard duty usage in wet locations. Cable installations must be suitable for disconnect and removal when the pump is removed and reinstalled.

3.9 PUMP DISCHARGE TAPS AND PRESSURE MEASURING SYSTEMS

3.9.1 Taps must be installed on each pump discharge line near the inlet of the check valve and on the line

from the discharge header. Each of these taps must include a two-inch long 1/2-inch stainless steel nipple and a lockable stainless ball valve with stainless steel ball. For the pressure transmitter, the Contractor must tap the discharge pipe boss (per NAPF installation standards) or furnish and install a Protecto 401 (ceramic epoxy) coated pre-tapped spool piece. Final location of tapping point must be coordinated with the County.

3.9.2 Diaphragm Seals for Pressure Measuring Systems: A diaphragm seal must attach to the inlet connection of a pressure instrument to isolate its measuring element from the process fluid.

3.9.2.1 Displacement of the liquid fill in the pressure element through the movement of the diaphragm must transmit process pressure changes directly to the gauge, transmitter, switch or any other pressure instrument.

3.9.2.2 Diaphragm seals must consist of a removable bottom housing; lower ring; diaphragm capsule; fill screw; flushing connection; and, a top housing.

3.9.2.3 The space between the diaphragm and the instrument pressure element must be solidly filled with a suitable liquid.

3.9.2.4 All exposed surfaces, the housing, and the diaphragm must be constructed of 316 stainless steel.

3.9.3 One interchangeable pressure gauge attached to a diaphragm seal must be supplied. See Appendix B for a list of pre-approved pressure gauges.

3.9.4 Electronic Transmitters: Electronic transmitters must be of the pressure type and consist of a capsule assembly, bottom works, weatherproof and bug-proof atmospheric vent assembly, drain plug, cover flange, process connector and connection, Teflon gaskets, amplifier unit, integral indicator, terminal box with cover, block and bleed valves, and conduit connections.

3.9.4.1 Pressure Indicating Transmitters (PIT) must be provided with two-valve stainless steel manifolds.

3.9.4.2 The amplifier unit must convert the pressure indication to a 4-20 mA DC signal, two wire type, with an allowable loop load of no less than 575 ohms.

3.9.4.3 Transmitter design must incorporate voltage surge and RFI protection.

3.9.4.4 Span must be adjustable over a minimum of a 7:1 range. External adjustments must include zero and span.

3.9.4.5 All equipment must be suitable for an ambient operating range of minus 40-degree F to plus 212-degree F.

3.9.4.6 All block and bleed valves must be constructed of 316 stainless steel.

3.9.4.7 Bolts for process covers and process connectors must be of the same material as that specified for the process covers.

3.9.4.8 The integral indicator must have a linear scale and be calibrated in the process units.

3.9.4.9 Power supply must be 24VDC.

3.9.4.10 Accuracy, including linearity and repeatability, must be plus or minus 0.2 percent of span.

a) Hysteresis must be limited to 0.5 percent of span.
b) Drift, over a six-month period, must not exceed 0.1 percent of reference span.
c) Ambient temperature effect must be limited to no more than plus or minus 0.5 percent of maximum span per 100 degrees F.

3.9.4.11 Transmitter must utilize “Smart” technology which employs a hand-held configuration terminal and outputs a digital flow signal superimposed on a 4-20 mA signal and complies with HART protocol.

3.10 LEVEL MEASURING SYSTEM

3.10.1 For pump stations installed with the County Standard SCADA control panel a submersible, transducer-type level measuring system must be used as the primary level measuring system.

3.10.1.1 The measuring system must consist of a 316 stainless steel submersible transducer, corrosion resistant support cable, and waterproof interconnecting cable.

3.10.1.2 The installation must allow for easy removal of the transducer and cable assembly for maintenance purposes.

3.10.1.3 The electronic level transmitter must produce a 4–20 mA DC signal linearly proportional to the level range indicated.

3.10.2 Float switches must be used as a back-up level measuring system.

3.10.3 Where back-up pumping capability is required, the diesel-powered pumps must be independently controlled using electronic level transmitters. See diesel-powered pump manufacturer's recommendations for compatible products. The diesel-powered pump levels must be set for high level on and low level off. When backup pumps start, an alarm must be sent to the PLC to indicate that the back-up pumps are operating.

3.10.4 For in-fill grinder pump stations, using the HighTide RTU and MPE Controller panel, float level switches must be used. Each site must have four (4) switches installed.

PART 4.0 CONSTRUCTION

4.1 SITE WORK

Site work must conform to the applicable requirements of Division 03 and 33 and the Construction Drawings.

4.2 WET WELLS

4.2.1 Excavation must be sheeted and shored in full compliance with all applicable rules and regulations. The excavation must be dewatered and kept dry until the wet well has been completed and backfill is in place.

4.2.2 The Wet well base must be constructed on a leveling course of crushed stone with the sub-base compacted to not less than 98 percent of maximum dry density as determined by the Modified Proctor Test ASTM D 1557.

4.2.3 Sheeting may be removed as the backfilling progresses. All voids created by sheeting removal must be filled and tamped. Backfill must be placed in lifts not greater than 12-inches. Backfill material must conform to AASHTO soil classification A-1, A-2, or A-3, and compacted to 98 percent of maximum dry density as determined by the Modified Proctor Test ASTM D 1557. One density test must be made for each two foot backfill lift, staggered spirally around the wet well, and a minimum of one test per day.

4.2.4 The wet well floor must have a grout fillet around the bottom of the wet well with a minimum slope of 1-to-1 toward a hopper bottom. The horizontal area of the bottom must be no greater than necessary for proper installation and function of the pump suction.

4.3 PIPING AND EQUIPMENT

4.3.1 All piping, valves, equipment, and appurtenances must be installed in full compliance with the Contract Documents, shop drawings, manufacturer's instructions, and the WRD Specifications, Manuals, and Drawings.

4.3.2 Electrical equipment must be protected from the weather, including dripping or splashing water, at all times during shipment, storage, and construction. Manufacturer's recommendations for storage and protection must be followed.

4.3.2.1 Should any apparatus be subjected to possible injury by water, it must be thoroughly dried and put through a dielectric test, at the expense of the Contractor. Hillsborough County must establish both the suitability and acceptability of the apparatus.

4.3.2.2 No equipment with visible signs of weathering will be accepted. Contractor must replace equipment deemed unacceptable by the County without additional cost to the County.

4.3.3 Damaged or Defective Equipment: Contractor must inspect all equipment and materials prior to installation. Damaged equipment and materials must not be installed.

4.3.4 Damaged or defective piping: Contractor must inspect all piping and valves prior to installation. Damaged piping, valves, or internal coatings will require the Contractor to replace at no additional cost to Hillsborough County. Internally lined pipe, valves, and fittings must be handled only from the outside. No forks, chains, straps, hooks, etc., must be placed inside the pipe, valves, or fittings for lifting, positioning, or laying. Pipe, valves, and fittings must not be dropped or unloaded by rolling. Improperly handled, dropped, or improperly unloaded piping and valves must be considered damaged.

4.3.5 Working clearances around equipment must be provided to allow safe and free access for installation, troubleshooting, and maintenance. Should there be apparent violations of clearances, the Contractor must notify Hillsborough County WRD Technical Services Division (TSD) before proceeding with connection or placement of equipment.

4.3.6 Stainless steel labels or tags must be provided for each pump, valve, pressure gauge, etc. Labels or tags must be of a size to properly fit manufacturer's brackets (where provided) and be legible. Where brackets are not provided, labels must be mounted with stainless steel screws or rivets. Label or tag identifiers must be stamped.

4.3.7 The Contractor must make every effort to coordinate the Work with the work of other trades.

4.3.8 Damage from interference caused by inadequate coordination by the Contractor must be rectified at no additional cost to the County.

4.3.9 Contractor must coordinate his work and schedule with the placement of the meter box and with other work required by the utility company.

4.3.10 Equipment must not be placed into service until all interested parties have been duly notified and are present or have waived their right to be present. Where equipment to be placed into service involves services or connections from another Contractor or Hillsborough County, the Contractor must notify Hillsborough County and the other Contractor in writing when the equipment will be ready. Hillsborough County must be notified as far in advance as possible, of the date the various items of equipment will be complete.

4.4 ELECTRICAL

4.4.1 Make electrical connections to equipment in accordance with equipment manufacturer's instructions, Drawings, and the following:

4.4.1.1 Verify that wiring and outlet rough-in work is complete and that utilization equipment is ready for electrical connection, wiring, and energization.

4.4.1.2 Make wiring connections in control panel or in the wiring compartment of prewired equipment. Provide all interconnecting wiring where indicated.

4.4.1.3 Install and connect disconnect switches, controllers, control stations, and control devices as indicated.

4.4.1.4 Use aluminum rigid metallic or Schedule 80 PVC conduit only, unless otherwise specifically noted.

4.4.1.5 Provide suitable strain-relief clamps for cable connections to submersible pumps per the pump manufacturer's requirements.

4.4.2 Contractor must obtain all items not supplied by the local electric utility necessary for the service connection and metering. The Contractor must furnish and install conductors from the meter box to the main disconnect. Final line side meter connections must be made by or under the supervision of the electric utility.

4.4.3 The electric-utility-supplied meter must be mounted in a Contractor-supplied meter box which must have a surge arrestor (approved by the electric utility and supplied by the Contractor) mounted on the box. The meter box must be mounted on a reinforced concrete post (six-inch by six-inch by nine-foot) located outside the fenced area. The post must be adjacent to the fence and at least three feet from any driveway or access gate. The main disconnect must be mounted next to the control panel inside the pumping station fence. Refer to Drawings for details.

4.4.4 All conduits entering and exiting the meter box, main disconnect, control panel, and junction boxes must be from the bottom only except as shown in the Drawings. Properly seal all conduits and penetrations. Rain tight fittings must be used for side connections.

4.4.5 Grounding: The pumping station electrical service must be grounded by a #1/0 bare tinned copper conductor bonded to a ¾ -inch diameter, twenty-foot (minimum) long driven ground rod located as shown on the Drawings. Pumping stations with large pumps may require a larger ground wire sized per the latest revision of NFPA 70. The Contractor must verify that the service ground is adequate for the conditions at the site.

4.4.6 Support systems must be sized and fastened to accommodate weight of equipment and conduit, including wiring, which they carry.

4.4.6.1 Hanger rods, conduit clamps, control panel and junction boxes must be fastened to the support structure using nut-and-bolt type hardware appropriate for the installation of powder coated 304L stainless steel.

4.4.6.2 Stainless steel bolts extending through the post must be used to fasten the support bars to the concrete posts. Use of expansion anchors or preset inserts to fasten the support bars to the concrete posts is prohibited.

4.4.6.3 Fastening supports to piping, mechanical equipment, or conduit is prohibited.

4.4.6.4 Use of powder-actuated anchors is prohibited.

4.4.6.5 Drilling of structural steel members is prohibited.

4.4.6.6 Fabricate support bars from stainless steel or aluminum. Aluminum strut may be utilized as shown on the Standard Electrical Drawings.

4.4.6.7 Install control panel, disconnects, junction box, etc., with a minimum of four stainless steel nut-and-bolt assemblies passing completely through support posts or bars.

4.4.6.8 Do not drill mounting holes into the control panel. Use a control panel with manufacturer supplied (welded) slotted mounting brackets. For other panels, enclosures, and boxes, use factory holes for mounting. Seal all openings resulting from unused mounting holes or knockout holes.

4.4.7 Identify all electrical distribution, control equipment, and loads served, to meet the regulatory requirements and as follows:

4.4.7.1 Secure nameplates to equipment using stainless steel screws or rivets, with edges parallel to equipment lines.

4.4.7.2 Use nameplates with 3/16-inch high indented lettering to identify individual switches, circuit breakers, receptacle circuits, loads served, and control equipment.

4.4.7.3 Label float leads with 316L stainless tags.

4.4.8 When required to utilize torque wrenches, or screw drivers, calibration certification of the tools must be supplied to the County upon request. Mark all screws/bolts after they are torqued to specification.

4.4.9 Install wire markers on each conductor in control panel and junction boxes. Wire markers must be on each end of the conductor.

4.4.9.1 Use branch circuit or circuit breaker number to identify power circuits.

4.4.9.2 Use control wire number as indicated on manufacturers' schematics and interconnection diagrams to identify control wiring.

4.4.10 Neatly train and secure wiring inside control panel, panels, boxes, equipment, and enclosures.

4.4.11 Use UL listed wire pulling lubricant for pulling larger conductors.

4.4.12 Protect exposed cables in the wet well from mechanical damage during construction and locate cables to avoid damage during operation or maintenance.

4.4.13 Verify that any mechanical work which may damage electrical conductors has been completed before installation of conductors.

4.4.14 Completely and thoroughly swab raceway system before installing conductors.

4.4.15 Make taps and terminations to carry the full ampacity of conductors without perceptible temperature rise. Splices are not permitted in either power or control circuits.

4.4.16 Cap off any spare conductors and neatly secure them.

4.4.17 Use of aluminum conductors is prohibited.

4.4.18 Install all wiring devices in accordance with manufacturer's instructions.

4.4.18.1 Install convenience receptacle at location indicated on Drawings with grounding pole on bottom.

4.4.18.2 Install emergency generator termination box, JB4, at location shown on Drawings.

4.4.18.3 Install mechanical interlock on main and emergency circuit breakers such that when the main breaker is on, the emergency breaker is off and vice-versa.

4.4.19 No more than two conductors must be connected to a single terminal position on the terminal blocks.

4.4.20 Apply an oxide inhibiting joint compound to all electrical termination contact surfaces, including compression and bolted connections.

4.5 CONTROL/RTU PANELS AND APPURTENANCES

4.5.1 Panels must provide mounting for power supplies, control equipment, input/output subsystems, panel-mounted equipment and appurtenances. Ample space must be provided between equipment to facilitate servicing and cooling.

4.5.2 All wiring must be bundled and run open or enclosed in vented plastic wireways. All conductors run open must be bundled and bound with nylon cable ties at regular intervals, not exceeding 12 inches. Care must be taken to separate electronic analog signals, discrete signals, and power wiring from one another. A copper ground bus must be installed in each panel. Interior panel wiring and field wiring must be tagged at all terminations with machine-printed plastic sleeves which fully encircle the conductor. The wire number must be the ID number listed in the input/output schedules.

4.5.3 Wires must be color coded as follows:

Average Flow (MGD)	Peak Factor
230/480 VAC Power	Black
120VAC Control Power	Red
120VAC Neutral	White
Ground	Green
24VDC Negative	Blue/White (Blue)
24VDC Positive	Blue
24VAC Control Power	Orange
24VAC Neutral	Orange/White
Externally Powered Circuits	Yellow

4.5.4 The Contractor must be responsible for furnishing and installing all conduit, wire and seals (as required to meet the specific classification of each installation site) between the Control Panel, and the wet well.

4.5.5 Calibration and programming instrumentation: As required, vendor support must be provided to assist in the start-up and commissioning of the system.

4.5.6 Free standing panels, 25 hp and greater, must be anchored to the pump station slab using three (3), 316 stainless steel, 1/2-inch x 6-1/2-inch wedge anchors per each panel foot. Anchors must be embedded 4 inches into the slab.

4.6 SITE PAVING AND FENCING

4.6.1 Pumping station site paving must be six inches minimum of 4,000 psi concrete to include all traffic areas which will have a six-inch minimum of concrete. All areas will be reinforced with a minimum six-by-six (6x6) - W 2.9-by-W 2.9 W.W.F. Refer to the Standard Pump Station Drawings and

Specification 033000 for concrete installation and testing requirements. Changes to the reinforcing is considered a design exception and requires review and approval.

4.6.2 Base and sub-base density tests must be taken prior to any concrete pour for both the concrete slab and concrete driveway. Densities must be compacted to no less than 98% of maximum dry density as determined by Modified Proctor Test ASTM D 1557. Any portion of the driveway constructed utilizing the same material as the adjacent roadway must meet the same testing requirements as required for the roadway construction.

4.6.3 No trees may be planted within 20 feet of the pump station access driveway or concrete slab.

4.6.4 Fencing: Pumping stations must be fenced with a six-foot high, wooden, shadow-box type fence as shown on the Standard Mechanical and Structural Drawings. Materials and installation must be in accordance with County pumping station fencing requirements. All wood dimensions are nominal lumber sizes.

4.6.4.1 Fence must be a shadow-box design made from pressure-treated pine lumber with a green appearance. Slats must be 1x6x6, with dog-ear cut on top end.

a) Each fence section must have three horizontal pressure-treated 2x4 runners. The maximum section width must be eight feet.
b) Slats to be attached to runners on nine-inch centers with three, #6 ring shank nails, or three, two-inch #8 SS deck screws. Runners must be attached to the post with two, 3½-inch SS deck screws.

4.6.4.2 Fence corner and line posts must be pressure-treated, 4x4x8. The bottom two feet must be buried below slab finish grade. Fence post must be installed no more than four feet apart. Pressure treating must be suitable for protecting buried wood (use category - ground contact).

4.6.4.3 Gate posts must be pressure treated 6x6x10, with four feet buried below slab finish grade. Pressure treating must be suitable for protecting buried wood (use category – ground contact).

4.6.4.4 Gates

a) Double gates of solid construction, seven feet per side for a 14½ foot opening, must be provided.
b) Gate slats must be the same size as fence slats.
c) Gates must have three 1½ -inch square steel tubing horizontal runners and two 1½ -inch square steel tubing vertical runners (all steel tubing 18 gauge, hot dipped galvanized). Steel tubing is to be welded at all corners and mid-points (six total welds). All welds and drilled holes in steel tubing are to be patched with Cold Galvanizing.
d) Three 1½ x 1½ inch horizontal wood runners will be attached to the 1½-inch horizontal square steel tubing with equally spaced 3/8-inch #316 stainless steel carriage bolts, nuts, and washers. Three attachments per runner are required. The top wood runner is to be attached to the bottom of the steel tubing; the bottom two runners are attached to top of the steel tubing.
e) Slats will be attached to the 1½- inch wood runners with 2-inch #8 SS deck screws, or #6 SS ring shank nails, two screws or three nails per slat. A gap of one-quarter inch minimum and one-half inch maximum must be maintained between slats to allow for air passage.
f) All gate lumber is to be pressure treated.
g) Each gate must be provided with three hinges. The top and bottom hooks must be

turned up and the center hook turned down. Hardware for gates must be as listed or heavier.

h) Hinges must be 1/8-inch thick by 2-inch wide by 4-inch long (1-5/8 standard female gate hinge), and each must have one square hole to accommodate 3/8-inch diameter carriage bolts, 2½-inch long, with washers and nuts.

i) Gate hinge straps must be secured to gates by bolts across the horizontal runners, and secured with washer and nuts on the inside of the gates. Bolt hooks for straps must be 5/8-inch in diameter by 13-3/8-inch long, threaded with 316 stainless nuts and washers for each side.

j) The gate is to be secured by chains with 3/8-inch 316L stainless steel bolts through gate slats and center horizontal runners, with washers and nuts on inside of the gates. All fence hardware to be hot dipped galvanized, except as noted.

k) Each gate must be provided with a ½-inch diameter by 34-inch long rod with 90-degree bend four inches long on the end for the gate drop rod.

l) Rods to be mounted with two, 316L stainless steel open eye bolts (3/8-inch by four-inch), nuts, and washers and one 3/8-inch by four-inch carriage bolt, to allow rod to drop 12 inches below the bottom of the gate to hold it in the open position. Rods must drop into a 1¼-inch diameter pipe that extends 18 inches below grade.

m) Rods to be installed on the vertical 1½-inch square steel tubing of the gate. Stainless steel (316L) carriage bolts, nuts, and washers must be installed on each gate to hold drop rods in the up position.

n) A one-inch diameter hole, nine inches deep must be bored into the concrete to hold the right-hand gate in the closed position.

4.7 FINAL INSPECTION AND TESTING

4.7.1 The pump station must be thoroughly tested to demonstrate that the entire system is in proper working order and in accordance with the plans and specifications. See Part 5 for Pump Station Start-up Procedures.

4.7.2 After the installation is complete, deliver to the Project Manager or the Hillsborough County Inspector the following information with the request for final inspection:

4.7.2.1 One set of Construction Drawings marked to show all significant changes in layout, equipment ratings and locations, alterations in the size of access hatches, or any other data differing from the design.

4.7.2.2 Certificate of final inspection from applicable permitting authority.

4.7.2.3 Test report from supplier of all motors, listing horsepower, voltage and full load current.

4.7.2.4 Certified test curves for each individual wastewater pump purchased. Results must be turned over to Project Manager or Hillsborough County Inspector along with serial numbers of the unit tested. Results must be certified.

4.7.2.5 A test report of ground electrode resistance test.

4.7.2.6 One set of electrical record drawings.

4.7.3 Only the Engineer of Record (EOR) or his representative will be allowed to schedule a pump station inspection. The EOR must be responsible for verifying that the following conditions have been met prior to scheduling the inspection:

4.7.3.1 Power will be supplied only by TECO and will be through the TECO meter serving the pump station. Generator power is not an acceptable source for the final inspection by the County; however, the Contractor may use generator power for conducting

preliminary tests during construction.

4.7.3.2 Backflow preventer and spark test (when applicable) inspections have been performed and that the certifications are available to present to the County inspector at the final inspection.

4.7.4 Each pump with its control circuit must be run as nearly as possible under operating conditions for a sufficient length of time to demonstrate correct alignment, wiring capacity, speed, and satisfactory operation.

4.7.5 Perform field inspection and testing of wiring prior to energizing circuits.

4.7.5.1 Inspect wire and cables for physical damage and proper connection.

4.7.5.2 Torque conductor connections and terminations to the manufacturer's recommended values.

4.7.5.3 Perform continuity test on all power and control circuit conductors. Verify proper phasing connections for motor feeders.

4.7.5.4 Megging of all power conductors must be performed, recorded, and turned over to the County. Refer to Part 4.7.15

4.7.5.5 Verify proper rotation of pumps prior to energizing control system for testing.

4.7.5.6 Measure the resistance of installed grounding electrodes and, if above NEC Article 250 allowable value, or 5 OHMs (whichever is less), augment the ground system as necessary.

4.7.6 Instrument Calibration

4.7.6.1 General: All devices must be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements. All original manufacturer factory calibration sheets must be turned over to the County. Refer to Part 4.7.15

4.7.6.2 Calibration Points: Each instrument must be calibrated at 20, 40, 60, 80 and 100% of span using test instruments to simulate inputs. The test instruments must have accuracy traceable to the National Institute of Standards and Testing.

4.7.6.3 Bench Calibration: Instruments that have been bench-calibrated must be examined in the field to determine whether any of the calibrations are in need of adjustment. Such adjustments, if required, must be made only after consultation with the County Pump Station Personnel.

4.7.6.4 Field Calibration: Instruments which were not bench-calibrated must be calibrated in the field to ensure proper operation in accordance with the instrument loop diagrams or specifications.

a) Mag Flow meters must have a comparison calibration performed by the Contractor. The Contractor must supply a strap-on flow meter and submit documentation that the strap-on meter has been calibrated within the last year.
b) The comparison calibration must be within 5% tolerance of the installed meter. Documentation must show testing was performed with actual flow from the station.

4.7.6.5 Calibration Sheets: Each instrument calibration sheet must provide the following information and a space for sign-off on individual items and on the completed unit:

a) Station name
b) Loop number
c) Tag number
d) Manufacturer
e) Model number

f) Serial number
g) Calibration range
h) Calibration data: Input, output, and error at 20, 40, 60, 80 percent and 100 percent of span
i) Switch setting, contact action, and deadband for discrete elements
j) Sensing tube leak detection test result (performed at maximum process pressure).
k) Space for comments
l) Space for sign-off by Instrumentation Supplier and signature date
m) Test equipment used and associated serial numbers

4.7.6.6 Calibration Tags: A calibration and testing tag must be attached to each piece of equipment or system at a location determined by the County. The Contractor must have the Instrumentation Supplier sign the tag when calibration is complete. The County will sign the tag when the calibration and testing has been accepted.

4.7.7 Loop Testing

4.7.7.1 General: Individual instrument loop diagrams per ISA Standard S5.4 - Instrument Loop Diagrams, expanded format, must be submitted to the County for review prior to the loop tests. The Contractor must notify the County of scheduled tests a minimum of 30 days prior to the estimated completion date of installation and wiring of the Pump Control & Instrumentation System (PCIS). After the County's review of the submitted loop diagrams for correctness and compliance with the specifications, loop testing must proceed. The loop check must be witnessed by the County.

4.7.7.2 Central Site Control Test: Start/Stop override pump control and set-point manipulation must be verified for each associated remote site. Status monitoring must also be confirmed.

4.7.7.3 Instrument and Instrument Component Validation: Each instrument must be field tested, inspected, and adjusted to its indicated performance requirement in accordance with its Manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or, in the absence of a Contract requirement, any published manufacturer performance specification for functional and operational parameters, must be repaired or replaced, at the discretion of the County.

4.7.7.4 Loop Validation: Controllers and electronic function modules must be field tested and exercised to demonstrate correct operation. All control loops must be checked under simulated operating conditions by impressing input signals at the primary control elements and observing appropriate responses of the respective control and monitoring elements, final control elements, and the graphic displays associated with the PCIS. Actual signals must be used wherever available. Following any necessary corrections, the loops must be retested. Accuracy tolerances for each analog network are defined as the root-mean-square (RMS) summation of individual component accuracy requirements. Individual component accuracy requirements must be as indicated by Contract requirements or by published manufacturer accuracy specifications, whenever Contract accuracy requirements are not indicated. Each analog network must be tested by applying simulated analog or discrete inputs to the first element of an analog network. For networks which incorporate analog elements, simulated sensor inputs corresponding to 20, 40, 60, 80 and 100% of span must be applied, and the resulting element outputs monitored to verify compliance with the calculated RMS summation accuracy tolerance requirements. Continuously variable analog inputs must be applied to verify the proper operation and setting of discrete devices. Provisional settings must be made on controllers and alarms during analog loop tests. All analog loop test data must be

recorded on test forms attached at the end of this section which include calculated RMS summation system accuracy tolerance requirements for each output.

4.7.7.5 Loop Validation Sheets: The Contractor must prepare loop confirmation sheets for each loop covering each active instrumentation and control device except simple hand switches and lights. Loop confirmation sheets must form the basis for operational tests and documentation. Each loop confirmation sheet must cite the following information and must provide spaces for sign-off on individual items and on the complete loop by the Instrumentation Supplier:

a) Project name
b) Loop number
c) Tag number, description, manufacturer and model number for each element
d) Installation bulletin number
e) Specification sheet number
f) Loop description number
g) Adjustment check
h) Verification of proper surge arrestor installation
i) Space for comments
j) Space for loop sign-off by Instrumentation Supplier and date
k) Space for County witness signature and date

4.7.7.6 Loop Certifications: When installation tests have been successfully completed for all individual instruments and all separate analog control networks, a certified copy of all test forms signed by the County or the County's representative as a witness, with test data entered, must be submitted to the County together with a clear and unequivocal statement that all instrumentation has been successfully calibrated, inspected, and tested.

4.7.8 All isolation and check valves must be tested for proper operation.

4.7.9 During the final inspection and test, the Contractor must furnish the test instruments.

4.7.10 Readings must be made of line voltage and current at the main disconnect on the load side of each motor starter during starting and operating conditions, as well as pump discharge pressures and flows. Such results must meet pump manufacturer's specifications.

4.7.11 The following parties or representatives must be present at the final inspection: EOR, site Contractor, subcontractor, pump manufacturer, County Inspector, WRD Pump Station Maintenance Supervisor.

4.7.12 The Contractor must supply sufficient water either by water truck or fire hose line to the wet well for pump pressure and flow testing. A hose bib is not an efficient method of supplying water and will not be used.

4.7.13 Each pump will be hoisted and removed from wet well, inspected and replaced, then operated to test for leaks at the discharge seal. The Contractor must provide the equipment to remove and reinstall the pumps in the wet well.

4.7.14 The Contractor must perform any reasonable tests requested by WRD Pump Station Group during the inspection. The cost of the tests must be borne by the Contractor, including expenses incident to retest caused by defects and/or failure of the equipment to meet the specifications.

4.7.15 One hardcopy and one USB Flash Drive (3.0 or higher) of all applicable operating and maintenance

manuals for mechanical and electrical equipment are to be supplied to the County inspector at the final pump station inspection. All pdf files must be in searchable PDF format.

4.7.16 After successfully completing final testing, installation of sealing compound in conduit seals must be performed, witnessed by WRD personnel.

4.7.17 Performance Testing

4.7.17.1 Each completed lift station RTU installation must operate for 14 days without system failures that requires a system reboot of the PLC, halts operation of the station, or inhibits (i.e. prevents or significantly retards) SCADA communications.

4.7.17.2 Downtime resulting from the following must be considered system failures:

a) If a component failure cannot be repaired or replaced within four hours
b) Downtime of any component (exclusive of I/O) whose failure results in the inability of the Operator to monitor and manipulate control loops from the associated workstation using standard workstation interface procedures
c) Downtime in excess of four hours, resulting from any I/O component failure
d) Downtime resulting from the concurrent failure of two or more I/O components in a single PLC.

4.7.17.3 The Contractor must furnish support staff as required to operate the system and to satisfy the repair or replacement requirements.

4.7.17.4 If any software or hardware component fails during the performance test, it must be repaired or replaced and the PCIS must be restarted for another 14-day period.

4.7.17.5 Each remote cellular modem must reply by sending a valid Modbus slave frame, to 95% of the Modbus master frames sent to it.

PART 5.0 WASTEWATER PUMPING STATION CONSTRUCTION START-UP PROCEDURE

5.1 PROJECT SUBSTANTIALLY COMPLETED – FINAL START-UP

5.1.1 Inspector will schedule, within five working days' notice, to have present:

5.1.1.1 Design Engineer
5.1.1.2 O & M People

5.1.2 Contractor will have present:

5.1.2.1 Superintendent
5.1.2.2 Pump and controls representatives
5.1.2.3 Other concerned persons

5.1.3 On site; Contractor will:

5.1.3.1 Demonstrate agreement compliance of the following:

a) Demonstrate pump removal, if applicable
b) Demonstrate pump operations
c) Make startup report, to include:
    1) Amp draw
    2) Meg ohms
    3) Voltages
    4) Rotation
d) Demonstrate pressure switches

e) Demonstrate lead, lag, off and alarm operation
f) Complete instrument loop testing

5.1.3.2 Supply one hard copy and one USB flash drive (3.0 or higher) of the O&M manuals, all spare parts and an itemized list of the parts, and the electrical schematic.

5.1.4 After demonstrated agreement compliance, inspector will:
5.1.4.1 Compile preliminary punch list within two days
5.1.4.2 Monitor punch list completion
5.1.4.3 Perform final punch list inspection

5.2 PUMP STATION START-UP CHECKLIST

See the following for the field checklist to be turned over to the Hillsborough County WRD Pump Station Maintenance Supervisor responsible for the pump station.

PUMP STATION START-UP Date: _____

Project Name: _____

Pump Manufacturer: _____ Model: _____ Imp.: _____

Design Conditions: _____ GPM @ _____ TDH _____HP: _____ FLA_____

Pump #1 SN _____ Pump #2 SN _____

Voltage Check L1/L2_____ L1/L3_____ L2/L3_____
L1/Grd_____ L2/Grd_____ L3/Grd_____

Amp/Meg Check

Pump #1	MEG	Amp
L1		
L2		
L3		

Pump #2	MEG	Amp
L1		
L2		
L3		

System Check Alarm Light _____
Horn _____
Silence _____

WW Dia.	6 foot	8 foot	10 foot
Gal/Inches	17.6	31.3	48.9

Gauge Ht._____

DRAWDOWN TEST

PUMP #1

	#1	#2	#3
Start			
Finish			
Drawdown			
GPM			
PSI			
Corr.			
TDH			

PUMP #2

	#1	#2	#3
Start			
Finish			
Drawdown			
GPM			
PSI			
Corr.			
TDH			

Stall Hd. Pump #1
psi _____
Corr. _____
TDH _____

Stall Hd. Pump #2
psi _____
Corr. _____
TDH _____

Notes: _____
_____

PUMP STATION START-UP Date:_____

Project Name: _____

PLC CONTROL CHECK

	PUMP #1	PUMP #2
Pump Start on PLC Control	_____	_____
Pump Stop on PLC Control	_____	_____
Pump Start on Relay Logic Control	_____	_____
Pump Stop on Relay Logic Control	_____	_____

SYSTEM CHECK

Antenna GPS coordinates _____

Power loss (UPS) test _____
Redundant 24V DC Power Supply test _____

Loop Test all Analog and Discreet Inputs and Outputs _____

Grounding Inspection _____

Surge Arrestor Installation Inspection _____

Wire Tagging & Terminal Label Inspection _____

Notes: _____

_____

_____