

SECTION 33 32 17

LOW PRESSURE SEWER SYSTEMS AND RESIDENTIAL GRINDER PUMP STATIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Section Includes Installation of:
 - 1. Low-pressure force main sewer system.
 - 2. Residential simplex grinder pump station and force main appurtenances.

- B. Related Requirements:
 - 1. CFPUA Material Specification Manual (MSM).
 - 2. Section 31 23 34 – Excavation, Trenching, Dewatering and Backfilling.
 - 3. Section 33 01 12 – Identification for Utilities Piping.
 - 4. Section 33 05 05.31 – Hydrostatic Testing.
 - 5. Section 33 05 09.33 – Thrust Restraint for Utility Piping
 - 6. Section 33 05 13 – Precast Concrete Manholes and Utility Structures
 - 7. Section 33 31 11 – Sanitary Sewer Gravity Mains
 - 8. Section 33 31 23 – Sanitary Sewer Force Mains, Valves, and Appurtenances

1.2 REFERENCE STANDARDS

- A. American Water Works Association:
 - 1. AWWA C600 – Installation of Ductile Iron Mains and Their Appurtenances.
 - 2. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings

- B. ASTM International:
 - 1. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 2. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
 - 3. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
 - 4. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Section 01 30 00 – Administrative Requirements

- B. Coordination:
 - 1. Coordinate inspections and field start-up with Manufacturer, Owner, Engineer and CFPUA to run all pump station equipment through its proper functions.
 - 2. The existing low-pressure system must be kept in operation at all times. Where connections are made to existing mains or other shutdowns are necessary, permission must be obtained and arrangements must be made with the CFPUA Wastewater Collections ORC, Utility Services Division.

3. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject of penalties in accordance with CFPUA's ordinance.
4. Notify CFPUA no less than two business days prior to an event requiring a CFPUA representative to be present.
5. The Contractor shall, at least two business days in advance, notify citizens subject to interruption of service by means of door hangers or any other approved method of the starting time and duration of such interruption.
6. Bypass pumping and hauling operations may be required to interrupt service. A bypass pumping plan shall be submitted in accordance with Section 01 50 00 - Bypass Pumping. Shutdowns must be held to a minimum in both number and duration.

1.4 SUBMITTALS

- A. Section 01 33 00 – Submittals
- B. Product Data/Source Quality:
 1. Manufacturer's literature and specifications, as applicable, for products specified in this Section.
- C. Shop Drawings adequate for control panel fabrication, installation and maintenance shall be submitted and approved prior to manufacturer. Drawings shall include:
 1. Elementary control (ladder) diagram.
 2. Interconnection wiring (schematic) diagram.
 3. Interior and exterior panel component layout drawings.
 4. Dimensioned outline drawing of the enclosure with mounting supports.
 5. Component catalog cuts and Contractor's installation drawings.
- D. Testing Procedures:
 1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER and CFPUA approval prior to commencing testing.
- E. Manufacturer Certificates:
 1. Certificates of compliance with referenced standards, where applicable, including those of AWWA and others required by Engineer.
- F. Field Quality Control Submittals:
 1. Results of Contractor furnished laboratory testing and field test results.

1.5 CLOSEOUT SUBMITTALS

- A. 01 70 00 – Execution and Closeout Requirements
- B. Project Record Documents:
 1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work.
 2. Record actual locations of piping mains, valves, connections, thrust restraints, elevations, and other utilities found and not indicated on design plans.

- C. Operations and Maintenance Data:
 1. Furnish complete operations and maintenance manuals for materials in accordance with 01 60 00 - Product Requirements.

1.6 QUALITY ASSURANCE

- A. Qualifications: Company specializing in manufacturing products specified in this Section.
- B. Perform Work according to AWWA, ASTM and PVC Pipe Association standards.

1.7 QUALIFICATIONS

- A. Installation Contractor shall hold a NC Public Utility License.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 – Product Requirements.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage and Protection:
 1. Store and protect materials according to manufacturer instructions.
 2. Block individual and stockpiled pipe lengths to prevent moving.
 3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
 4. Store materials out of sunlight and protect from moisture and dust.

1.9 WARRANTY

- A. Section 01 70 00 – Execution and Closeout Requirements.
- B. Furnish 10-year manufacturer's warranty for valves.
- C. Furnish 2-year parts and labor warranty on the complete station and accessories, including but not limited to the control panel, pump and motor assembly, and integral check valve.

PART 2 PRODUCTS

2.1 CFPWA MATERIALS SPECIFICATION MANUAL

- A. Refer to CFPWA Material Specification Manual (MSM) for the following products:

MSM Section	Material
A	Pipe
B	Fittings and Accessories
C	Joint Restraints

D	Valves and Accessories
F	Service Saddles and Tapping Devices
I	Castings & Aluminum Access Covers
K	Miscellaneous
L	Electrical
M	Coatings and Sealants

2.2 MATERIALS & ACCESSORIES

- A. Grinder Pump Systems:
1. Simplex residential low-pressure sewer grinder pumps shall be
 - a. Barnes OGP 2 HP, or approved equal
 2. Wet well shall be fiberglass with a minimum storage capacity of three hundred and sixty (360) gallons above the Pump Off level; (4) inch diameter PVC inlet flange for Schedule 40 PVC sanitary line, pump discharge brass adapter socket, aluminum lid with bug free screen mushroom vent on tank lid, extended base for anchoring the anti-flotation concrete ballast to tank.
 3. Pump and motor shall be a vertical rotor, motor driven, solids handling type; Double O-ring seal at all casting joints, pump castings cast iron, fully epoxy coated 8-10 mils nominal dry thickness; rotor shall be stainless steel, through hardened, polished' maximum discharge pressure shall not exceed 150 psi, 2 HP Standard.
 4. Grinder shall be direct driven, fastened to the pump motor by means of a threaded connection; cutter teeth hardened to Rockwell 50-60 abrasion resistance; solids must be fed in an upward flow.
- B. Low pressure force mains shall be:
1. PVC Pipe manufactured in accordance with ASTM and AWWA Standards:
 - a. Pipes (2) inches diameter: minimum SDR-9
 - b. Pipes (3) inches diameter: minimum DR-21
 - c. Pipes (4) inches diameter and larger: minimum DR-18
 - d. All low-pressure sewer main piping installed within NCDOT right-of-way shall be minimum DR-18.
 2. DIP manufactured in accordance with AWWA and ASTM Standards with pressure class 350.
 3. HDPE Pipe manufactured in accordance with ASTM Standards.
 4. Fusible PVC or HDPE Pipe manufactured in accordance with ASTM Standards.
- C. Low-pressure sewer service laterals:
1. (2) inch residential service, SDR-9, or Polyethylene (PE), with a minimum pressure rating of (200) psi.
- D. Bedding, Cover, and Backfill:
1. As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.
- E. Pipe Location Wire: As specified in Section 33 01 12 – Identification for Utilities Piping.

- F. Valves shall include (2) inch square operating nut. No wheel handled gate valves.
- G. Vaults and Utility Boxes: As specified in Section 33 05 13 – Precast Concrete Man-holes and Utility Structures.
- H. Electrical Equipment: Electrical equipment shall be capable of operating successfully at full-rated load, without failure, with ambient outside air temperature of 0 degrees F to 104 degrees F.
 - 1. Control panel shall consist of main power input terminals, inlet for connection of a portable generator connector, surge protector, power transfer relay, auxiliary relays, indicator lights, circuit breakers, motor contactor, alarm light and buzzer, circuitry, battery backup for alarm circuitry, and terminal blocks with all components mounted in one common enclosure.
 - a. Shall be listed to UL 508A, Industrial Control Panels.
 - b. Short Circuit Current Rating (SCCR): 10,000 AIC.
 - c. Float switches shall be used for level sensing:
 - 1) Pump operates upon reaching the On level.
 - 2) Upon pumping down to the Off level, the pump will shut down.
 - 3) If level continues to rise, a high-water alarm shall be activated.
 - d. Relays, circuitry, etc. for monitoring and indication of the following shall be provided:
 - 1) Motor RUN status.
 - 2) High wet well level.
 - e. Alarm buzzer and light activated by:
 - 1) High wet well level.
 - f. The alarm buzzer shall be silenced by an alarm silence pushbutton.
 - g. Alarm functions shall operate when power is lost by utilizing a battery back-up.
 - 2. Enclosure:
 - a. NEMA 4X.
 - b. External hardware, hinges, etc., shall be 316 series stainless steel.
 - c. Weatherdoor: Gasketed, continuously hinged quick release latches and a hasp assembly for padlocking.
 - d. Control compartment shall incorporate a fixed, rigid back panel on which control components shall be mounted. Back panel shall be tapped to accept all mounting screws.
 - e. Mounting provisions: Mounting lugs shall be provided for wall mounted panels.
 - 3. Components:
 - 1. Generator inlet connection matching CFPUA's portable generator connector.
 - 2. A surge protection device for the control panel shall be connected to the main power input terminals.
 - 3. Power transfer relay assembly shall automatically transfer power to portable generator source when it is active.
 - 4. Circuit Breakers: Individual breakers for pump motor, controls, and alarms.
 - 5. Pushbutton operator: Momentary, for alarm silence.
 - 6. Indicator lights:
 - a. Compact, LED, push-to-test.
 - b. Lens Colors:
 - 1) Green for indication of ON, running status.

- 2) Red for indication of high-level alarm.
7. Auxiliary and control relays:
 - a. General purpose, plug-in type rated for continuous duty.
 - b. Contacts: Silver cadmium oxide rated not less than 5 A resistive.
 - c. Clear plastic dust cover.
 - d. Pilot light to show energized coil.
8. Contactor:
 - a. Individual full voltage across the line type.
 - b. Size contactor in accordance with the nameplate rating of the motor provided.
 - c. Contactor shall meet UL 508 & NEC requirements.
9. Alarm buzzer shall be provided on the control panel exterior, with waterproof connections to the control panel.
10. Terminal blocks shall be provided for connection of both internal connections and connections for external circuitry.
 - a. Channel mounted, sectional type.
 - b. Rated 600 volts, 20 amps minimum.
11. Labeling:
 - a. All switches, pilot lights, control devices, major components, etc., shall be clearly labeled according to function with engraved plastic plates, black with white core. Minimum letter size shall be 1/8 inch.
 - b. All conductors and terminal strips shall be labeled, matching schematic, and wiring diagrams.
 - c. Identification labeling shall match the bill of materials, schematic diagram, and wiring diagram.
 - d. Schematic and wiring diagrams shall be displayed via a placard mounted to the inside surface of the panel door.
12. All other components necessary for a completely operable system performing the functions required shall be supplied.
4. Wiring:
 - a. Outdoors: PVC Schedule 80, THWN-2, or XHHW-2 conductors, NEMA 4X Enclosure
 - b. Indoors: PVC Scheduler 40 or 80. THWN-2 or XHHW-2 conductors.
 - c. All wiring workmanship and schematic wiring diagrams shall be in compliance with applicable standards and specifications for industrial controls set forth by the Joint Industrial Council (JIC), National Machine Tool Builders Association (NMTBA), National Electrical Code (NEC), electrical requirements of these specifications and other pertinent electrical codes and standards.
 - d. All control circuit wiring shall be stranded copper, color coded and clearly marked at each end to match schematic wiring diagrams, and of adequate size to safely carry required electrical loads. All control wires shall be marked using T&B Shur-code sleeve markers. All wires on the back panel shall be contained in wire troughs with removable covers to facilitate field repairs and addition of optional/additional components. Splices shall not be used.
5. Insulated conductors shall be single conductor copper cable complying with ASTM B3 and ASTM B8 with flame retardant, moisture, and heat-resistant insulation for 90 degrees C in dry or wet locations; Listed by UL as Type XHHW-2 or THWN-2 compliant with UL 44. Wires shall not be smaller than No. 12 AWG for

- power and No. 14 AWG for 120-volt control circuit. 600-volt cable shall be stranded.
6. Cable Connectors, Solderless Type: For wire sizes up to and including No. 6 AWG, use compression type. Alarm and control wire shall be terminated using forked type connectors at terminal boards. Properly size connectors to fit fastening device and wire size. Connectors shall be rated for 90 degree C, 600 volts.
 7. Cable Splices:
 - a. For wire sizes No. 8 AWG and larger, splices shall be made up with pre-insulated solderless connectors with one spare port for future conductor connection.
 - b. For wire sizes No. 10 AWG and smaller, splices may be made up with pre-insulated spring connectors.
 - c. No electrical connections, splices, or junction boxes with the wet well or in locations of condensing humidity. For wet locations, splices shall be waterproof. Spring connector splices shall be waterproofed with sealant filler.
 - d. Splices shall be suitably sized for cable, rated 90 degrees C, and 600 volts.
 8. Hangers and Struts shall be 1 5/8 inches by 1 5/8 inches, Type 316 stainless steel, unless otherwise noted. Attachment holes, when required, shall be factory-punched on hole centers and shall be 9/16-inch diameter. All fittings, braces, brackets, hardware, nuts, bolts, screws, washers, and accessories shall be Type 316 stainless steel.
 - a. Hex nuts shall be Type 316 stainless steel and include nylon inserts.
 9. Rigid Conduits:
 - a. Fastener material, to the extent possible, shall be consistent with conduit material.
 - b. Duct sealing compound shall be soft, fibrous, slightly tacky, non-hardening compound. Remains workable at all temperatures.
 - c. Warning tape shall be provided in accordance with this Section. Polyethylene or polyester with detectable metal core and polyester underlamine. Yellow or Red with permanently printed black letters.
 10. Pull, Junction and Terminal Boxes shall be NEMA 4X, with neoprene gaskets provided for wet and corrosive locations.
 11. Identification for manufactured units shall include engraved name plates, laminated thermoset plastic, legend plate for push buttons, pilot lights, and selector switches. Engraved nameplate shall be attached with 2-part epoxy adhesive.
 12. Arc-flash Safety Signs shall read, "Warning – Arc Flash and Shock Hazard. Appropriate PPE Required."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 – Execution and Closeout Requirements.
- B. Identify project horizontal and vertical control points, establish easement and right-of-way lines, stakeout construction points for work and pipeline alignments, establish limits of disturbance.

- C. Determine exact location and size of low-pressure force mains, valves, and appurtenances from Drawings.
- D. Verify location and elevation of existing facilities prior to excavation and installation of proposed interconnecting low-pressure force main and valves.

3.2 PREPARATION

- A. Section 01 70 00 – Execution and Closeout Requirements.
- B. All materials found during the progress of work to have flaws, cracks, or other defects will be rejected by the Engineer regardless of whether or not it has been installed and shall be replaced by and at the expense of the Contractor.
- C. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surfaces, interior linings, and components. If any part of the coating, lining or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer prior to attempting installation.
- D. Pipe Cutting:
 - 1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
 - 2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
 - 3. Grind edges smooth with beveled end for push-on connections.
- E. Remove scale and dirt on inside and outside before assembly.
- F. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Placement: As specified in Section 31 23 34 – Trenching, Excavation, Dewatering and Backfilling.
 - 1. All mains shall be laid and maintained at the required lines and grades with fittings, valves, and appurtenances at the described locations. All pipes shall be laid to the depth as shown on the drawings, or when a depth is not indicated, with a minimum cover of thirty-six (36) inches and a maximum of sixty (60) inches below finished grade. Grade lines shall be set by the Contractor. Realignment must be approved by the Engineer. The Contractor shall have suitable survey equipment on the site at all times.
 - 2. After placement in the trench the spigot end of the pipe shall be centered in the bell and the pipe shall be driven home and then brought to the proper line and grade by tamping approved backfill material under it, except for the bell. Joint deflection shall not exceed manufacturer's limit.
 - 3. The Work shall at all times progress with caution so as to prevent damage to underground obstructions both known and unknown. Should an obstruction not shown on the drawings be encountered, the Engineer shall be immediately notified, and he shall be responsible for alteration to the design should realignment

be necessary. Notify the Engineer far enough in advance to allow the realignment to be accomplished by deflection in the pipe joints.

- B. Low-pressure sewer main and fittings:
1. Handle and assemble pipe according to manufacturer instructions.
 2. Install pipe and fittings in strict conformance with AWWA C600 and C605.
 3. Install plastic pipe in conformance with ASTM D2774 and recommended practices of the UNI-BELL Plastic Pipe Association.
 4. Joint Deflection: Maximum joint deflection shall meet requirements of AWWA C600 or AWWA Manual of Practice M23.
 5. Prevent foreign material from entering pipe during placement and Work stoppages using plugs designed for that purpose. If trench contains standing water in joining zone, plug shall remain in place until the trench has been pumped dry before proceeding pipe laying.
 6. Allow for expansion and contraction without stressing pipe or joints.
 7. Install access fittings to permit work performed under Section 33 05 05.31 – Hydrostatic Testing.
 - a. Lateral service connections shall be used for injections and blowoff locations.
 - b. Fittings permanently installed for testing procedures will not be permitted unless directed by CFPUA or the Engineer.
 8. Jointing:
 - a. Fused HDPE
 - 1) HDPE Pipe shall be joined by the butt-fusion process in accordance with pipe manufacturer's directions.
 - 2) Contractor shall provide butt-fusion technicians who are trained and certified by the HDPE pipe manufacturer to complete the project. The date of technician certification shall not exceed 12 months before commencing construction.
 - 3) Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure.
 - 4) The internal and external beads resulting from the butt-fusion process shall be visible and examined for penetration 360 degrees around the pipe diameter.
 - 5) DI/HDPE Mechanical Joint Adaptors shall be ductile iron mechanical joint fittings per CFPUA Material Specification Manual and shall be joined to the HDPE pipe by a heat-fused joint on one end, and connected to a ductile iron pipe valve, or fitting with a mechanical joint on the other end.
 - 6) Solvent epoxy cementing, electro-fusion couplings, and mechanical joining with bolt on wrap around clamps or mechanical joints without an adapter shall not be used for connections.
 - b. Push-On Joints
 - 1) The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove dirt, grit, oil or excess coatings and other foreign matter. For ductile iron pipe, the gasket shall be flexed inward and inserted in the gasket recess of the bell socket.

- 2) A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot ends, care will be taken to avoid contact with the ground.
 - 3) The joint shall be completed by forcing the plain end to the bottom of the socket with a forked tool or jacking device or other approved method. All pipe shall have depth mark prior to insertion. Pipe cut in the field shall be filed to resemble the spigot end of manufactured pipe.
 - 4) When deflection is required, the joint shall be completed prior to setting the deflection. The deflection shall conform to applicable AWWA Standards or manufacturer's recommendation.
- c. Mechanical Joints
- 1) The inside of the socket, the outside of the spigot end and the gland shall be thoroughly cleaned and or washed with an approved solution to remove dirt, grit, oil or excess coatings and foreign matter to improve gasket seating.
 - 2) The gland shall then be placed on the plain end of the pipe with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end of the pipe.
 - 3) The pipe shall be inserted into the socket and the gasket pressed firmly and evenly into the gasket recess. The joint shall be kept straight during the assembly and any deflection required shall be done after the joint has been assembled but prior to tightening the bolts.
- C. Low-pressure connection to sewer infrastructure:
1. Connections to manholes shall be installed per Section 33 31 11 – Sanitary Sewer Gravity Mains and Section 33 05 13 Precast Concrete Manholes and Utility Structures.
 2. If a connection is made to an existing manhole, the manhole shall be lined per Section 33 05 13 - Precast Concrete Manholes and Utility Structures.
- D. Low-pressure sewer service laterals:
1. No joints are permitted in the service lateral from the main to the valve box. Valve boxes shall contain an isolation plug valve and check valve with the isolation valve installed between the main and the check valve to allow for check valve replacement.
- E. Grinder pump systems:
1. Wet well shall not be installed in the rear of the house or inside any fenced area; removal of the pumps and / or operation of discharge valve shall not require personnel entry into the tank or disconnection.
 2. Top of wet well shall be installed flush with final grade.
 3. Minimum six (6) inches of separation between all penetrations including cable hangers and discharge piping.
 4. Floodplain applications shall include a watertight lid, no mushroom vent on lid; a (2) inch NPT female hub shall be provided in place of the mushroom vent for installation by the Contractor for side wall venting of the tank utilizing Schedule 80 PVC vent piping.
 5. Control panel and accessory equipment shall be installed in strict accordance with the manufacturer's instructions and good practice in a workmanship manner.

- a. Control panel must be within line of sight of the wet well, a placard shall be affixed to the control panel with the Cape Fear Public Utilities Emergency phone number listed for the Owner's use and a 2nd copy placed inside the control panel. Alarm light must be visible from the street.
 - 1) A schematic wiring diagram shall be permanently affixed to the inside of the panel door. An installation and service manual shall be provided
- 6. Integral check valve shall be factory installed, gravity operated; Flapper type integral check valve built into the stainless-steel discharge piping; Must provide a full-ported passageway when open; Working parts construction of 316 stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance.
- 7. Low Voltage Electrical Power and Conductors:
 - a. Install cables complete with proper terminations at both ends.
 - b. Slack: Provide maximum slack at all terminal points.
 - c. Splices:
 - 1) Where possible, install cable continuous, without splice, from termination to termination. All splices not specifically indicated on the drawings shall require approval of the Engineer.
 - 2) Where required, splice as shown and also where required for cable installation. No electrical connections or splices within the wet well or in locations of condensing humidity.
 - 3) Splices are not allowed in conduits.
- 8. Grounding and Bonding Equipment:
 - a. Ground conductors, pulled into conduits with non-grounded conductors, shall be insulated, green.
 - b. Connect to equipment ground bars.
 - c. Where grounding provisions are not included, drill suitable holes in locations recommended by equipment manufacturer and connect to equipment by means of lug compressed on cable end.
 - d. Scrape bolted surfaces clean and coat with conductive oxide resistant compound.
- 9. Hangers and Supports Installation:
 - a. Provide hangers and supports for electrical systems with necessary channels, fittings, brackets, and related hardware for mounting and supporting materials and equipment. Provide anchor systems, concrete inserts, and associated hardware for proper support of electrical systems.
 - b. Supports for Cabinets, Panels, Enclosures, and Boxes:
 - 1) Wall-Mounted: Provide space not less than ¼-inch between cabinets, consoles, panels, enclosures, and boxes and the surface on which each is mounted. Provide non-metallic or stainless-steel spacers as required.
- 10. Rigid Conduits Installation:
 - a. Supports: Support conduits by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the support surface.
 - b. Exposed Conduit: Install parallel or perpendicular to structural members or walls.
 - c. Underground Conduits:
 - 1) Install individual, underground conduits minimum of 20 inches below grade.
 - 2) Perform excavation, bedding, backfilling, and surface restoration, including pavement replacement where required.

- 3) Install warning tape 12 inches below finished grade over buried conduits.
 - d. Terminations:
 - 1) Install insulated bushings on conduits entering boxes or cabinets, except when threaded hubs are used.
 - 2) Provide locknuts on both inside and outside of enclosure, except when threaded hubs are used.
 - e. Moisture Protection: Seal conduit openings within control panels and distribution equipment with duct sealing compound to provide watertight seal.
 - f. Corrosion Protection:
 - 1) Dissimilar Metals: Prevent occurrence of electrolytic action between dissimilar metals.
11. Electrical: 240 VAC, 60 Hz, single phase, 3450 RPM; pump cord length (25) feet minimum, UL and CSA listed; Quick connect cord for watertight attachment to pump.
 - a. Pumps will not operate on 208 VAC circuits and shall not be connected to a 208 VAC circuit. Buildings with 208 VAC electrical systems shall require a 208/240 VAC transformer to provide the required 240 VAC.
 12. Level controls shall be located in the cast iron enclosure of the core unit; Provide float switch type level controls for Pump Off, Pump On, and High-Level Alarm in the wet well for simplex grinder pump stations.
 - a. Float switches shall consist of a mercury tube switch sealed within a corrosion resistant polypropylene housing with a minimum (18) gauge, (2) wires, SJOW / A jacketed cable. The cable shall be of sufficient length to reach the connection junction box without splicing. The floats shall be suspended from a stainless-steel support bracket mounted inside the wet well such that any adjustment or replacement may be done without entering the tank; Float level controls shall be UL / CSA listed and approved.
 13. Power and control cables shall be a minimum of (25) feet long or as needed to connect the wet well to the pump control panel. The power and control cables shall not be spliced between the wet well and pump control panel. The cables shall be UL / CSA listed and approved. The power and control cables shall be installed in minimum (1.5) inch PVC conduit. The conduit ends shall be sealed at each end with non-hardening duct sealant.
 - a. Direct burial rated power and control cable assembly may be installed with the approval of CFPUA. Direct burial cable assembly shall be UL / CSA listed and approved.
 - b. Connection of power and control cables at the wet well shall be a sealed watertight connection. Power cable shall be sealed at the motor and clamped in place with a rubber watertight seal bushing to seal the outer jacket against leakage and to provide for strain relief. Cables shall withstand a pull of 300 lb force.
 14. Local Disconnects: A safety switch disconnection shall be provided adjacent to the pump control panel.
 - a. Single family residential grinder pumps are required to have the pump alarm and control circuit powered independently of the pump power circuit. Therefore, separate breakers shall be provided in the pump control panel for pump alarm and control, and pump power.
 - b. Pump alarm and control circuit: 120 VAC, single phase, (15) amperes, single pole disconnect.

- c. Pump power circuit: 240 VAC, single phase, (3) amperes, double pole disconnects.
 - d. Disconnects shall be UL listed and rated for outdoor applications and installed per the NEW and Authority Having Jurisdiction (AHJ) requirements.
 - e. Disconnects are required on the homeowner's branch circuit supplying the grinder pump panel and shall be installed before the grinder pump system is energized.
- F. Valves:
- 1. Valves shall be set and joined to the pipe and each type of joint as specified for pipe.
 - 2. Cast iron valve boxes shall be firmly supported, maintained centered and plumb over the operating nut of the valve. Outside of paved areas, valve boxes shall be set in a 2-foot diameter x 6-inch thick concrete collar. The box cover shall be flush with the surface of the finished pavement. All force main valve box lids shall have the word "SEWER" cast in the lid.
 - 3. All reasonable effort must be made to locate valves/valve boxes, back of curb, in grass areas and at street corners, whenever possible.
 - 4. Valve boxes in areas that will require sod at a later date must be left one to two inches above existing grade (to allow for sod thickness).
 - 5. All valves must be centered over the operating nut and all valves, after being fully opened, will be backed off one-quarter turn to prevent them from being jammed open. This procedure should take place only after the main has passed pressure testing and has been certified by the Engineer.
 - 6. Should the operating nut be more than three feet below the final grade, an extension shall be supplied and installed by the Contractor. The extension shall bring the nut to within twelve (12) inches of final grade.
- G. Installation of Tapping Sleeves and Valves
- 1. Install the tapping sleeve and valve and pressure test prior to making the tap.
 - 2. If leaks are present, the Contractor shall repair them to the satisfaction of the Engineer or Resident Project Representative.
 - 3. Complete the tapping operation and close tapping valve.
 - 4. Tapping valve shall not be opened until new main has been tested and certified for operation.
- H. Thrust Restraints: As specified in Section 33 05 09.33 – Thrust Restraint for Utility Piping.
- 1. New main construction shall be restrained by means of field or factory applied systems as shown on the Engineer drawings.
 - 2. Thrust blocks in new mains are prohibited except when directed by the Engineer.
 - 3. Where a fitting or device is to be inserted into an existing main, thrust blocking shall be installed as directed by the Engineer or CFPUA.
- I. Polyethylene (PE) encasement when indicated for ductile iron pipe and fittings:
- 1. Encase piping in PE as indicated on Drawings to prevent contact with surrounding soil material or insulation from adjacent cathodic protection system.
 - 2. Comply with AWWA C105.
 - 3. Where pipe exits ground, terminate encasement 3 to 6 inches above surface.

- J. Vent Pipe (If determined necessary by Engineer due to existing flood elevations):
 - 1. (2) inch Schedule 80 PVC, vented through the side wall of the grinder tank, and shall replace the standard top mounted vent, and the vent pipe opening shall be screened and terminate a minimum of (2) feet above the (100) year flood elevation or as directed by the Engineer.
- K. Pipe Locator Wire: Install per Section 33 01 12 – Identification for Utilities Piping.
 - 1. All low-pressure sewer main shall be marked with diameter, manufacturer's name, pressure pipe type, and grade and class.
- L. Pipe Markers: According to CFPUA Details and Material Specification Manual.
- M. Landscaping: Shrubs, bushes, trees, and similar vegetation shall be planted in a manner that will provide a minimum of three feet unrestricted access from the meter box and clean-out to the road. No shrubs, bushes, or trees shall be planted within three feet around the meter box or clean-out that may hinder CFPUA's ability to maintain infrastructure. Small (less than 18" diameter and height), shallow rooted or seasonal planting may be approved within three feet of the meter box or cleanout, provided that these plantings do not hinder the CFPUA's ability to access and maintain the infrastructure at the planting's mature growth.

3.4 FIELD QUALITY CONTROL

- A. Section 01 70 00 – Execution and Closeout Requirements.
- B. Section 33 05 05.31 – Hydrostatic Testing.
 - 1. Prior to pressure test, all piping shall be flushed at a minimum of (2.5) feet per second to result in at least a 100% turnover of water in the pipe.
 - 2. Working pressure shall be 100 PSI and test pressure shall be a minimum of 150 PSI. All piping shall be tested for a period not less than (2) hours and shall be witnessed by a CFPUA Inspector. The pressure gauge must be liquid filled with 2 psi increments maximum. The gauge must be a minimum of three feet above grade. No more than 3 psi can be lost during the two-hour test. The gauge must return to 0 psi when the test is completed. There will be no allowable leakage. Air testing will not be accepted on mains and services, but will be accepted for tapping sleeves, 40 psi for 15 minutes or hydrostatic testing @150 psi for 15 min with zero pressure loss for both.
- C. Start-Up Testing:
 - 1. Test instrumentation system for proper function and sequencing of all motors, indication, and remote notification capabilities in accordance with the Manufacturer's recommendations.
 - 2. Conduct a test for observation by the Owner's representative to demonstrate operation in accordance with the drawings and specifications.
 - 3. At a minimum, the pumps shall run through two (2) cycles for proper functioning.
 - 4. Alarm and Light Test as recommended per the Manufacturer.
 - 5. Battery Backup Test:
 - a. Switch residential power off, and trip alarm to test that the battery backup successfully powers the alarm.

D. Low-Voltage Electrical:

1. Operate power circuits to verify proper operation and connection to electrical systems materials and equipment, including mechanical key-interlocks for circuit breakers.
2. Test each electrical circuit after permanent cables are in place, to demonstrate that circuit and equipment are connected properly and will perform satisfactorily, free from improper grounds and short circuits.
3. Individually test 600-volt cable mechanical connections after installation and before they are put in service, with calibrated torque wrench. Values shall be in accordance with manufacturer's recommendations.
4. Individually test 600-volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service, with Megger for one minute at voltage rating recommended by cable manufacturer. Insulation resistance for each conductor shall not be less than value indicated in IEEE 525-2016 for the circuit run length as indicated below:
 - a. Length of Cable Minimum Acceptable Value (M-ohms)
 - 1) 100 ft 16
 - 2) 200 ft 8
 - 3) 300 ft 5.3

E. Tracer Wire Test:

1. The tracer wire on mains and services up to the shut off ball curb valve located at right-of-way will be tested at the time of site development.
2. The tracer wire on laterals from shut off ball curb valve to wet well shall be tested at the time of installation.

END OF SECTION