

SECTION 221313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. PVC pipe and fittings.
 - 2. Nonpressure-type transition couplings.
 - 3. Expansion joints and deflection fittings.
 - 4. Cleanouts.
 - 5. Manholes.
 - 6. Concrete

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe and fittings.
 - 2. Non-pressure and pressure couplings
 - 3. Expansion joints and deflection fittings.
 - 4. Backwater valves.
 - 5. Cleanouts.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of pipe and fitting.
- B. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Engineer no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Engineer's permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Pressure Piping:
 - 1. Pipe & Fittings: ASTM D1785, scheduled 40, socket-type fittings for solvent-cemented joints
 - 2. Fittings: ASTM D3034, PVC with bell ends.
- B. PVC Gravity Sewer Piping:
 - 1. Pipe and Fittings: PVC compound with a cell class of 12364 as per ASTM D-1784. PVC SDR 35 PSM pipe shall conform to ASTM D-3034 for gasket or solvent weld pipe with bell-and-spigot ends.
 - 2. Gaskets: Elastomeric seals for gasketed joints shall conform with ASTM F-477.

2.2 CLEANOUTS

- A. PVC Cleanouts:
 - 1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.3 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:
 - 1. Cement: ASTM C150/C150M, Type II.
 - 2. Fine Aggregate: ASTM C33/C33M, sand.

3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.
- C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of micro-tunneling.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 0.50 percent unless otherwise indicated.

2. Install piping 15" and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install reinforced-concrete sewer piping according to ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install force-main, pressure piping according to the following:

1. Install piping with 36-inch minimum cover.
2. Install PVC pressure piping according to AWWA M23 or to ASTM D2774 and ASTM F1668.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join PVC gravity sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.

B. Join force-main, pressure piping according to the following:

1. Join PVC pressure piping with solvent cement joints in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564..

3.4 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use Schedule-40 PVC in sewer pipes at branches for cleanouts and use Schedule-40 PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in all areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 12 by 12 by 6 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.7 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- #### A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, PVC caps, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- #### B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
1. Remove manhole and close open ends of remaining piping.
- #### C. Backfill to grade according to Section 312000 "Earth Moving."

3.8 IDENTIFICATION

- A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 - 1. Use warning tapes as shown on the detail sheet of the utility plans.

3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water and maintain such pressure without leakage for at least 15 minutes.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Test plastic gravity sewer piping according to ASTM F1417.
 7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 100 psig.
 - a. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
 8. Manholes: Perform hydraulic test according to ASTM C969. Vacuum testing may be used as an alternate method of testing.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.10 CLEANING

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 221313

SECTION 221353 - FACILITY SEPTIC TANKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Septic system is permitted under the Engineered Option Permit. All installation shall be in accordance with GS 130A-336.1.

1.2 DEFINITIONS

- A. Effluent Sewer Package/System – Component contained within and critical to the function of the components contained within the tanks (Pumps, Filters, Controls, ect). Does not include the tanks, force main, or field components.

1.3 SUMMARY

- A. Section Includes:
 - 1. Septic tanks.
 - 2. Dosing tanks.
 - 3. Recirculation tanks.
 - 4. Pre-Treatment Systems
 - 5. Pressure Manifolds
 - 6. Pipe and fittings.
 - 7. Absorption\Dispersal systems.
 - 8. Pumps.
 - 9. Controls.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include set of shop drawings and technical data sheets. The submittals shall clearly specify the materials of construction and equipment compatibility, along with drawings for each unique package being supplied.
 - 2. Include construction details, material descriptions, dimensions of individual components, and profiles.
 - 3. Include manhole openings, covers, and pipe connections.

- B. Shop Drawings: For trench absorption, tanks, & pretreatment systems.
 - 1. Include manhole openings, covers, pipe connections, and accessories.
 - 2. Include piping with sizes and invert elevations.
 - 3. Include underground structures.
 - 4. Include other utilities.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Septic Tank System Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's written permission.
- B. All approved effluent sewer packages must be sourced from a single manufacturer or supplier and sold as a complete assembly. In addition, the onsite tank must be deemed by the Manufacturer/Supplier as being compatible with the approved effluent sewer package.
- C. The equipment furnished shall be manufactured and supplied by a company experienced in the design and manufacture of effluent sewer systems. **Manufacturer** shall have a minimum ten (10) years' experience in the design and manufacture of effluent sewer systems of similar size and equipment specified. **Manufacturer** shall have a minimum of twenty-five (25) successful installations of effluent sewer systems, five of which shall have more than 100 connections or at least the size of the system being bid, whichever is smaller.
- D. **Manufacturer** of the effluent sewer package shall provide a warranty of five (5) years to include, without being limited to, the pump vault, effluent filter, float switches, discharge assembly, wiring connection system, and control panel, with a separate warranty of ten (10) years from the date of manufacture for the liquid end of the effluent pump. Warranty term shall ensue after **Owner's** acceptance and system start-up procedures are complete. **Manufacturer** shall submit detailed limitations and exclusions from the warranty. The warranty shall be documented in product literature.
- E. The entire effluent sewer package, including the pre treatment pod, float switches, pump, pump vault with effluent filter, discharge assembly, wiring connection system, and control panel, shall be an integrated package provided by a single manufacturer/**supplier** and be designed to work together.
- F. The effluent sewer package(s) shall be completely serviceable, with easy access to the pump(s), filter, and float switches. The pump(s) shall be designed for removal without removing the filter and float switches. The pumps must consist of a motor, a liquid end, and an electrical cable and must be repairable (by replacing impellers and/or diffusers), serviceable, and cleanable. The pump shall be lightweight for easy removal and maintenance without removing the filter or float switches.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Septic Installer must provide proof of experience with installation of Type V Systems with dual alternating pumps and tank installations of greater than 6,000 gallons.
2. Septic Installer must provide proof of experience with installation of three or more similar fiberglass underground tank installations. For installers with less experience, the tank manufacturer shall provide "Construction Oversight Services" to the installer at the installers expense.

- B. Septic System Installation is permitted under the Engineered Option Permit process. The conditions set forth in GS 130A-336.1 shall govern the installation of the system. Should the engineer determine those conditions are not being met and the installer does not take action to address the outlined concerns, the engineer reserves the right to revoke the permit. Upon revocation of the EOP, the installer is responsible for permitting through the Wake County Health Department at their expense.

PART 2 - PRODUCTS

2.1 CONCRETE SEPTIC TANKS

- A. Description: ASTM C1227, precast, reinforced-concrete tank and covers; two chambers.
- B. Design: For A-16 (HS20-44) traffic loading according to ASTM C890.
- C. Manholes: 24-inch- minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include one manhole in center of each end of the tank top.
- D. Filter Access: Reinforced-concrete access hole, large enough to remove filter, over filter position.
- E. Resilient Connectors: ASTM C923, of size required for piping, fitted into inlet and outlet openings.
1. Capacity: 8,000 gal.
 2. Inlet and Outlet Size: 6" PVC
 3. Size/Dimensions: As detailed
- F. All joints and penetrations shall be sealed and watertight, with tanks passing pressure test upon installation. Joint sealant shall be bitumen of butyl rubber and comply with ASTM C 990.

BASIS OF DESIGN

2.2 FILTERS

- A. Description: Removable, septic-tank-outlet filter that restricts discharge solids to 1/8 inch. All filter systems shall be supplied by a reputable manufacturer with at least ten (10) years of experience in supplying equipment for effluent sewers. Effluent filters shall have a solid bottom or deflecting device that prevents vertically rising solids from reaching the filtering surface area during ebullition (Sludge bulking).
 - 1. Housing: HDPE or PVC.
 - 2. Outlet Size: NPS 6.
- B. Description: Recirculation Tank filters shall be removable, outlet filter that restricts discharge solids to 1/8 inch housed in a 12 inch diameter polyethylene vault with eight (8) 2inch diameter holes evenly spaced around the perimeter to allow for maximum sludge and scum accumulation before required pumping. Attached to the filter vault shall be a flow inducer to accept two high head effluent pumps, compatible with or by the same manufacturer.
 - 1. Housing: HDPE or PVC
 - 2. 2" Outlet

BASIS OF DESIGN

2.3 DOSING/PUMPTANKS

- A. Description: Comply with ASTM C913 for precast, reinforced-concrete tank and cover; designed for structural loading according to ASTM C890.
- B. Design: For effluent pump installation and A-16 (HS20-44) traffic loading according to ASTM C890.
- C. Access:
 - 1. 24-inch- minimum diameter opening with reinforced-concrete riser to grade and access lid with steel lift rings. Include "bolt down" style manhole in center of inlet end of septic tank compartment top.
 - 2. 48"x48" square riser with 6" walls to grade. Include aluminum hatch and pad lock hasp in center of the outlet .
- D. Resilient Connectors: ASTM C923 or other watertight seal, of size required for piping, fitted into inlet and outlet openings.
- E. Capacity and Characteristics:
 - 1. Size/Dimensions: As detailed
- F. All joints and penetrations shall be sealed and water tight, with tanks passing pressure test upon installation. Joint sealant shall be bitumen of butyl rubber and comply with ASTM C 990.
- G. Pumps:
 - 1. Pumps must be submersible high-head effluent pumps. Pumps shall be UL and CSA listed for use with effluent. The pumps shall have a 1/8in bypass orifice to ensure flow circulation for motor cooling and to prevent air bind. The pumps shall have floating

impeller or floating stack design to protect against up thrust and increase pump life. The pumps 'liquid ends must be repairable (by replacing impellers and /or diffusers) for better long-term cost of ownership. The motor must be rated for continuous use and frequent cycling, at least 100 cycles per day. The motor cable must be suitable for Class I, Division 1 and 2 applications. The pumps shall be lightweight for easy removal and maintenance. The pumps' intake screens must be 1/8in mesh polypropylene. Pumps shall have internal thermal overload protection and internal lightning protection. All pumps shall undergo 3-point (Dead head, design flow, and design flow + 30%) wet testing at the factory to confirm performance. Pumps shall be compatible with and of the same manufacturer/supplier as mounting brackets and housings to ensure compatibility.

- a. Duplex Pumps shall be approved for use in the pump vault as described in these specifications. Pump shall be 1hp 230v 10.0Amps capable of pumping 98gpm at 26ft of total dynamic head.

H. Floats:

1. Dose/Pump Tanks: Float switches shall be mercury free, normally open mechanical float switches mounted of a PVC Stem attached to the pump vault. The float switches must be adjustable and must be removable without removing the pump vault. The high-level alarm, lag pump enable, demand dose, and pump off shall be preset as shown on the plans. Each float switch lead shall be secured with a nylon stain relief bushing at the splice box. All components shall be an integrated package provided by a single manufacturer/**supplier** and be designed to work together.

I. Controls: Controls for both dose/pump and recirculation tanks shall be duplex controls

1. Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or the need for substantial disassembly.
2. Control Panels shall have SCADA capabilities which requires an Ethernet or cellular access with static IP addressing. Panel are required to allow real-time connectivity with the control panel web page and alarm communications. Phone dialers shall not be considered as an equivalent Engineer-approved equal.
3. Panel shall be covered by a 3-year warranty unless covered under a project-specific warranty. All components shall be an integrated package provided by a single manufacturer/**supplier** and be designed to work together.
4. Panel shall be capable of the following:
 - a. Data collection and utilization: logs data for system conditions and events such as daily flows, pump run time, pump cycles, and alarm conditions. Logs shall be stored for at least one year.
 - b. Downloadable logs: Download logs into a .dif or ASCII format for simple conversion to common spreadsheet or word processing file.
 - c. Multit-level password security: only qualified personnel can remotely access site.
 - d. Programmed logic to meet the required functionality for a fully operational system and remote capable for changes and updates to firmware of programming.
 - e. Program rules to be written based on several operands, including the following:
 - 1) Input/output status
 - 2) Point status
 - 3) Date: mm/dd/yy format
 - 4) Time of day: 24-hour clock
 - 5) Historical data (allows for control optimization or detection of trends)

- f. Scheduling function to control digital “points” based on date or day of week/time.
 - g. Automatic daylight savings time adjustments.
 - h. Email function with automatic call-out to at least 16 unique mailboxes.
 - i. Collecting data and detecting trends that could lead to system failures.
 - 5. In addition, the unit shall have the capability of real-time direct connection to the panel via laptop serial port, to allow the operator real-time access to detailed logged data and the ability to change point values.
 - a. Standard components must include at a minimum:
 - 1) Motor-start contactor: 18A, three phase, 1-1.5hp 50/60Hz, 2.5 million cycles at FLA.
 - 2) HOA 3-way toggle switches: single -pole switch, Hand, Off, Auto (on).
 - 3) Controls circuit breaker: 10A, OFF/ON switch. Single-pole 120VAC. DIN rail mounting with thermal magnetic tripping characteristics.
 - 4) Pump circuit breaker: 20A, OFF/ON switch. Single-pole for 120VAC or double-pole for 230VAC. DIN rail mounting with thermal magnetic tripping characteristics.
 - 5) Audio alarm: 95dB at 24in (610mm), warble-tone sound.
 - 6) Ground fault interrupter (GFI): 120VAC, 15A.
 - 7) Current sensor: 24VDC, 4-20mA with adjustable high and low alarm set points.
 - 8) Visual alarm: 22mm pushbutton with red lens, “push-to-silence.” Must maintain UL Type 4X rating, LED bulb, 115VAC.
 - 9) Panel enclosure: UL Type 4X rated (NEMA rating not acceptable) constructed of UV-resistant fiberglass or UL Type 4 rated (NEMA rating not acceptable), constructed of steel; hinges and latch must be stainless steel.
 - 10) Remote telemetry unit: VCOM or approved equal telemetry controller; required for system input/output (I/O) to be fully supported plus 10% spare; self, 24VDC power supply for all calculated needs plus 25%; 16 digital I/O expandable as necessary; minimum 16 analog inputs expandable as necessary. On-board Ethernet port (10 base T, RJ45jack) and Modbus port (R5422/485 terminals). Non-volatile memory backup of programming.
 - 11) Local touchscreen display: must connect to the controller via Ethernet, bright 16-bit colors, high definition TFT analog resistance touchscreen, 32-bit RISC CPU, 400MHz with 128M Flash DRAM, 10.1in (257mm)
 - 12) Industrial Ethernet switch: managed with at least 5 ports, 10/100 Base-T, 10-30VDC power input.
 - 13) Surge arrestor: Type 1 surge protective device, rated for 36kA per phase, UL listed.
 - 6. Control Panel Location: Post and Panel mounting is required as shown on plans. The control panel shall be located within 50ft and in sight of the pump motor. The panel should be located at a convenient height and where it will be accessible for maintenance.

BASIS FOR DESIGN

2.4 CONCRETE RECIRCULATION TANKS

- A. Description: ASTM C1227, precast, reinforced-concrete tank and covers; single chamber with two chambers.

- B. Design: For A-16 (HS20-44) traffic loading according to ASTM C890.
- C. Access:
 - 1. 24-inch- minimum diameter opening with reinforced-concrete riser to grade and access lid with steel lift rings. Include “bolt down” style manhole in center of inlet end of septic tank compartment top.
 - 2. 48”x48” square riser with 6” walls to grade. Include aluminum hatch and pad lock hasp in center of the outlet.
- D. Resilient Connectors: ASTM C923, of size required for piping, fitted into inlet and outlet openings.
 - 1. Capacity: 3,600 gal.
 - 2. Inlet Size: 6” PVC
 - 3. Size/Dimensions: As detailed
- E. All joints and penetrations shall be sealed and watertight, with tanks passing pressure test upon installation. Joint sealant shall be bitumen of butyl rubber and comply with ASTM C 990.
 - 1. Recirculating Splitter Valve – Assembly to allow effluent to recirculate through the pre treatment pod or to the dosing/pump tank. Valve position is influenced by the level of effluent in recirculation tank. Recirculation Splitter Valve shall be part of an integrated treatment package provided by a single manufacturer/**supplier** and be designed to work together.
- F. Pumps:
 - 1. Pumps must be submersible high-head effluent pumps. Pumps shall be UL and CSA listed for use with effluent. The pumps shall have a 1/8in bypass orifice to ensure flow circulation for motor cooling and to prevent air bind. The pumps shall have floating impeller or floating stack design to protect against up thrust and increase pump life. The pumps ‘liquid ends must be repairable (by replacing impellers and /or diffusers) for better long-term cost of ownership. The motor must be rated for continuous use and frequent cycling , at least 100 cycles per day. The moto cable must be suitable for Class I, Division 1 and 2 applications. The pumps shall be lightweight for easy removal and maintenance. The pumps’ intake screens must be 1/8in mesh polypropylene. Pumps shall have internal thermal overload protection and internal lightning protection. All pumps shall undergo 3-point (Dead head, design flow, and design flow + 30%) wet testing at the factory to confirm performance. Pumps shall be compatible with and of the same manufacturer/supplier as mounting brackets and housings to ensure compatibility.
 - a. Recirculation Tank Pumps (Duplex) – Pumps shall be approved for use in the pump vault as described in these specifications. Pumps shall be 3/4hp 230v 8.5Amps rated for 50 gpm and 300 cycles per day.
- G. Floats:
 - 1. Recirculation Tank Floats: Float switches shall be mercury free, normally open mechanical float switches mounted of a PVC Stem attached to the pump vault. The float switches must be adjustable and must be removable without removing the pump vault. The high-level alarm, timer override on/off, and low-level alarms shall be preset as

shown on the plans. Each float switch lead shall be secured with a nylon strain relief bushing at the splice box. All components shall be an integrated package provided by a single manufacturer/**supplier** and be designed to work together.

- H. Controls: Controls for both dose/pump and recirculation tanks shall be duplex controls
1. Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or the need for substantial disassembly.
 2. Control Panels shall have SCADA capabilities which requires an Ethernet or cellular access with static IP addressing. Panel are required to allow real-time connectivity with the control panel web page and alarm communications. Phone dialers shall not be considered as an equivalent Engineer-approved equal.
 3. The panel shall be covered by a 3-year warranty unless covered under a project-specific warranty. All components shall be an integrated package provided by a single manufacturer/**supplier** and be designed to work together.
 4. Panel shall be capable of the following:
 - a. Data collection and utilization: logs data for system conditions and events such as daily flows, pump run time, pump cycles, and alarm conditions. Logs shall be stored for at least one year.
 - b. Downloadable logs: Download logs into a.dif or ASCII format for simple conversion to common spreadsheet or word processing file.
 - c. Multi-level password security: only qualified personnel can remotely access site.
 - d. Programmed logic to meet the required functionality for a fully operational system and remote capable for changes and updates to firmware of programming.
 - e. Program rules to be written based on several operands, including the following:
 - 1) Input/output status
 - 2) Point status
 - 3) Date: mm/dd/yy format
 - 4) Time of day: 24-hour clock
 - 5) Historical data (allows for control optimization or detection of trends)
 - f. Scheduling function to control digital "points" based on date or day of week/time.
 - g. Automatic daylight savings time adjustments.
 - h. Email function with automatic call-out to at least 16 unique mailboxes.
 - i. Collecting data and detecting trends that could lead to system failures.
 5. In addition, the unit shall have the capability of real-time direct connection to the panel via laptop serial port, to allow the operator real-time access to detailed logged data and the ability to change point values.
 - a. Standard components must include at a minimum:
 - 1) Motor-start contactor: 18A, three phase, 1-1.5hp 50/60Hz, 2.5 million cycles at FLA.
 - 2) HOA 3-way toggle switches: single -pole switch, Hand, Off, Auto (on).
 - 3) Controls circuit breaker: 10A, OFF/ON switch. Single-pole 120VAC. DIN rail mounting with thermal magnetic tripping characteristics.
 - 4) Pump circuit breaker: 20A, OFF/ON switch. Single-pole for 120VAC or double-pole for 230VAC. DIN rail mounting with thermal magnetic tripping characteristics.
 - 5) Audio alarm: 95dB at 24in (610mm), warble-tone sound.
 - 6) Ground fault interrupter (GFI): 120VAC, 15A.

- 7) Current sensor: 24VDC, 4-20mA with adjustable high and low alarm set points.
- 8) Visual alarm: 22mm pushbutton with red lens, "push-to-silence." Must maintain UL Type 4X rating, LED bulb, 115VAC.
- 9) Panel enclosure: UL Type 4X rated (NEMA rating not acceptable) constructed of UV-resistant fiberglass or UL Type 4 rated (NEMA rating not acceptable), constructed of steel; hinges and latch must be stainless steel.
- 10) Remote telemetry unit: VCOM or approved equal telemetry controller; required for system input/output (I/O) to be fully supported plus 10% spare; self, 24VDC power supply for all calculated needs plus 25%; 16 digital I/O expandable as necessary; minimum 16 analog inputs expandable as necessary. On-board Ethernet port (10 base T, RJ45jack) and Modbus port (RS422/485 terminals). Non-volatile memory backup of programming.
- 11) Local touchscreen display: must connect to the controller via Ethernet, bright 16-bit colors, high definition TFT analog resistance touchscreen, 32-bit RISC CPU, 400MHz with 128M Flash DRAM, 10.1in (257mm); or **Engineer**-approved equal.
- 12) Industrial Ethernet switch: managed with at least 5 ports, 10/100 Base-T, 10-30VDC power input.
- 13) Surge arrestor: Type 1 surge protective device, rated for 36kA per phase, UL listed.

- I. Control Panel Location: Post and Panel mounting is required as shown on plans. The control panel shall be located within 50ft and in sight of the pump motor. The panel should be located at a convenient height and where it will be accessible for maintenance.

BASIS FOR DESIGN

2.5 PRETREATMENT POD

- A. Pretreatment must be capable of treating a peak of 3,000 gpd and shall be installed to plan and manufacturer's recommendations and instruction. Pretreatment shall be a packed-bed filter consisting of a proprietary textile media housed in a 15.9ft x 7.6ft x 3.3ft basin. The media has been engineered for wastewater applications. Pretreatment should result in peak reduction of 90% in BOD, 88% TSS, 57.8% NH₃, and 40% TN.
 1. Pod shall be dosed at 50GPM for one minute with 12 minutes off to achieve desired treatment rate.

BASIS FOR DESIGN

2.6 CHEMICAL FEEDERS

- A. Liquid chemical feeder shall be manufactured from corrosion-resistant stainless steel and durable fiberglass parts. Feeder shall include a 1/3hp 1750rpm, direct drive mixer to keep slurries in suspension. Alkalinity feed rates shall be controlled by a peristaltic pump with a maximum rate of 2.19gal/h to the injection point. Chemical feed program shall be selected

from suppliers standard programming protocol based on alkalinity deficit in the pumped influent.

BASIS FOR DESIGN

2.7 CONCRETE MANIFOLD BOXES

- A. Description: Precast concrete, single-chamber box and cover.
- B. Design: Precast concrete, Aluminum hatch with locking clasp.
- C. Resilient Connectors: ASTM C923, of size required for piping, fitted into inlet and outlet openings. Include watertight plugs in outlets not required.
- D. Capacity and Characteristics
 - 1. Inlet Size: 2.5" Sch 40 PVC.
 - 2. Number of Outlets: Varies, See Tap Charts.
 - 3. Outlet Size: 3.0" Sch 80 PVC

2.8 CHAMBER ABSORPTION-SYSTEM MATERIALS

- A. Chamber: Arched, molded-PE structures with solid top, perforated sides, open ends, and open bottom. Chamber system must be an approved innovative system in the State of North Carolina, compliant with 15A NCAC 18A .1900 ,with equivalency Rating/sizing of 4.0ft²/lf..
- B. End Pieces: Blank without opening for distribution pipe at end of last chamber in row, and with opening for distribution pipe where pipe penetrates chamber.
- C. Effluent Distribution Piping: PE or PVC pipe, with holes or slots along pipe, attached to underside of top of chambers.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling for piping are specified in Section 312000 "Earth Moving."
 - 1. Stockpile topsoil for reuse in finish grading without intermixing with other excavated material. Stockpile materials away from edge of excavation and do not store within drip line of remaining trees.
 - 2. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Excavating and Backfilling for Septic, recirculation, and Dosing Tanks:

1. Excavate sufficient width and length for tanks to depth determined by tank inlet elevation. Provide level bottom.
 2. Backfill in lifts with excavated soil, compacting to 95%.
- C. Excavating and Backfilling for Chamber Absorption Systems:
1. When excavating and backfilling trenches, care should be taken to minimize impacts to surrounding soils.
 2. Backfill with excavated soil as specified in details without compacting.

3.2 SEPTIC TANK INSTALLATION

- A. Install precast concrete septic tanks according to ASTM C891 and manufactures standards.
- B. Install septic tanks level.
- C. Install filter in septic tank outlet. Secure filter to septic tank wall. Make direct connections to distribution piping.
- D. Fill septic tank with water.

3.3 DOSING/RECIRCULATION TANK INSTALLATION

- A. Install dosing tanks according to ASTM C891.
- B. Install tanks level.
- C. Install filter in the recirculation tank and make direct connections to distribution piping in both tanks.
- D. Set submersible effluent pumps within pump vault. Make direct connections to outlet system and 2.5" force main.
- E. Fill dosing and recirculation tanks with water.

3.4 PRETREATMENT POD INSTALLATION

- A. All treatment, pumping, and electrical components shall be installed in accordance with the manufacturer's recommendations and instructions, the engineers' plans, and all state and local regulations.
- B. Install pod level.

3.5 PUMPS & CONTROLS

- A. All treatment, pumping, and electrical components shall be installed in accordance with the manufacturer's recommendations and instructions, the engineers' plans, and all state and local regulations.

3.6 MANIFOLD BOX INSTALLATION

- A. Install precast-concrete manifold boxes according to ASTM C891 and at invert elevations indicated. Set level and plumb.

3.7 PIPING INSTALLATION

- A. Comply with requirements for sewer pipe installation specified in Section 221313 "Facility Sanitary Sewers."

3.8 PIPE JOINT CONSTRUCTION

- A. Join distribution piping with or according to the following:
 - 1. Install pipe and fittings for trench absorption systems with closed joints unless otherwise indicated.
 - 2. PVC Sewer Pipe and Fittings: With solvent-cemented joints according to ASTM F402 and ASTM D2321.
- B. Join dissimilar pipe materials according to ASTM D5926, with couplings and gaskets compatible with pipe materials being joined.

3.9 CLEANOUT INSTALLATION

- A. Install cleanouts according to the following:
 - 1. Inlet of Septic Tanks: PVC cleanouts.
 - 2. Outlet of Manifold Boxes: PVC cleanouts.
 - 3. At Ends of Each Row of Distribution Piping: PVC cleanouts.
- B. Comply with requirements for cleanouts specified in Section 221313 "Facility Sanitary Sewers."

3.10 CHAMBER ABSORPTION-SYSTEM INSTALLATION

- A. Install sewer piping flat.
- B. Install chambers with no slope above plowed area.

1. Install chamber distribution piping with tight joints throughout chambers.

3.11 IDENTIFICATION

- A. Identification materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green, detectable warning tape directly over piping, at outside edges of underground structures, and at outside edges of absorption systems.

3.12 FIELD QUALITY CONTROL

- A. Preconstruction Conference: Before work on the septic system at the site is started, a conference attended by the Owner, Contractor, Engineer, Manufacturer or Manufacturer's Representative, Operator, and others as appropriate, will be held to establish a working understanding among the parties as to the work involved for installing each component of the treatment system.
- B. System Tests and Training: Manufacturer's representative shall provide the services of a trained representative to instruct the installing Contractor's crew regarding the proper installation and field testing of each component of the mechanical systems per the Manufacturer's recommendations and requirements. Perform testing of completed septic tank system piping and structures according to authorities having jurisdiction and manufacturers recommendations.
- C. Additional Tests: Fill underground structures with water and let stand overnight. If water level recedes, locate and repair leaks and retest. Repeat tests and repairs until no leaks exist.
- D. To ensure quality control, the **Inspector** shall inspect and certify that an initial installation of the mechanical system complies with the **Manufacturer's** recommendations and requirements.
- E. Upon completion of the inspection, the **Inspector**, in coordination with the **Engineer**, shall direct the **Contractor** to perform any required adjustments to the equipment and place it into operation under the supervision of the Manufacturers representative and the **Engineer**. All equipment and materials required to perform the testing shall be the responsibility of the **Contractor**. A letter of completion shall be signed by the **Inspector** and copies shall be faxed, emailed, or mailed to the **Engineer** and **Manufacturer** within one (1) week of the system being installed and prior to system commissioning.

3.13 CLEANING

- A. Clear interior of piping and structures of dirt and other superfluous material as work progresses.
- B. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of workday or when work stops.

END OF SECTION 221353