SECTION 33 30 00

SANITARY SEWER UTILITIES

SPEC WRITER NOTES:

1. Delete between // _____ // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.

2. References to pressure in this section are gage pressure unless otherwise noted.

3. This section covers sanitary sewer utilities on-site to five feet from building line.

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies materials and procedures for construction of outside, underground sanitary sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.

B. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

C. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATION.

D. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

E. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

SPEC WRITER NOTE: Add definitions as necessary for project clarity.

1.4 ABBREVIATIONS

A. PVC: Polyvinyl chloride plastic

B. DI: Ductile iron pipe

1.5 DELIVERY, STORAGE AND HANDLING

A. Store plastic piping protected from direct sunlight and support to prevent sagging and bending. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.

B. Handle manholes according to manufacturer's written rigging instructions.

SPEC WRITER NOTE: Verification by designer needs to document that the sewer main has capacity for sewerage flow. Use one paragraph A or B below based on the responsibility for the verification.

1.6 COORDINATION

A. Coordinate connection to sanitary sewer main with Public Utility company. (Approval from public utility has been obtained indicating that the downstream sanitary systems have sufficient capacity to handle the sanitary discharge from the facility.)

B. Contractor to obtain approval from the Public Agency that the existing sanitary sewer systems have the capacity to handle the discharge from the facility.

C. Coordinate exterior utility lines and connections to building lines up to 5 feet of building wall.

D. Coordinate connection to public sewer system with Public Utility Company.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Sanitary Sewer lines and the extension, and/or modifications to Public Utility Systems.

1.8 SUBMITTALS:

A. Manufacturers' Literature and Data shall be submitted for the following as one package:

1. Pipe, Fittings, and, Appurtenances.
2. Jointing Material.
3. Manhole and Structure Material.
4. Frames and Covers.

5. Steps and Ladders.
6. // Gate Valves. //
7. // Valve Boxes. //
8. // Check Valves. //
9. // Air Release Valves. //
10. // Acid Neutralization Tanks. //

1.9 APPLICABLE PUBLICATIONS

SPEC WRITER NOTE: Based on project design for local conditions, delete references not applicable for project.

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A74-09	Cast Iron Soil Pipe and Fittings
A185/A185M-07	Steel Welded Wire Reinforcement, Plain, for Concrete
A615/A615M-09b	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
A746-99	Ductile-Iron Gravity Sewer Pipe
C478-09	Precast Reinforced Concrete Manhole Sections
C857-11	Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
C890-11	Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
C913-08	Precast Concrete Water and Wastewater Structures
C923-08	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
C924-02(2009)	Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

C990-09 ..... Joints for Concrete Pipe, Manholes, and precast Box Sections using Preformed Flexible Joint Sealants

C1173-10 ..... Flexible Transition Couplings for Underground Piping Systems

C1440-08 ..... Thermoplastic Elastomeric (TPE) Gasket Materials for Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems

C1460-08 ..... Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground

C1461-08 ..... Mechanical Couplings Using Thermoplastic Elastomeric (TPE) Gaskets for Joining Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing systems for Above and below Ground Use

D2321-11 ..... Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D3034-08 ..... Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

F477-10 ..... Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-08 ..... Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F891-10 ..... Coextruded Poly(vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

F949-10 ..... Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

F1417-11 ..... Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1668-08 ..... Construction Procedures for Buried Plastic Pipe

C. American Water Works Association (AWWA):

C105/A21.5-10 ..... Polyethylene Encasement for Ductile-Iron Pipe Systems

C110-08 ..... Ductile-Iron and Gray-Iron Fittings

C111/A21.11-06 ..... Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

C151/A21.51-09 ..... Ductile Iron Pipe, Centrifugally Cast

C153/A21.53-06 ..... Ductile Iron Compact Fittings for Water Service

C219-11 ..... Bolted, Sleeve-Type Couplings for Plain-End Pipe

C512-07 ..... Air Release, Air/Vacuum and Combination Air Valves for Water Works Service

C600-10 ..... Installation of Ductile-Iron Mains and Their Appurtenances

C900-07 ..... Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

D. American Society of Mechanical Engineers:

A112.14.1–2003 ..... Backwater Valves

A112.36.2M-1991 ..... Cleanouts

1.10 WARRANTY

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of // one year // two years // from final acceptance. Further, the Contractor will provide all manufacturers’ and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

SPEC WRITER NOTE: If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another. Verify rated pressure listed is applicable to project. Delete sections not applicable to project.

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements.

B. All pipe and fittings used in the construction of force mains shall be rated to meet the system maximum operating pressure with a minimum of 150 psi (1035 kPa).

C. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

SPEC WRITER NOTE: Preferred joints for all pipes are gasketed type. Verify if any acids or petroleum products are to be carried in main pipe. If condition exists, gaskets need to be compatible with the material being handled.

2.2 DUCTILE-IRON PIPE AND FITTINGS

SPEC WRITER NOTE: Joints are gasketed type.

A. Mechanical Joint Piping

1. Pipe and Fittings: AWWA C151, thickness // insert class // unless otherwise shown or specified.
2. Compact Fittings: AWWA C153.
3. Gaskets: AWWA C111.
4. Exterior coating: AWWA C151.
5. Interior lining shall be as per ASTM A746.
6. Pipe and fittings shall be polyethylene encased as per AWWA C105.

B. Push-on-Joint Piping:

1. Pipe: AWWA C151, thickness // insert class // , with bolt holes in bell.
2. Standard Fittings: AWWA C110.
3. Compact Fittings: AWWA C153.
4. Gaskets: AWWA C111.
5. Exterior coating: AWWA C151.
6. Interior lining: AWWA C151.
7. Pipe and fittings shall be polyethylene encased as per AWWA C105.

2.3 PVC, GRAVITY SEWER PIPE AND FITTINGS

SPEC WRITER NOTE: Select the appropriate type of pipe and fitting for use on project. Delete other options.

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings shall conform to // ASTM D3034 // or // ASTM F679 //, // SDR 35 // SDR 26 //.
2. Gaskets: ASTM F477.

B. PVC Cellular-Core Sewer Piping:

1. Pipe and Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: // ASTM D3034 // ASTM F679 // SDR 35 // SDR 26.

C. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F949, corrugated pipe with bell and spigot ends.
2. Fittings: ASTM F949.
3. Gaskets: ASTM F477.

D. PVC Type PSM Sewer Piping:

1. Pipe shall conform to // ASTM D3034 // or // ASTM F679 //, // SDR 35 // SDR 26 //.
2. Fittings: ASTM D3034.
3. Gaskets: ASTM F477.

SPEC WRITER NOTE: Select one of the paragraphs.

2.4 PVC, PRESSURE PIPE AND FITTINGS

A. PVC:

1. Pipe: AWWA C900, // Class 100 // Class 150 // and // Class 200// PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, // Class 100 // Class 150 // and // Class 200//.
3. Gaskets: ASTM F477.

2.5 GRAVITY FLOW LINES WITH SECONDARY CONTAINMENT (ENCASEMENT)

A. Piping systems conveying hazardous materials shall be constructed with a watertight primary (carrier) pipe completely enclosed within a watertight secondary (containment) pipe.

B. Piping and fittings shall be as per // ASTM D3034 // AWWA C105 //.

C. The carrier pipe shall be installed with manufactured spacers to maintain a minimum interstitial space of 0.75 inch (19 mm) between the carrier pipe and the containment pipe.

D. The encasement piping shall be equipped with // adequate monitoring ports // and // vents // to detect the presence of fluids within the containment pipe and for the extraction of fluids from the containment pipe.

E. Encasement pipe shall be bell and spigot with adhesive bond.

2.6 PVC PRESSURE (FORCE) MAIN:

A. Joints shall be fully restrained with mechanical joints, capable of restraining 50 percent above all loads acting on the joint, but not less than 150 psi (1035 kPa). Thrust blocks shall not be permitted.

B. Ductile iron pipe and fittings: AWWA C151.

1. Push-on joints shall be restrained by a mechanical restraint and prevent the opening of the joint.

C. Polyvinyl Chloride (PVC) Pipe and Fittings:

1. Pipe: ASTM D3034, SDR 35.
2. Gaskets: ASTM F477.

2.7 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve type, reducing or transition coupling, for joining underground nonpressure piping. Include ends to match same sizes of main line piping and install corrosion-resistant metal tension bands and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F477, elastomeric seal.
2. For Dissimilar Pipes: PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Couplings shall be elastomeric sleeve with //stainless steel shear ring and // corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Couplings shall meet ASTM C1460 with // elastomeric // or // rubber sleeve // with full-length, corrosion-resistant outer shield with corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger mainline pipe and for spigot of smaller main line pipe to fit inside ring.

SPEC WRITER NOTE: Coupling in paragraph below should not be used for liquids at temperatures below minus 0 deg F (18 deg C) or above 130 deg F (54 deg C).

F. Nonpressure-Type, Rigid Couplings:

1. Coupling shall be ASTM C1461, // sleeve-type, reducing- // or // transition-type mechanical coupling //, molded from ASTM C1440, TPE

material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.8 PRESSURE-TYPE PIPE COUPLINGS

A. Tubular-Sleeve Couplings:

1. Couplings shall meet AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

B. Metal, bolted, sleeve-type, reducing or transition couplings for joining underground pressure piping:

1. Couplings shall meet a // 150-psi (1035-kPa)// 200-psi (1380-kPa) // insert value // minimum pressure rating and ends of same sizes of the main line piping.

C. Center-Sleeve Material:

1. Sleeve shall be // Manufacturer's standard // Carbon steel // Stainless steel // Ductile iron // Malleable iron //.

D. Gasket material: Gaskets shall be natural or synthetic rubber.

E. Metal component finish: Finish shall be a corrosion-resistant material or coating.

2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS

SPEC WRITER NOTES:

1. Joints and fittings in this article are for buried, ductile iron pipe. Select joint for project specific criteria.

2. Expansion joints in first paragraph below provide both offset and expansion. Indicate minimum required offset and expansion data on Drawings.

A. Ductile-Iron, Flexible Expansion Joints:

1. Compound fittings: Fittings shall have a combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and // one // or // Insert number // gasketed sleeve section//s//, rated for 250-psi (1725-kPa) minimum working pressure and for offset and expansion indicated.

SPEC WRITER NOTE: Expansion joints below provide linear expansion only.

B. Ductile-Iron Expansion Joints:

1. Jointing Material: Joints shall be a three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psi (1725-kPa) minimum working pressure and for expansion indicated.

SPEC WRITER NOTE: Fittings in paragraph below provide deflection only.

C. Ductile-Iron Deflection Fittings:

1. Jointing Material: Compound coupling fittings with ball joint, flexing section, gaskets, and restrained-joint ends shall comply with AWWA C110 or AWWA C153. Include rating for 250-psi (1725-kPa) minimum working pressure and for up to 15 deg of deflection.

2.10 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

1. Valve Material: Valve shall be as per ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

SPEC WRITER NOTE: Retain one or more of three subparagraphs below. If more than one type is required, show location of each on Drawings.

2. // Horizontal type //: Horizontal valve will include a swing check valve and hub-and-spigot ends.
3. // Combination horizontal and manual gate-valve type //: Valve will include a swing check valve, integral gate valve, and hub-and-spigot ends.
4. // Terminal type //: Valve will include a bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:

1. PVC valve shall be a horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.11 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Cleanouts shall be as per ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

SPEC WRITER NOTE: Retain one or more options in first subparagraph below. If more than one loading classification is required, show location of each on Drawings.

2. Top-Loading Classification(s): Valve loadings shall be designed for // Light Duty // Medium Duty // Heavy Duty // and // Extra-Heavy Duty //.
3. Cleanout Riser: Sewer pipe fitting on main line pipe and riser shall be as per ASTM A74, service class.

B. PVC Cleanouts:

1. PVC body with PVC threaded plug: Cleanout shall be as per ASTM D3034. PVC sewer pipe fitting and riser to cleanout.
2. Cleanout Riser: Sewer pipe fitting on main line sewer and riser shall match main line piping.

2.12 MANHOLES

A. Standard precast concrete manholes and vaults shall be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections or cast-in-place concrete.

1. Precast Concrete Manholes: Material shall be as per ASTM C478, precast, reinforced concrete, of depth indicated, with sealed joints.
2. Concrete Base: Concrete for base of manhole shall have a minimum compressive strength of 5000 psi (35 MPa) at 28 days. Thickness to be 8 inches (200 mm), minimum.
3. Riser Section: 4 inch (100 mm) minimum thickness, of lengths to provide the total depth of manhole.
4. Top Section: Eccentric-cone type unless otherwise indicated. Top section to match adjustment ring configurations.
5. Joint Sealant: ASTM C990.
6. Resilient Pipe Connectors: ASTM C923.
7. Steps: If over 60 inches (1500 mm) in depth, // individual FRP steps or ladder // ASTM A615 deformed, 1/2 inch (13 mm) steel reinforcing rods encased in precast concrete sections // // insert material //, with 16 inch (400 mm) minimum width, 12 to 16 inches (300 to 400 mm) center-to-center from top to bottom.
8. Adjusting Rings: Reinforced-concrete rings; 6 to 9 inch (150 to 225 mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Concrete Manholes:

1. Description: ASTM C913; designed according to ASTM C890 for AASHTO HS20-44, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.

5. Steps: If over 60 inches (1500 mm) in depth, // individual FRP steps or FRP ladder // individual FRP steps, FRP ladder, or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing rods encased in // Insert material //; width 16 inches (400 mm) minimum, 12 to 16 inches (300 to 400 mm) center-to-center from top to bottom.
6. Adjusting Rings: Reinforced-concrete rings; 6 to 9 inch (150 to 225 mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Base Channels: Manhole channels shall be main line pipe material. Lay main pipe through manhole and cut top of pipe out to be three-fourths of pipe diameter. Slope through manhole to match run slopes of the main pipe.

2.13 CONCRETE

A. Cast-in-place concrete shall be 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.
B. Reinforcement
   1. Reinforcing fabric shall be ASTM A185, steel, welded wire fabric, plain.
   2. Reinforcing bars shall be ASTM A615, Grade 60 (420 MPa) deformed steel.
C. Benches shall be concrete, sloped to drain into the channel. Provide 6 inches (150 mm) from the cut section of top of pipe to edge of manhole.
D. Ballast and Pipe Supports shall be Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

2.14 WET WELL

SPEC WRITER NOTE: Select type of wet well tank. Concrete tanks shall not be used when total required volume is less than 1000 gallons (3,785 liters).

A. Fiberglass wet well. Tank shall be a single wall fiberglass reinforced plastic (FRP) UL labeled underground storage tanks as shown on the drawings. Size and fittings shall be as shown on drawings.
B. Concrete Wet Well:
   1. Concrete wet well shall be a circular precast vault conforming to ASTM C857.
   2. Vault Material: The vault shall have a poured concrete base with precast walls, and top poured in place structure.

3. Concrete: Concrete shall be 5000 psi (35 MPa) concrete at 28 days.
4. Design Load: The vault shall be rated for AASHTO HS20-44 loading and 30 percent impact loads.
5. Joints: Joints in the vault shall be tongue and groove. Flexible sealing compound, as recommended by the manufacturer, shall be placed in all joints to form a watertight structure.
6. Interior Coating: Concrete coating for the interior of wet wells shall consist of an epoxy blended filler sealer, and a cross linked epoxy phenolic cured, resistant protective coating.

C. Tank Design Criteria:

1. Internal Load: Tank shall withstand without leakage a 5 psi (34.5 kpa) air pressure test with 5 to 1 safety factor. Contractor shall test prior to installation as this is to test for leakage.
2. Vacuum Test: The tank shall be tested to 11.5 inches (292 mm) of mercury vacuum by the tank manufacturer to assure structural integrity. Contractor shall submit vacuum test certificate if test conducted by manufacturer at plant.
3. Surface Loading: Tank shall withstand surface AASHTO HS20-44 axle loads.
4. External Hydrostatic Pressure: Tank shall withstand 7 feet (2.1 m) of overburden with the hole fully flooded with a 3 to 1 safety factor against leaking.
5. Threaded fittings shall be of a material consistent with the requirements of the UL label and be of the sizes and locations shown on the drawings.
6. Tanks shall have nominal capacity as shown on drawings with a minimum of a 36 inch square (900 mm) ID manway riser, a complete cast iron frame and lid at finish grade, steps, and lid that is spring loaded. //

2.15 ACID NEUTRALIZATION TANKS

SPEC WRITER NOTE: Acid neutralization tank materials should be coordinated with piping materials and requirements for building and laboratory water piping specifications. If an acid tank is required, verify all main line gasket specifications for compatibility with the chemicals being handled.

A. Acid neutralization tanks shall be constructed of 1/4 inch (6 mm) plate, mild carbon steel suitable for rubber type lining with all welds double

butt, continuous full welded, non porous and ground smooth and having no crevices, offsets or sharpened edges. The bottom and side walls shall be lined with 1/4 inch (6 mm) thermoplastic sheet lining fused directly to white ceramic lining 2 inches (50 mm) thick laid in Permamite acid and alkali proof mortar. The tank shall include 42 inch (1050 mm) ID manway riser constructed of steel shell with an interior corrosion resistant coating and complete cast iron frame and lid at the finish grade. Neutralizing charge shall be limestone, 3 inches (75 mm) in size.

2.16 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

A. Pit shall be constructed of reinforced precast concrete or cast-in-place concrete of the shape and configuration indicated on the plans. Precast vaults shall be constructed in accordance with ASTM C857 and be rated for AASHTO HS20-44 loading. The concrete shall have a minimum compressive strength of 5000 psi (35 MPa) at 28 days, and reinforcement shall comply with ASTM A615, Grade 60. Access to the pit shall be through 24 inches (600 mm) diameter manhole frame and cover or through hinged aluminum access manways.

B. Baffles shall be constructed of 1/4 inch (6 mm) mild carbon steel with 1/4 inch (6 mm) thermoplastic coating.

2.17 AIR RELEASE VALVE FOR FORCE MAINS

A. Valves shall be combination air release and vacuum valve with a single body. The valves shall be rated for 150 psi (1025 kPa) working pressure, and conform to AWWA C512. Valve shall be provided with threaded connections, and be mounted on a full opening ball valve to isolate the air release valve from the system.

SPEC WRITER NOTE: Use non-detectable type at cemeteries only.

2.18 WARNING TAPE

A. Warning tape shall be standard, 4 mil (0.1 mm) polyethylene 3 inch (76 mm) wide tape // detectable // non-detectable // type, green with black letters and imprinted with “CAUTION BURIED SEWER LINE BELOW”.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans and details indicate the general location and arrangement of underground sanitary sewer piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at the low point, true to grades and alignment indicated on the drawings, 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. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.

D. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.

E. Inspect pipes and fittings for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.

F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.

G. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 12 inches (300 mm) over the crown of the pipe.

H. Warning tape shall be continuously placed 12 inches (300 mm) above sewer pipe

I. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

J. 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.

K. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process or microtunneling.

L. Install gravity-flow, non-pressure, drainage piping according to the following:

SPEC WRITER NOTE: Revise first three subparagraphs below to suit Project.

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping with // 36 inch (915 mm) // 48 inch (1220 mm) // 60 inch (1520 mm) // 72 inch (1830 mm) // Insert number // minimum cover as shown on Drawings.
3. Install ductile iron, gravity sewer piping according to AWWA C600.

4. Install PVC cellular-core, PVC corrugated sewer, PSM sewer and PVC gravity sewer according to ASTM D2321 and ASTM F1668.

M. Install force-main, pressure piping according to the following:
1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fittings, or cast-in-place-concrete supports or anchors. Pressure (force) mains shall have the bells facing the direction of flow.
2. Sections of piping listed on the drawings shall be fully restrained. For devices with twist off nuts, the twist off nuts shall be placed on top of the fitting for the Resident Engineer’s inspection. The Contractor shall torque test all bolts, set screws, identified by the Resident Engineer.
3. Thrust blocks shall not be permitted.

N. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

O. Gravity Flow Lines with Secondary Containment (Encasement Pipe):
1. Install per manufacturer’s recommendations. Install all pipe centering devices to maintain an interstitial space below the invert of the carrier pipe. Both the carrier and containment pipe shall be tested for leaks.

3.2 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping according to the following:
1. Join ductile iron, gravity sewer piping according to AWWA C600 for push-on joints.
2. Join PVC piping according to ASTM D2321.
3. Join dissimilar pipe materials with nonpressure-type, // flexible // or rigid // couplings.

B. Join force-main, pressure piping according to the following:
1. Join ductile iron pressure piping according to AWWA C600 for push-on joints.
2. Join PVC pressure piping according to manufacturer’s recommendations.
3. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.
   a. // Unshielded // Shielded // Flexible // or // Rigid // couplings for pipes of same or slightly different OD.
   b. Unshielded, increaser/reducer-pattern, // flexible // or // rigid // couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure pipe couplings for force-main joints.

3.3 SEWER AND MANHOLE SUPPORTS, CONCRETE CRADLES WITHIN VAULTS

A. Install reinforced concrete as detailed on the drawings. The concrete shall not restrict access for future maintenance of the joints within the piping system.

3.4 BUILDING SERVICE LINES

A. Install sanitary sewer service lines to point of connection within approximately 5 feet (1500 mm) outside of building(s) where service is required and make connections. Coordinate the invert and location of the service line with the Contractor installing the building lines.

3.5 MANHOLE INSTALLATION

A. Install manholes complete with appurtenances and accessories indicated.

1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top, shall be sealed as per manufacturer’s recommendations. Adjust the length of the rings so that the top section will be at the required elevation. Cutting the top section is not acceptable.
3. Concrete manhole risers and tops: Install as specified.

B. Designed Concrete Structures:

1. Concrete structures shall be installed in accordance with Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. Do not build structures when air temperature is 32 deg F (0 deg C), or below.
D. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.
E. Install steps and ladders per the manufacturer’s recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade.
G. Install manhole frames and covers on a mortar bed, such that frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. Install an 8 inches (200 mm) thick, by 12 inches (300 mm) wide concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

SPEC WRITER NOTE: Select from Articles 3.6 through 3.9 below, if needed. Delete articles not pertinent to project.

3.6 WET WELLS

A. Install tank on a concrete pad as recommended by the manufacturer.
B. Installation of the tank and fittings shall be in accordance with the recommendations of the manufacturer.
C. In areas where the tank is subject to groundwater, the tank shall be anchored against floating as recommended by the manufacturer.
D. After installation, the inlets and outlets shall be plugged, and the tank completely filled with water. The tank shall have no leakage over a 48 hour period.
E. Top of wet well should be set a minimum of 6 inches (150 mm) above finish grade, unless in a traffic area, then it must match existing grade.
F. Install a 12 inches (300 mm) concrete ring around the fiberglass tank if in a grassed area.
G. All tank walls shall be level and plumb.
H. Seal all joints and depressions in the wet well.
I. Pipe and fittings entering and within the wet well shall be poly-lined ductile iron pipe.
J. All pipe penetrations through the walls of the wet well shall be sealed water tight.

3.7 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

A. Pipe and fittings shall be // ductile iron // poly-lined // PVC //, piping shall be used inside of trap, between trap and buildings, and between trap and manhole.

B. Manways and access manholes shall be set to finish grade providing adequate access to the unit. Slope pavement around the access-way to prevent stormwater from entering the unit.

C. Install baffles as indicated on the drawings.

3.8 ACID NEUTRALIZING TANKS

A. Set tank on aggregate base per the manufacturer’s recommendations.

B. Inspect interior and exterior of the tank and repair all damage to the lining. Place limestone in tank per manufacturer’s recommendations.

C. Backfill around tank with sand material.

3.9 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping manholes or pits.

B. Install combination horizontal and manual gate valves in piping and in manholes.

C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

3.10 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Cleanouts should be 6 inches (150 mm) in diameter and consist of a ductile iron 45 degree fitting on end of run, or combination Y fitting and l/8 bend in the run with ductile iron pipe extension, water tight plug or cap and cast frame and cover flush with finished grade. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete, 18 by 18 by 12 inches (450 by 450 by 300 mm) 1 inch (25 mm) above surrounding grade.

C. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with a 2 inches (50 mm) base

valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 24 inches (600 mm) in diameter.

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

E. The top of the cleanout assembly shall be 2 inches (50 mm) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

3.11 CONNECTIONS

A. Make connections to existing piping and underground manholes by coring and installing the pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.

B. Connection to an existing manhole: The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all new pipes connected to the manhole.

C. Use commercially manufactured wye fittings for piping branch connections. Encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

1. Make branch connections from the side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500), by removing a section of the existing pipe.
2. Make branch connections from the side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting an opening into existing unit large enough to allow 3 inches (76 mm) 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 concrete to provide additional support of collar from connection to undisturbed ground.
3. 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.

SPEC WRITER NOTE: Use article below if a pressurized system is required on the project.

3.12 AIR RELEASE VALVES

A. Set valves in vault or force mains with adequate space for maintenance of the valve. The vault shall have a solid floor to prevent all sanitary blowoff from being absorbed into the soils.

B. Valves shall be set plumb and supported to the vault. Maintain accessibility to the isolation valve on the air valve line.

C. Install the valve after the completion of testing of the pressure (force) main.

3.13 REGRADING

A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.14 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. 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.

1. Piping under and within 5 feet (1500 mm) of building areas shall be completely removed.
2. Piping outside of building areas shall // be completely removed // plugged with concrete, and abandoned in-place //.

B. Excavate around manholes as required and use either procedure below:

1. Manholes and structures outside of building areas: Remove frame and cover, cut and remove the top of an elevation of 2 feet (600 mm) below finished grade. Fill the remaining portion with compacted gravel or crushed rock or concrete.
2. Manholes and structures with building areas: Remove frame and cover and remove the entire structure and the base.

C. Backfill to grade according to Division 31 Section 31 20 00, EARTH MOVING.

D. When the limit of the abandonment terminates in an existing manhole to remain, the flow line in the bench of the manhole to the abandoned line shall be filled with concrete and shaped to maintain the flowline of the lines to remain.

3.15 PIPE SEPARATION

A. Horizontal Separation - Water Mains and Sewers:

1. Existing and proposed water mains shall be at least 10 feet (3 m) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.
2. Gravity flow mains and pressure (force) mains may be located closer than 10 feet (3 m) but not closer than 6 feet (1.8 m) to a water main when:
   a. Local conditions prevent a lateral separation of 10 feet (3 m); and
   b. The water main invert is at least 18 inches (450 mm) above the crown of the gravity sewer or 24 inches (600 mm) above the crown of the pressure (force) main; and the water main is in a separate trench separated by undisturbed earth.
3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe.

B. Vertical Separation - Water Mains and Sewers at Crossings:

1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 24 inches (600 mm) above the crown of gravity flow sewer or 48 inches (1200 mm) above the crown of pressure (force) mains. The vertical separation shall be maintained within 10 feet (3 m) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.
2. In no case shall pressure (force) sanitary main cross above, or within 24 inches (600 mm) of water lines.
3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 18 inches (450 mm) above or 12 inches (300 mm) below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 24 inches (600 mm) below the water line

provided both the water line and sewer line are constructed of ductile iron pipe.

4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 10 feet (3 m).

3.16 IDENTIFICATION

A. Install green warning tape directly over piping and at outside edges of underground manholes.

3.17 FIELD QUALITY CONTROL

A. All systems shall be inspected and obtain the Resident Engineer's approval. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

B. To inspect, thoroughly flush out the lines and manholes before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lips at joints on the inside of gravity sewer lines are not acceptable.

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. Re-inspect and repeat procedure until results are satisfactory.

C. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

1. Test plastic gravity sewer piping according to ASTM F1417.
2. Test concrete gravity sewer piping according to ASTM C924.
3. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be

pressurized to 4 psi (28 kPa) and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 3.5 psi (24 kPa) greater than the average back-pressure of any groundwater above the sewer.

4. For force mains, perform testing after supports and anchors are installed. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psi (1035 kPa).
5. Testing of Fiberglass Sewage Holding Tanks shall show no leakage during a 5 psi (35 kPa) air pressure test with 5:1 safety factor.
6. Testing of Concrete Wet Well shall show no leakage with the wet well completely filled with water for a duration of 4 hours.

3.18 CLEANING

A. Clean dirt and superfluous material from interior of piping.

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