SECTION 221313 - FACILITY SANITARY SEWERS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Hub-and-spigot, cast-iron soil pipe and fittings.

Hubless cast-iron soil pipe and fittings.

Ductile-iron, gravity sewer pipe and fittings.

Ductile-iron, pressure pipe and fittings.

ABS pipe and fittings.

PVC pipe and fittings.

Fiberglass pipe and fittings.

Concrete pipe and fittings.

Nonpressure-type transition couplings.

Pressure-type pipe couplings.

Expansion joints and deflection fittings.

Backwater valves.

Cleanouts.

Encasement for piping.

Manholes.

Concrete.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. FRP: Fiberglass-reinforced plastic.
			1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are submitted and tabbed (for combined submittals).
				4. Product Data: For the following:

Pipe and fittings.

Non-pressure and pressure couplings

Expansion joints and deflection fittings.

Backwater valves.

Cleanouts.

* + - * 1. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. Coordination Drawings:

Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

Retain subparagraph below if profiles are not indicated on Drawings.

Show system piping in profile. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet and to vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

Retain "Product Certificates" paragraph below to require submittal of product certificates from manufacturers.

* + - * 1. Product Certificates: For each type of pipe and fitting.
				2. Field quality-control reports.
			1. DELIVERY, STORAGE, AND HANDLING

Retain first paragraph below for ABS, PVC, or fiberglass piping.

* + - * 1. Do not store plastic manholes, pipe, and fittings in direct sunlight.
				2. Protect pipe, pipe fittings, and seals from dirt and damage.
				3. Handle manholes according to manufacturer's written rigging instructions.
			1. FIELD CONDITIONS

Retain this article if interruption of existing sanitary sewerage service is required.

* + - * 1. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Director’s Representative or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

Notify [**Director’s Representative**] no fewer than [**two**] <**Insert number**> days in advance of proposed interruption of service.

Do not proceed with interruption of service without [**Director’s Representative's**] written permission.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

If using more than one type of material and joining method, identify various materials on Drawings and indicate points of transition from one material to another.

* + - 1. HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

Pipe and fittings in this article are available in NPS 2 to NPS 15 (DN 50 to DN 375).

* + - * 1. Pipe and Fittings: ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”, [**Service class**] [**Service and Extra-Heavy classes**] [**and**] [**Extra-Heavy class**].
				2. Gaskets: ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber.

Retain "Calking Materials" paragraph below if allowed by local authorities having jurisdiction.

* + - * 1. Calking Materials: ASTM B29 “Standard Specification for Refined Lead”, pure lead and oakum or hemp fiber.
			1. HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

Pipe, fittings, and couplings in this article are available in NPS 1-1/2 to NPS 15 (DN 40 to DN 375).

* + - * 1. Pipe and Fittings: ASTM A888 or CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”.

Retain one or more of four paragraphs below. If retaining more than one, indicate location of each type on Drawings or by inserts.

Couplings in "CISPI-Trademark, Shielded Couplings" paragraph below are made in NPS 1-1/2 to NPS 15 (DN 40 to DN 375). They may be unsuitable for installation in corrosive soil.

* + - * 1. CISPI-Trademark, Shielded Couplings:

Description: ASTM C1277 “Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings” and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber sleeve with integral, center pipe stop.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2111) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[ANACO-Husky](http://www.specagent.com/Lookup?uid=123457056860).

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457056935).

[Mission Rubber Company, LLC; a division of MCP Industries](http://www.specagent.com/Lookup?uid=123457056863).

Approved equivalent.

Couplings in "Heavy-Duty, Shielded Couplings" paragraph below are made in NPS 1-1/2 to NPS 15 (DN 40 to DN 375).

* + - * 1. Heavy-Duty, Shielded Couplings:

Description: ASTM C1277 “Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings” and ASTM C1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber sleeve with integral, center pipe stop.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2112) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[ANACO-Husky](http://www.specagent.com/Lookup?uid=123457056866).

[Clamp-All Corp](http://www.specagent.com/Lookup?uid=123457056867).

[Tyler Pipe; a subsidiary of McWane Inc](http://www.specagent.com/Lookup?uid=123457056869).

Approved equivalent.

Couplings in "Cast-Iron, Shielded Couplings" paragraph below are made in NPS 1-1/2 to NPS 10 (DN 40 to DN 250).

* + - * 1. Cast-Iron, Shielded Couplings:

Description: ASTM C1277 “Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings” with ASTM A48/A48M “Standard Specification for Gray Iron Castings”, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber sleeve with integral, center pipe stop.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2113) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[ANACO-Husky](http://www.specagent.com/Lookup?uid=123457056936).

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457056941).

[Tyler Pipe; a subsidiary of McWane Inc](http://www.specagent.com/Lookup?uid=123457056940).

Approved equivalent.

Couplings in "Unshielded Couplings" paragraph below are made in NPS 1-1/2 to NPS 4 (DN 40 to DN 100). They should not be used for liquids at temperatures below 0 deg F (minus 18 deg C) or above 130 deg F (54 deg C).

* + - * 1. Unshielded Couplings:

Description: ASTM C1277 “Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings” and ASTM C1461 “Standard Specification for Mechanical Couplings Thermoplastic Elastomeric Gaskets for Joining Drain, Waste and Vent, Sewer, Sanitary and Storm Plumbing Systems for Above and Below Ground Use”, rigid, sleeve-type, reducing- or transition-type mechanical coupling, with integral, center pipe stop, molded from ASTM C1440 “Standard Specification for Thermoplastic Elastomeric Gasket Materials for Drain, Waste, and Vent, Sewer, Sanitary and Storm Plumbing Systems”, thermoplastic elastomer (TPE) material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2115) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[ANACO-Husky](http://www.specagent.com/Lookup?uid=123457056878).

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457056947).

[Tyler Pipe; a subsidiary of McWane Inc](http://www.specagent.com/Lookup?uid=123457056946).

Approved equivalent.

* + - 1. DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

Piping in this article should be available in NPS 3 to NPS 64 (DN 80 to DN 1600), but no manufacturer of NPS 3 or NPS 4 (DN 80 or DN 100) was located. Joints are gasketed type.

* + - * 1. Pipe: ASTM A746 “Standard Specification for Ductile Iron Gravity Sewer Pipe”, for push-on joints.

Fittings in "Standard Fittings" paragraph below should be available in NPS 3 to NPS 48 (DN 80 to DN 1200).

* + - * 1. Standard Fittings: AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings”, ductile or gray iron, for push-on joints.

Fittings in "Compact Fittings" paragraph below should be available in NPS 3 to NPS 24 (DN 80 to DN 600) and in NPS 54 to NPS 64 (DN 1350 to DN 1600).

* + - * 1. Compact Fittings: AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”, ductile iron, for push-on joints.
				2. Gaskets: AWWA C111/A21.11 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, rubber.
			1. DUCTILE-IRON, PRESSURE PIPE AND FITTINGS
				1. Push-on-Joint Piping:

Pipe in first subparagraph below should be available in NPS 3 to NPS 64 (DN 80 to DN 1600), but no manufacturer of NPS 3 (DN 80) was located. Joints are gasketed type.

Pipe: AWWA C151/A21.51 “Standard for Ductile-Iron Pipe, Centrifugally Cast”.

Fittings in "Standard Fittings" subparagraph below are available in NPS 3 to NPS 48 (DN 80 to DN 1200).

Standard Fittings: AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings”, ductile or gray iron.

Fittings in "Compact Fittings" subparagraph below are available in NPS 3 to NPS 64 (DN 80 to DN 1600).

Compact Fittings: AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”.

Gaskets: AWWA C111/A21.11 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, rubber, of shape matching pipe and fittings.

* + - * 1. Mechanical-Joint Piping:

Pipe in first subparagraph below should be available in NPS 3 to NPS 64 (DN 80 to DN 1600). Joints are gasketed type.

Pipe: AWWA C151/A21.51 “Ductile-Iron Pipe, Centrifugally Cast”, with bolt holes in bell.

Fittings in "Standard Fittings" subparagraph below are available in NPS 3 to NPS 48 (DN 80 to DN 1200).

Standard Fittings: AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings”, ductile or gray iron, with bolt holes in bell.

Fittings in "Compact Fittings" subparagraph below are available in NPS 3 to NPS 64 (DN 80 to DN 1600).

Compact Fittings: AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”, with bolt holes in bells.

Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.

Gaskets: AWWA C111/A21.11 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, rubber, of shape matching pipe, fittings, and glands.

* + - 1. ABS PIPE AND FITTINGS

Piping in this article should be available in three SDRs and in NPS 3 to NPS 12 (DN 80 to DN 300). Verify availability with manufacturers. Joints are solvent-cemented and gasketed types.

* + - * 1. ABS Sewer Pipe and Fittings: ASTM D2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings”, with bell-and-spigot ends for gasketed joints.

NPS 3 to NPS 6: SDR 35.

NPS 8 to NPS 12: SDR 42.

* + - * 1. Gaskets: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seals.
			1. PVC PIPE AND FITTINGS

Piping in "PVC Cellular-Core Sewer Piping" paragraph below is available in various SDR sizes and in NPS 1-1/2 to NPS 12 (DN 40 to DN 300). Joints are solvent-cemented type.

* + - * 1. PVC Cellular-Core Sewer Piping:

Pipe: ASTM F891 “Standard Specification for Coextruded Poly(Vinyl Chloride) Plastic Pipe With a Cellular Core”, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.

Fittings: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”, [**SDR 35**] <**Insert SDR**>, PVC socket-type fittings.

Piping in "PVC Corrugated Sewer Piping" paragraph below is available in NPS 4 to NPS 36 (DN 100 to DN 900). Joints are gasketed type.

* + - * 1. PVC Corrugated Sewer Piping:

Pipe: ASTM F949 “Standard Specification for Poly(Vinyl Chloride) Corrugated Sewer Pipe with a Smooth Interior and Fittings”, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.

Fittings: ASTM F949 “Standard Specification for Poly(Vinyl Chloride) Corrugated Sewer Pipe with a Smooth Interior and Fittings”, PVC molded or fabricated, socket type.

Gaskets: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seals.

Piping in "PVC Profile Sewer Piping" paragraph below is available in at least NPS 8 to NPS 30 (DN 200 to DN 750). Standard includes NPS 4 to NPS 48 (DN 100 to DN 1200), but availability in all sizes is uncertain. Joints are gasketed type and are watertight.

* + - * 1. PVC Profile Sewer Piping:

Pipe: ASTM F794 “Standard Specification for Poly(Vinyl Chloride) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter”, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.

Fittings: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”, PVC with bell ends.

Gaskets: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seals.

Piping in "PVC Type PSM Sewer Piping" paragraph below is available in four SDRs and in NPS 4 to NPS 15 (DN 100 to DN 375). Joints are gasketed type.

* + - * 1. PVC Type PSM Sewer Piping:

Pipe: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”, [**SDR 35**] <**Insert SDR**>, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.

Fittings: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”, PVC with bell ends.

Gaskets: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seals.

Piping in "PVC Gravity Sewer Piping" paragraph below is available in two thicknesses and in NPS 18 to NPS 36 (DN 450 to DN 900). Joints are gasketed type. Gaskets are furnished with the pipe and fittings.

* + - * 1. PVC Gravity Sewer Piping:

Pipe and Fittings: ASTM F679 “Standard Specification for Poly(Vinyl Chloride) Large-Diameter Plastic Gravity Sewer Pipe and Fittings”, [**T-1**] [**T-2**] wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seals for gasketed joints.

Piping in "PVC Pressure Piping" paragraph below is available in NPS 4 to NPS 12 (DN 100 to DN 300). Joints are gasketed type.

* + - * 1. PVC Pressure Piping:

Pipe: AWWA C900 “Standard for Polyvinyl Chloride Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in., for Water Transmission and Distribution”, [**Class 100**] [**Class 150**] [**and**] [**Class 200**] PVC pipe with bell-and-spigot ends for gasketed joints.

Fittings: AWWA C900 “Standard for Polyvinyl Chloride Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in., for Water Transmission and Distribution”, [**Class 100**] [**Class 150**] [**and**] [**Class 200**] PVC pipe with bell ends.

Gaskets: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seals.

Piping in "PVC Water-Service Piping" paragraph below is available in NPS 1/8 to NPS 24 (DN 6 to DN 600). Joints are solvent-cemented type.

* + - * 1. PVC Water-Service Piping:

Pipe: ASTM D1785 “Standard Specification for Poly(Vinyl Chloride) Plastic Pipe, Schedules 40, 80, and 120”, [**Schedule 40**] [**and**] [**Schedule 80**] PVC, with plain ends for solvent-cemented joints.

Fittings: [**ASTM D2466, Schedule 40**] [**and**] [**ASTM D2467, Schedule 80**] PVC, socket type.

* + - 1. FIBERGLASS PIPE AND FITTINGS

Pipe in "Fiberglass Sewer Pipe" paragraph below is available in NPS 8 to NPS 144 (DN 200 to DN 3600). Joints are gasketed type.

* + - * 1. Fiberglass Sewer Pipe: ASTM D3262 “Standard Specification for "Fiberglass" Sewer Pipe”, RTRP, for gasketed joints fabricated with [**Type 2, polyester**] [**or**] [**Type 4, epoxy**] resin.

Liner: [**Reinforced thermoset**] [**Nonreinforced thermoset**] [**Thermoplastic**] [**No liner**].

Grade: [**Reinforced, surface layer matching pipe resin**] [**Nonreinforced, surface layer matching pipe resin**] [**No surface layer**] <**Insert grade**>.

Stiffness: [**9 psig**] [**18 psig**] [**36 psig**] [**72 psig**].

* + - * 1. Fiberglass Nonpressure Fittings: ASTM D3840 “Standard Specification for "Fiberglass" Pipe Fittings for Nonpressure Applications”, RTRF, for gasketed joints.

Laminating Resin: [**Type 1, polyester**] [**or**] [**Type 2, epoxy**] resin.

Reinforcement: Grade with finish compatible with resin.

* + - * 1. Gaskets: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seals.
			1. CONCRETE PIPE AND FITTINGS

Concrete piping in this article is available in many variations of class and wall thickness. Review the applicable standard before making selection.

Piping in "Nonreinforced-Concrete Sewer Pipe and Fittings" paragraph below is available in three classes and in NPS 4 to NPS 36 (DN 100 to DN 900). Joints are gasketed type.

* + - * 1. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C14 “Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe”, [**Class 1**] [**Class 2**] [**Class 3**], with [**bell-and-spigot**] [**or**] [**tongue-and-groove**] ends for gasketed joints with ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber gaskets.

Piping in "Reinforced-Concrete Sewer Pipe and Fittings" paragraph below is available in five classes and three wall thicknesses and in NPS 12 to NPS 144 (DN 300 to DN 3600). Not all classes and wall thicknesses are available. Joints are gasketed type.

* + - * 1. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C76 “Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe”.

[**Bell-and-spigot**] [**or**] [**tongue-and-groove**] ends for gasketed joints, with ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets “, rubber gaskets.

Retain one of four subparagraphs below.

Class II, [**Wall A**] [**Wall B**] [**Wall C**].

Class III, [**Wall A**] [**Wall B**] [**Wall C**].

Class IV, [**Wall A**] [**Wall B**] [**Wall C**].

Class V, [**Wall A**] [**Wall B**].

* + - 1. NONPRESSURE-TYPE TRANSITION COUPLINGS
				1. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.
				2. Sleeve Materials:

For Cast-Iron Soil Pipes: ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber.

For Concrete Pipes: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber.

For Fiberglass Pipes: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seal or ASTM D5926 “Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems”, PVC.

For Plastic Pipes: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric seal or ASTM D5926 “Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems”, PVC.

For Dissimilar Pipes: ASTM D5926 “Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems”, PVC or other material compatible with pipe materials being joined.

* + - * 1. Unshielded, Flexible Couplings:

Description: Elastomeric sleeve with[**stainless-steel shear ring and**] corrosion-resistant-metal tension band and tightening mechanism on each end.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2116) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Dallas Specialty & Mfg. Co](http://www.specagent.com/Lookup?uid=123457056880).

[Fernco Inc](http://www.specagent.com/Lookup?uid=123457056881).

[NDS Inc](http://www.specagent.com/Lookup?uid=123457056882).

Approved equivalent.

* + - * 1. Shielded, Flexible Couplings:

Description: ASTM C1460 “Standard Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground”, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2118) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Cascade Waterworks Mfg. Co](http://www.specagent.com/Lookup?uid=123457056885).

[Dallas Specialty & Mfg. Co](http://www.specagent.com/Lookup?uid=123457056886).

[Mission Rubber Company, LLC; a division of MCP Industries](http://www.specagent.com/Lookup?uid=123457056887).

Approved equivalent.

* + - * 1. Ring-Type, Flexible Couplings:

Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2119) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Fernco Inc](http://www.specagent.com/Lookup?uid=123457056888).

[Logan Clay Pipe](http://www.specagent.com/Lookup?uid=123457056889).

[Mission Rubber Company, LLC; a division of MCP Industries](http://www.specagent.com/Lookup?uid=123457056890).

Approved equivalent.

Couplings in "Nonpressure-Type, Rigid Couplings" paragraph below should not be used for liquids at temperatures below 0 deg F (minus 18 deg C) or above 130 deg F (54 deg C).

* + - * 1. Nonpressure-Type, Rigid Couplings:

Description: ASTM C1461 “Standard Specification for Mechanical Couplings Thermoplastic Elastomeric Gaskets for Joining Drain, Waste and Vent, Sewer, Sanitary and Storm Plumbing Systems for Above and Below Ground Use”, sleeve-type, reducing- or transition-type mechanical coupling; molded from ASTM C1440 “Standard Specification for Thermoplastic Elastomeric Gasket Materials for Drain, Waste, and Vent, Sewer, Sanitary and Storm Plumbing Systems”, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2121) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[ANACO-Husky](http://www.specagent.com/Lookup?uid=123457056891).

Approved equivalent.

* + - 1. PRESSURE-TYPE PIPE COUPLINGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=2123) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Cascade Waterworks Mfg. Co](http://www.specagent.com/Lookup?uid=123457056892).

[JCM Industries, Inc](http://www.specagent.com/Lookup?uid=123457056894).

[Jay R. Smith Mfg Co; a division of Morris Group International](http://www.specagent.com/Lookup?uid=123457056898).

[Victaulic Company](http://www.specagent.com/Lookup?uid=123457056896).

Approved equivalent.

* + - * 1. Tubular-Sleeve Couplings: AWWA C219 “Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe”, with center sleeve, gaskets, end rings, and bolt fasteners.
				2. Metal, bolted, sleeve-type, reducing or transition coupling; for joining underground pressure piping. Include [**150-psig**] [**200-psig**] <**Insert value**> minimum pressure rating and ends of same sizes as piping to be joined.
				3. Center-Sleeve Material: [**Manufacturer's standard**] [**Carbon steel**] [**Stainless steel**] [**Ductile iron**] [**Malleable iron**].
				4. Gasket Material: Natural or synthetic rubber.
				5. Metal Component Finish: Corrosion-resistant coating or material.
			1. EXPANSION JOINTS AND DEFLECTION FITTINGS

Joints and fittings in this article are for buried, ductile-iron pressure pipe and other pipe with same diameters.

Expansion joints in "Ductile-Iron, Flexible Expansion Joints" paragraph below provide both offset and expansion. Indicate minimum required offset and expansion data on Drawings.

* + - * 1. Ductile-Iron, Flexible Expansion Joints:

Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings” or AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2124) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[EBAA Iron Sales, Inc](http://www.specagent.com/Lookup?uid=123457056873).

[Romac Industries, Inc](http://www.specagent.com/Lookup?uid=123457056874).

[Star Pipe Products](http://www.specagent.com/Lookup?uid=123457056875).

Approved equivalent.

Expansion joints in "Ductile-Iron Expansion Joints" paragraph below provide linear expansion only.

* + - * 1. Ductile-Iron Expansion Joints:

Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings” or AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”. Include rating for 250-psig minimum working pressure and for expansion indicated.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2126) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Dresser Utility Solutions](http://www.specagent.com/Lookup?uid=123457056900).

[JCM Industries, Inc](http://www.specagent.com/Lookup?uid=123457056902).

[Jay R. Smith Mfg Co; a division of Morris Group International](http://www.specagent.com/Lookup?uid=123457056903).

Approved equivalent.

Fittings in "Ductile-Iron Deflection Fittings" paragraph below provide deflection only.

* + - * 1. Ductile-Iron Deflection Fittings:

Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings” or AWWA C153/A21.53 “Standard for Ductile-Iron Compact Fittings”. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2127) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[EBAA Iron Sales, Inc](http://www.specagent.com/Lookup?uid=123457056904).

Approved equivalent.

* + - 1. BACKWATER VALVES
				1. Cast-Iron Backwater Valves:

Description: ASME A112.14.1 “Backwater Valves”, gray-iron body and bolted cover, with bronze seat.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2129) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Jay R. Smith Mfg Co; a division of Morris Group International](http://www.specagent.com/Lookup?uid=123457056906).

[Josam Company](http://www.specagent.com/Lookup?uid=123457056905).

[WATTS; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457056908).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457056909).

Approved equivalent.

Retain one or more of three subparagraphs below. If more than one type is required, indicate location of each on Drawings.

Horizontal type; with swing check valve and hub-and-spigot ends.

Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.

Terminal type; with bronze seat, swing check valve, and hub inlet.

* + - * 1. PVC Backwater Valves:

Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2130) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Endura; a brand of IPEX](http://www.specagent.com/Lookup?uid=123457056910).

[Sioux Chief Manufacturing Company, Inc](http://www.specagent.com/Lookup?uid=123457056913).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457056915).

Approved equivalent.

* + - 1. CLEANOUTS
				1. Cast-Iron Cleanouts:

Description: ASME A112.36.2M “Cleanouts”, 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.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2132) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Jay R. Smith Mfg Co; a division of Morris Group International](http://www.specagent.com/Lookup?uid=123457056918).

[Josam Company](http://www.specagent.com/Lookup?uid=123457056916).

[WATTS; A Watts Water Technologies Company](http://www.specagent.com/Lookup?uid=123457056920).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457056921).

Approved equivalent.

Retain one or more options in "Top-Loading Classification(s)" subparagraph below. If more than one loading classification is required, indicate location of each on Drawings.

Top-Loading Classification(s): [**Light Duty**] [**Medium Duty**] [**Heavy Duty**] [**and**] [**Extra-Heavy Duty**].

Sewer Pipe Fitting and Riser to Cleanout: ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”, Service class, cast-iron soil pipe and fittings.

* + - * 1. PVC Cleanouts:

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

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2133) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Endura; a brand of IPEX](http://www.specagent.com/Lookup?uid=123457056923).

[Sioux Chief Manufacturing Company, Inc](http://www.specagent.com/Lookup?uid=123457056922).

[Zurn Industries, LLC](http://www.specagent.com/Lookup?uid=123457056927).

Approved equivalent.

* + - 1. ENCASEMENT FOR PIPING
				1. Standard: ASTM A674 “Standard Practice for Polyethylene Encasement for Ductile Iron Pipe” or AWWA C105/A21.5 “Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems”.
				2. Material: [**Linear low-density polyethylene film of 0.008-inch**] [**or**] [**high-density, cross-laminated polyethylene film of 0.004-inch**] minimum thickness.
				3. Form: [**Sheet**] [**or**] [**tube**].
				4. Color: [**Black**] [**or**] [**natural**] <**Insert color**>.
			2. MANHOLES
				1. Standard Precast Concrete Manholes:

Description: ASTM C478 “Standard Specification for Circular Precast Reinforced Concrete Manhole Sections”, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

Diameter: 48 inches minimum unless otherwise indicated.

Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.

Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.

Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.

Joint Sealant: ASTM C990 “Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants”, bitumen or butyl rubber.

Resilient Pipe Connectors: ASTM C923 “Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals”, cast or fitted into manhole walls, for each pipe connection.

Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps, FRP ladder, or ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] [**ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] <**Insert material**>; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than [**60 inches**] <**Insert dimension**>.

Retain "Adjusting Rings" or "Grade Rings" subparagraph below if required to raise top of manhole to grade.

Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

Grade Rings: Reinforced-concrete rings, 6- to 9-inch 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.

* + - * 1. Designed Precast Concrete Manholes:

Description: ASTM C913 “Standard Specification for Precast Concrete Water and Wastewater Structures”; designed according to ASTM C890 “Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures” for A-16 (ASSHTO HS20-44 in AASHTO HL), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.

Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.

Joint Sealant: ASTM C990 “Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants”, bitumen or butyl rubber.

Resilient Pipe Connectors: ASTM C923 “Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals”, cast or fitted into manhole walls, for each pipe connection.

Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps, FRP ladder, or ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] [**ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP**] <**Insert material**>; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than [**60 inches**] <**Insert dimension**>.

Retain "Adjusting Rings" or "Grade Rings" subparagraph below if required to raise top of manhole to grade.

Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

Grade Rings: Reinforced-concrete rings, 6- to 9-inch 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.

* + - * 1. Fiberglass Manholes:

Description: ASTM D3753 “Standard Specification for Fiberglass Manholes and Wetwells”.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2135) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Associated Fiberglass Enterprises](http://www.specagent.com/Lookup?uid=123457056928).

[L. F. Manufacturing, Inc](http://www.specagent.com/Lookup?uid=123457056930).

Approved equivalent.

Diameter: 48 inches minimum unless otherwise indicated.

Ballast: Increase thickness of concrete base as required to prevent flotation.

Base Section: Concrete, 6-inch minimum thickness.

Retain "Resilient Pipe Connectors" subparagraph below if required.

Resilient Pipe Connectors: ASTM C923 “Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals”, cast or fitted into manhole walls, for each pipe connection.

Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than [**60 inches**] <**Insert dimension**>.

Retain "Adjusting Rings" or "Grade Rings" subparagraph below if required to raise top of manhole to grade.

Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

Grade Rings: Reinforced-concrete rings, 6- to 9-inch 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.

* + - * 1. Manhole Frames and Covers:

Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

Material: [**ASTM A536, Grade 60-40-18 ductile**] [**ASTM A48/A48M, Class 35 gray**] iron unless otherwise indicated.

* + - * 1. Manhole-Cover Inserts:

Description: Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2136) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[FRW Industries](http://www.specagent.com/Lookup?uid=123457056934).

[L. F. Manufacturing, Inc](http://www.specagent.com/Lookup?uid=123457056932).

[Parson Environmental Products, Inc](http://www.specagent.com/Lookup?uid=123457056933).

Approved equivalent.

Type: [**Solid**] [**Drainage with vent holes**] [**Valve**].

* + - 1. CONCRETE
				1. General: Cast-in-place concrete complying with ACI 318 “Building Code Requirements for Structural Concrete and Commentary”, ACI 350 “Code Requirements for Environmental Engineering Concrete Structures and Commentary”, and the following:

Cement: ASTM C150 “Standard Specification for Portland Cement”, Type II.

Fine Aggregate: ASTM C33 “Standard Specification for Concrete Aggregates”, sand.

Coarse Aggregate: ASTM C33 “Standard Specification for Concrete Aggregates”, crushed gravel.

Water: Potable.

* + - * 1. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

Reinforcing Fabric: ASTM A1064 “Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete”, steel, welded wire fabric, plain.

Reinforcing Bars: ASTM A615 “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”, Grade 60 deformed steel.

* + - * 1. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

Invert Slope: [**1**] [**2**] percent through manhole.

Benches: Concrete, sloped to drain into channel.

Slope: [**4**] [**8**] percent.

* + - * 1. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

Reinforcing Fabric: ASTM A1064 “Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete”, steel, welded wire fabric, plain.

Reinforcing Bars: ASTM A615 “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”, Grade 60 deformed steel.

1. EXECUTION
	* + 1. PIPING INSTALLATION
				1. 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.
				2. 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.
				3. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
				4. 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.

Process in first paragraph below is often used for gravity sewers of NPS 10 (DN 250) and larger, but there are no size limits.

* + - * 1. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
				2. Install gravity-flow, nonpressure, drainage piping according to the following:

Revise first three subparagraphs below to suit Project.

Install piping pitched down in direction of flow, at minimum slope of [**1**] [**2**] <**Insert number**> percent unless otherwise indicated.

Install piping [**NPS 6**] <**Insert pipe size**> 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.

Install piping with [**36-inch**] [**48-inch**] [**60-inch**] [**72-inch**] <**Insert dimension**> minimum cover.

Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

Install hubless cast-iron soil piping according to CISPI 310 “Specification for Use in Connection With Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications” and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

Install ductile-iron, gravity sewer piping according to ASTM A746 “Standard Specification for Ductile Iron Gravity Sewer Pipe”.

Install ABS sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install PVC cellular-core sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install PVC corrugated sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install PVC profile sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install PVC Type PSM sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install PVC gravity sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install fiberglass sewer piping according to ASTM D3839 “Standard Guide for Underground Installation of "Fiberglass" Pipe” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install nonreinforced-concrete sewer piping according to ASTM C1479 “Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations” and ACPA's "Concrete Pipe Installation Manual."

Install reinforced-concrete sewer piping according to ASTM C1479 “Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations” and ACPA's "Concrete Pipe Installation Manual."

* + - * 1. Install force-main, pressure piping according to the following:

Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.

Install piping with [**36-inch**] [**48-inch**] [**60-inch**] [**72-inch**] <**Insert dimension**> minimum cover.

Install ductile-iron pressure piping according to AWWA C600 “Standard for Installation of Ductile-Iron Mains and Their Appurtenances” or AWWA M41 “Standard for Ductile-Iron Pipe and Fittings”.

Install ductile-iron special fittings according to AWWA C600 “Standard for Installation of Ductile-Iron Mains and Their Appurtenances”.

Install PVC pressure piping according to AWWA M23 “Standard for PVC Pipe-Design and Installation” or to ASTM D2774 “Standard Practice for Underground Installation of Thermoplastic Pressure Piping” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Install PVC water-service piping according to ASTM D2774 “Standard Practice for Underground Installation of Thermoplastic Pressure Piping” and ASTM F1668 “Standard Guide for Construction Procedures for Buried Plastic Pipe”.

Retain first paragraph below if required to provide protection for metal piping.

* + - * 1. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A674 “Standard Practice for Polyethylene Encasement for Ductile Iron Pipe” or AWWA C105/A21.5 “Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems”:

Hub-and-spigot, cast-iron soil pipe.

Hubless cast-iron soil pipe and fittings.

Ductile-iron pipe and fittings.

Expansion joints and deflection fittings.

* + - * 1. 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.
			1. PIPE JOINT CONSTRUCTION
				1. Join gravity-flow, nonpressure, drainage piping according to the following:

Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

Join hubless cast-iron soil piping according to CISPI 310 “Specification for Use in Connection With Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications” and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

Join ductile-iron, gravity sewer piping according to AWWA C600 “Standard for Installation of Ductile-Iron Mains and Their Appurtenances” for push-on joints.

Join ABS sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” for elastomeric-seal joints.

Join PVC cellular-core sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM F891 “Standard Specification for Coextruded Poly(Vinyl Chloride) Plastic Pipe With a Cellular Core” for solvent-cemented joints.

Join PVC corrugated sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications”.

Join PVC profile sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” for elastomeric-seal joints or ASTM F794 “Standard Specification for Poly(Vinyl Chloride) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter” for gasketed joints.

Join PVC Type PSM sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings” for elastomeric-seal joints or ASTM D3034 “Standard Specification for Type PSM Poly (Vinyl Chloride) Sewer Pipe and Fittings” for elastomeric-gasket joints.

Join PVC gravity sewer piping according to ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications” and ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings” for elastomeric-seal joints or ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings” for elastomeric-gasket joints.

Join fiberglass sewer piping according to ASTM D4161 for elastomeric-seal joints.

Join nonreinforced-concrete sewer piping according to ASTM C14 “Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe” and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.

Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.

Join dissimilar pipe materials with nonpressure-type, flexible[**or rigid**] couplings.

* + - * 1. Join force-main, pressure piping according to the following:

Join ductile-iron pressure piping according to AWWA C600 “Standard for Installation of Ductile-Iron Mains and Their Appurtenances” or AWWA M41 “Standard for Ductile-Iron Pipe and Fittings” for push-on joints.

Join ductile-iron special fittings according to AWWA C600 “Standard for Installation of Ductile-Iron Mains and Their Appurtenances” or AWWA M41 “Standard for Ductile-Iron Pipe and Fittings” for push-on joints.

Join PVC pressure piping according to AWWA M23 “Standard for PVC Pipe-Design and Installation” for gasketed joints.

Join PVC water-service piping according to ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”.

Join dissimilar pipe materials with pressure-type couplings.

* + - * 1. 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.

Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

[**Unshielded**] [**Shielded**] flexible[**or rigid**]couplings for pipes of same or slightly different OD.

Unshielded, increaser/reducer-pattern, flexible[**or rigid**]couplings for pipes with different OD.

Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

Use pressure pipe couplings for force-main joints.

* + - 1. MANHOLE INSTALLATION
				1. General: Install manholes complete with appurtenances and accessories indicated.
				2. Install precast concrete manhole sections with sealants according to ASTM C891 “Standard Practice for Installation of Underground Precast Concrete Utility Structures”.
				3. Install FRP manholes according to manufacturer's written instructions.
				4. Form continuous concrete channels and benches between inlets and outlet.
				5. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops [**3 inches**] <**Insert dimension**> above finished surface elsewhere unless otherwise indicated.

Retain paragraph below only if specified in "Manholes" Article.

* + - * 1. Install manhole-cover inserts in frame and immediately below cover.
			1. CONCRETE PLACEMENT
				1. Place cast-in-place concrete according to ACI 318 “Building Code Requirements for Structural Concrete and Commentary”.
			2. BACKWATER VALVE INSTALLATION
				1. Install horizontal-type backwater valves in piping manholes or pits.
				2. Install combination horizontal and manual gate-type valves in piping and in manholes.
				3. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.
			3. CLEANOUT INSTALLATION
				1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

Use Light-Duty, top-loading classification cleanouts in [**earth or unpaved foot-traffic**] <**Insert other**> areas.

Use Medium-Duty, top-loading classification cleanouts in [**paved foot-traffic**] <**Insert other**> areas.

Use Heavy-Duty, top-loading classification cleanouts in [**vehicle-traffic service**] <**Insert other**> areas.

Use Extra-Heavy-Duty, top-loading classification cleanouts in [**roads**] <**Insert area**>.

* + - * 1. Set cleanout frames and covers in earth in cast-in-place-concrete block, [**18 by 18 by 12 inches**] <**Insert dimensions**> deep. Set with tops [**1 inch**] <**Insert dimension**> above surrounding grade.
				2. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.
			1. CONNECTIONS
				1. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."
				2. Connect force-main piping to building's sanitary force mains specified in Section 221316 "Sanitary Waste and Vent Piping." Terminate piping where indicated.
				3. Make connections to existing piping and underground manholes.

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.

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.

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.

Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

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.

* + - * 1. Connect to [**grease**] [**oil**] [**and**] [**sand**] interceptors specified in Section 221323 "Sanitary Waste Interceptors."
			1. CLOSING ABANDONED SANITARY SEWER SYSTEMS
				1. 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:

Close open ends of piping with at least [**8-inch-**] <**Insert dimension**> thick, brick masonry bulkheads.

Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

* + - * 1. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

Remove manhole and close open ends of remaining piping.

Remove top of manhole down to at least [**36 inches**] <**Insert dimension**> below final grade. Fill to within [**12 inches**] <**Insert dimension**> of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

* + - 1. IDENTIFICATION
				1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

Use[**warning tape or**] detectable warning tape over ferrous piping.

Use detectable warning tape over nonferrous piping and over edges of underground manholes.

* + - 1. FIELD QUALITY CONTROL
				1. 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.

Submit separate report for each system inspection.

Defects requiring correction include the following:

Alignment: Less than full diameter of inside of pipe is visible between structures.

Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

Damage: Crushed, broken, cracked, or otherwise damaged piping.

Infiltration: Water leakage into piping.

Exfiltration: Water leakage from or around piping.

Replace defective piping using new materials and repeat inspections until defects are within allowances specified.

Reinspect and repeat procedure until results are satisfactory.

* + - * 1. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

Do not enclose, cover, or put into service before inspection and approval.

Test completed piping systems according to requirements of authorities having jurisdiction.

Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

Submit separate report for each test.

Retain "Hydrostatic Tests" or "Air Tests" subparagraph below for tests.

Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

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.

Close openings in system and fill with water.

Purge air and refill with water.

Disconnect water supply.

Test and inspect joints for leaks.

Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

Retain one of first two subparagraphs below.

Test plastic gravity sewer piping according to ASTM F1417.

Test concrete gravity sewer piping according to ASTM C1628.

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 [**150 psig**] <**Insert value**>.

Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.

PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

Manholes: Perform hydraulic test according to ASTM C969.

* + - * 1. Leaks and loss in test pressure constitute defects that must be repaired.
				2. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.
			1. CLEANING
				1. Clean dirt and superfluous material from interior of piping.[**Flush with potable water.**]

END OF SECTION 221313