



Delivering water and power™

Construction Specification Manual

Salt River Project

Technical Specification Index – February 2024

Division 33

Division	Title	Updated
DIVISION 33:	UTILITIES	
331000	Water Utilities	Revised 02/24
333000	Sanitary Sewerage	Revised 02/24
334000	Stormwater Utilities	Revised 02/24

SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes water distribution piping and related components outside the building for water service and fire-service mains.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE AND SAFETY

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water service piping, including materials, hose threads, installation, and testing.
 - 4. Use excavation shoring, bracing, sheeting, barricading, and plating necessary to perform work and protect excavation and personnel as required for safety and conformance to governing law, including OSHA Construction Standards, Subpart P, and Salt River Project Specification Section 314133 Trench Safety.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- F. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
 - 2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations.
- B. Piping, equipment, and associated accessories kept on-site shall be stored off the ground on skids, ends should be capped or sealed, and these items shall be covered with plastic to prevent fouling or contact with excessive moisture.
- C. Piping and equipment shall be cleaned of debris inside and out before installation, and kept clean and protected throughout construction.

1.7 COORDINATION

- A. Coordinate connection to water main with utility company.
- B. All shutdowns are to be requested with the respective SRP Project Manager. All shutdowns must have a shutdown request filled out for the applicable trade and submitted to the respective trades shop calendar 48 hours in advance, they shall include Methods of Procedure. Emergency situations will be addresses and a case-by-case basis.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS – DOMESTIC WATER SERVICE

- A. Copper Tube:
 - 1. Soft Copper, ASTM B 88, Type K, water tube, annealed
 - 2. Hard Copper, ASTM B 88, Type K, water tube, drawn temper.

3. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
4. Solder Filler Metals: ASTM B 32, lead-free alloy, Sterling Premium Grade or Silverbrite 100. Include water-flushable flux according to ASTM B 813.
5. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

B. PVC Pipe:

1. Pipe: PVC, AWWA C900, Class 165, with bell end with gasket, and with spigot end.
2. Fittings:
 - a. Ductile Iron, Mechanical Joint type, AWWA C110, ductile iron standard pattern or AWWA C153, ductile iron compact pattern.
 - b. Mechanical Wedge Action Joint Restraints, Grade 65-45-12 ductile iron per ASTM A536, break-off torque control nuts, UL listed, FM approved
 - c. Glands, Gaskets, and Bolts: AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

C. Ductile Iron Pipe:

1. Pipe: Ductile Iron, AWWA C151, with bell and spigot ends or flanged ends.
2. Fittings:
 - a. Ductile Iron, Mechanical Joint type, AWWA C110, ductile iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - b. Mechanical Wedge Action Joint Restraints, Grade 65-45-12 ductile iron per ASTM A536, break-off torque control nuts, UL listed, FM approved
 - c. Glands, Gaskets, and Bolts: AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.
 - d. Flanges: ASME B16.1, Class 125, cast iron.

2.2 PIPE AND FITTINGS – FIRE SERVICE @CITY WATER PRESSURE

A. Polyethylene Pipe:

1. Pipe: ASTM F 714, AWWA C906, or equivalent for Polyethylene (PE) water pipe; FMG approved, with minimum thickness equivalent to FMG Class 150.
2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

B. PVC Pipe:

1. Pipe: PVC, AWWA C900, Class 235, with bell end with gasket, and with spigot end.
2. Fittings:
 - a. Ductile Iron, Mechanical Joint type, AWWA C110, ductile iron standard pattern or AWWA C153, ductile iron compact pattern.

- b. Mechanical Wedge Action Joint Restraints, Grade 65-45-12 ductile iron per ASTM A536, break-off torque control nuts, UL listed, FM approved
- c. Glands, Gaskets, and Bolts: AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

C. Ductile Iron Pipe:

- 1. Pipe: Ductile Iron, AWWA C151, with bell and spigot ends or flanged ends.
- 2. Fittings:
 - a. Ductile Iron, Mechanical Joint type, AWWA C110, ductile iron standard pattern or AWWA C153, ductile iron compact pattern.
 - b. Mechanical Wedge Action Joint Restraints, Grade 65-45-12 ductile iron per ASTM A536, break-off torque control nuts, UL listed, FM approved
 - c. Glands, Gaskets, and Bolts: AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.
- 3. Flanges:
 - a. Cast iron, ASME B16.1, Class 125.
 - b. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1) ASME B16.21, rubber, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
 - 2) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 3) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 4) AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
 - 5) Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

2.3 PIPE AND FITTINGS – FIRE SERVICE @BOOSTER PUMP PRESSURE

A. PVC Pipe:

- 1. Pipe: Ductile Iron, AWWA C900, Class 305, with bell end with gasket, and with spigot end.
- 2. Fittings:
 - a. Ductile Iron, Mechanical Joint type, AWWA C110, ductile iron standard pattern or AWWA C153, ductile iron compact pattern.
 - b. Mechanical Wedge Action Joint Restraints, Grade 65-45-12 ductile iron per ASTM A536, break-off torque control nuts, UL listed, FM approved
 - c. Glands, Gaskets, and Bolts: AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

B. Ductile Iron Pipe:

- 1. Pipe: Ductile Iron, AWWA C151, with bell and spigot ends or flanged ends.

2. Fittings:
 - a. Ductile Iron, AWWA C110, ductile iron standard pattern or AWWA C153, ductile iron compact pattern.
 - b. Mechanical Wedge Action Joint Restraints, Grade 65-45-12 ductile iron per ASTM A536, break-off torque control nuts, UL listed.
 - c. FM approved Glands, Gaskets, and Bolts: AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.
3. Flanges:
 - a. Cast iron, ASME B16.1, Class 125.
 - b. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1) ASME B16.21, rubber, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
 - 2) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 3) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 4) AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
 - 5) Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

2.4 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.

2.5 VALVES

- A. Domestic Water, NPS 4 to NPS 8, AWWA, Cast-Iron Gate Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Cast Iron Pipe Co.; American Flow Control Div.
 - b. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - c. McWane, Inc.; Kennedy Valve Div.
 - d. Mueller Co.; Water Products Div.
 - e. Watts.
 - f. Apollo.

2. Nonrising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Gray or ductile iron valve body and bonnet; with bronze, gray, or ductile iron valve gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig.
 - 3) End Connections: Mechanical joint or flanged.
 - 4) Interior Coating: Complying with AWWA C550.
 - 5) 2" square operating nut for below grade installations, hand wheel for above grade installations

- B. Underground Domestic Water, NPS 3/4 to NPS 2, AWWA, Brass Corporation Stops:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mueller
 - b. A. Y. McDonald
 - c. Ford Meter Box
 2. Ball Type Corporation Stops:
 - a. Description: Brass body, coated ball.
 - 1) Standard: AWWA C800
 - 2) Minimum Pressure Rating: 300 psig
 - 3) EPDM seats and gaskets
 - 4) 2" square operating nut

- C. Aboveground Domestic Water, NPS 3/4 to NPS 4, AWWA, Ball Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mueller
 - b. Watts
 - c. Apollo.
 2. Full Port Ball Valve
 - a. Description: Copper alloy body, stainless steel or coated brass ball.
 - 1) Standard: NSF/ANSI 61
 - 2) Minimum Pressure Rating: 150 psig
 - 3) PTFE Seats
 - 4) Blowout proof stem

- D. Fire Service, NPS 4 to NPS 8, UL/FMG, Cast-Iron Gate Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Cast Iron Pipe Co.; American Flow Control Div.
 - b. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - c. McWane, Inc.; Kennedy Valve Div.
 - d. Mueller Co.; Water Products Div.

2. UL/FMG, Nonrising-Stem Gate Valves:
 - a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig.
 - 3) End Connections: Flanged.
3. OS&Y, Rising-Stem Gate Valves:
 - a. Description: Iron body and bonnet and bronze seating material.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig.
 - 3) End Connections: Flanged.

2.6 VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - b. McWane, Inc.; Kennedy Valve Div.
 - c. Mueller Co.; Water Products Div.
 2. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.
- B. Valve Boxes: Comply with MAG Standard Detail No. 270 and 391-1, Type A with a Class C900 PVC sleeve instead of cast iron sleeve. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
 2. Valve Stem Extensions: Steel, centering ring, rock guard, 2" operating nut, 2" socket with two locking screws.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.7 WATER METERS

- A. Water meters will be furnished by utility company.

2.8 WATER METER BOXES

- A. Installed by Municipal Water Department or their contractors

2.9 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers for water service:
 - 1. Watts LF909
 - 2. Wilkins375RP
- B. Double-Check, Backflow-Prevention Assemblies for fire service:
 - 1. Wilkens 350A

2.10 CONCRETE VAULTS

- A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.
 - 1. Ladder: ASTM A 36/A 36M, polyethylene-encased steel steps.
 - 2. Manhole: ASTM A 48/A 48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
 - a. Dimension: 36-inch minimum diameter, unless otherwise indicated.
 - 3. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.
 - a. Dimension: 36-inch minimum diameter, unless otherwise indicated.
 - 4. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.11 FIRE HYDRANTS

- A. Dry-Barrel Fire Hydrants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American AVK Co.; Valves & Fittings Div.
 - b. American Cast Iron Pipe Co.; American Flow Control Div.
 - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - d. American Foundry Group, Inc.
 - e. East Jordan Iron Works, Inc.
 - f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - g. McWane, Inc.; Kennedy Valve Div.
 - h. McWane, Inc.; M & H Valve Company Div.

- i. Mueller Co.; Water Products Div.
 - j. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
 - k. U.S. Pipe and Foundry Company.
2. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
- a. Standard: AWWA C502.
 - b. Pressure Rating: 150 psig minimum.

B. Wet Barrel Fire Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. American AVK Co.; Valves & Fittings Div.
 - b. Jones, James Company.
 - c. McWane, Inc.; Clow Valve Co. Div. (Corona).
 - d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - e. Mueller Co.; Water Products Div.
2. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550.
- a. Standard: AWWA C503.
 - b. Pressure Rating: 150 psig minimum.

2.12 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

1. Manufacturers: Subject to compliance with requirements of the municipality where installed, provide products by one of the following:
- a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire End & Croker Corporation.
 - c. Guardian Fire Equipment, Inc.
 - d. Kidde Fire Fighting.
 - e. Potter Roemer.
 - f. Reliable Automatic Sprinkler Co., Inc.
2. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch-high brass sleeve; and round escutcheon plate.
- a. Standard: UL 405.
 - b. Connections: Two NPS 2-1/2 inlets and one NPS 4 outlet.
 - c. Inlet Alignment: Inline, horizontal.
 - d. Finish Including Sleeve: Polished bronze.

- e. Escutcheon Plate Marking: "[AUTO SPKR] [&] [STANDPIPE]."

2.13 DIELECTRIC FITTINGS

- A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature. These fittings are to be used only where necessary.
- B. Dielectric Unions:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Central Plastics Company.
 - b. Epco Sales, Inc.
 - c. Hart Industries, International, Inc.
 - d. Watts Water Technologies, Inc.
 - e. Zurn Plumbing Products Group; Wilkins Div.
- C. Dielectric Flanges:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Central Plastics Company.
 - b. Epco Sales, Inc.
 - c. Watts Water Technologies, Inc.
 - d. CTS Flange.
- D. Dielectric Couplings:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
- E. Dielectric Nipples:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Matco-Norco.
 - b. Precision Plumbing Products, Inc.
 - c. Watts.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Domestic Water Service – Underground:
 1. NPS 3/4 to NPS 3: Type K soft copper tube, cast copper alloy or wrought copper fittings, brazed joints
 2. NPS 4 to NPS 8: C900 PVC pipe with push-on joints, ductile iron fittings with mechanical wedge action restraint connections.
 3. NPS 4 to NPS 8: Ductile iron pipe with push-on joints, ductile iron fittings with mechanical wedge action restraint connections.
- B. Domestic Water Service – Within Boxes and Vaults Below Grade:
 1. NPS 3/4 to NPS 3: Type K hard copper tube, cast copper alloy or wrought copper fittings, Brazed joints, unions.
 2. NPS 4 to NPS 8: C900 PVC pipe with push-on joints, ductile iron fittings with mechanical wedge action restraint connections.
 3. NPS 4 to NPS 8: Ductile iron pipe with push-on joints, ductile iron fittings with mechanical wedge action restraint connections.
 4. NPS 4 to NPS 8: Ductile iron pipe, ductile iron fittings, flanged connections.
- C. Domestic Water Service – Above Grade:
 1. NPS 3/4 to NPS 3: Type K hard copper tube, cast copper alloy or wrought copper fittings, soldered joints, unions. Joints and unions above 2" shall be brazed.
 2. NPS 4 to NPS 8: Ductile iron pipe, ductile iron fittings, flanged connections
- D. Fire Service @City Water Pressure – Underground:
 1. Polyethylene water pipe, FMG approved Class 150, with molded PE fittings
 2. PVC pipe, AWWA C900, Class 235, with bell end with gasket, and with spigot end, ductile iron fittings with mechanical wedge action restraint connections
 3. Ductile iron pipe with push-on joints, ductile iron fittings with mechanical wedge action restraint connections.
- E. Fire Service @City Water Pressure – Above Grade:

1. Ductile iron pipe, ductile iron fittings, flanged connections.

F. Fire Service @Booster Pump Pressure – Underground:

1. PVC pipe, AWWA C900, Class 305, with bell end with gasket, and with spigot end, ductile iron fittings with mechanical wedge action restraint connections.
2. Ductile iron pipe with push-on joints, ductile iron fittings with mechanical wedge action restraint connections.

G. Fire Service @Booster Pump Pressure – Above Grade:

1. Ductile iron pipe, ductile iron fittings, flanged connections.

3.3 PIPING INSTALLATION

- A. Install piping, valves, devices, and accessories in accordance with the manufacturer's published installation instructions.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure and test pressures.
- I. Permanent sleeves are not required for holes formed by removable PE sleeves.
- J. Verify final equipment locations before roughing-in.
- K. Refer to equipment specifications in other Sections for roughing-in requirements.
- L. Water-Main Connection: Municipal water supplier shall make all taps.
- M. Comply with NFPA 24 for fire-service-main piping materials and installation.
- N. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

- O. Install PE pipe according to ASTM D 2774 and ASTM F 645.
- P. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- Q. Bury piping with a minimum of 6 inches of sand on all sides and at least 30 inches below grade and include tracer wire with PVC pipe.
- R. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- S. Sleeves are specified in Section 22 05 15 "Common Work Results for Plumbing."
- T. Mechanical sleeve seals are specified in Section 22 05 15 "Common work Results for Plumbing."
- U. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- V. Copper tube, ductile iron pipe, fittings, and associated ferrous components installed underground shall be protected with 8 mil polyethylene wrap or 10 mil tape.

3.4 JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

- G. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- H. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- J. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - 3. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
 - 4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
 - 5. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.5 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Set-screw mechanical retainer glands.
 - 4. Bolted flanged joints.
 - 5. Heat-fused joints.
 - 6. Pipe clamps and tie rods.
 - 7. Mechanical wedge action joints.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 - 2. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply polyethylene wrap or tape to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

- A. AWWA Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

3.7 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on pipe stands or cast in place concrete piers.
- E. Provide a y-pattern strainer upstream of a backflow prevention valve assembly serving a domestic water service line.

3.8 CONCRETE VAULT INSTALLATION

- A. Install precast concrete vaults according to ASTM C 891.

3.9 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
- C. AWWA Fire Hydrants: Comply with AWWA M17.
- D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.10 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install protective pipe bollards on three sides of each fire department connection. Pipe bollards are specified in Section 05 50 00 "Metal Fabrications."

3.11 CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 3 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 3 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.12 QUALITY CONTROL

A. Piping Tests: Conduct hydrostatic piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than the following for two hours:

1. Water Service Piping – 120 psig.
2. Fire Service Piping exposed to city water pressure – 200 psig.
3. Fire Service Piping exposed to booster pump water pressure – 250 psig.

C. Prepare reports of testing activities.

3.13 IDENTIFICATION

A. Install continuous underground tracer wire and detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping.

B. Permanently attach signage indicating plastic water-service piping has been provided for building, on main electrical meter panel.

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure as prescribed below:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

Project Name
Project Number

Deliverable
Issue Date

- d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 33 30 00
SANITARY SEWERAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipe and fittings.
 2. Non-pressure and pressure couplings.
 3. Expansion joints.
 4. Cleanouts.
 5. Encasement for piping.
 6. Manholes.

1.2 ACTION SUBMITTALS

- A. Product Data: For expansion joints.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.3 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Type PSM Sewer Piping:
1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
 2. Fittings: ASTM D 3034, PVC with bell ends.
 3. Gaskets: ASTM F 477, elastomeric seals.

2.2 NON-PRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.3 MANHOLES

- A. Standard Precast Concrete Manholes:
 - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 2. Diameter: 48 inches minimum unless otherwise indicated.
 - 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 - 4. 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.
 - 5. Riser Sections: 4-inch minimum thickness of length to provide depth indicated.
 - 6. 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.
 - 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection. Install mechanical link seal at manhole walls
 - 9. Steps: Individual FRP steps, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP; 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 48 inches.
 - 10. 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.

11. 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.

B. Manhole Frames and Covers:

1. 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."
2. Material: ASTM A 481A 48M, Class 35 gray iron unless otherwise indicated.

2.4 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. 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.

1. 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.
 - a. Invert Slope: Maximum 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: Maximum 4 percent.

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

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving." Use excavation shoring, bracing, sheeting, barricading and plating necessary to perform work and protect excavation and personnel as required for safety and conformance to governing law, including OSHA Construction Standards, Subpart P, and Salt River Project Specification Section 314133 Trench Safety. Cost of protection systems shall be included in Contractor bid price.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of micro-tunneling.
- F. Install gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 - 3. Install piping with 36-inch minimum cover.
 - 4. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
- G. 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.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 - 2. Join dissimilar pipe materials with non-pressure type, flexible or rigid couplings.
- B. Pipe couplings 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 flexible couplings for pipes of same or slightly different OD.
 - b. Unshielded, increaser/reducer-pattern, flexible 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.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
- E. Install manhole-cover inserts in frame and immediately below cover.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC soil pipe fittings in sewer pipes at branches for cleanouts and use PVC soil pipe for riser extensions to cleanouts. 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 Extra Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

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

3.6 CONNECTIONS

- A. Connect Non-pressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow
 - 4. 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 - 5. 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.
- C. Connect to grease-oil-and-sand interceptors specified in Section 22 13 23 "Sanitary Waste Interceptors."

3.7 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 - 1. Use warning tape or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.8 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water and maintain such pressure without leakage for at least 15 minutes.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 - 6. Manholes: Perform hydraulic test according to ASTM C 969.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.9 CLEANING

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

Project Name
Project Number

Deliverable
Issue Date

END OF SECTION

SANITARY SEWERAGE
33 30 00 - 8

Last Updated:

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SECTION 33 40 00
STORMWATER UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Facility wastewater piping, equipment, and specialties.
- B. Related Requirements:
 - 1. Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" for grade cleanout anchor pads.
 - 2. Section 31 20 00 "Earth Moving" for excavation, trenching, and backfilling.
 - 3. Section 31 37 00 "Riprap."

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe, for each type required.
 - 2. Fittings, for each type required.
 - 3. Cleanouts, for each type required.
- B. Shop Drawings: For the following:
 - 1. Concrete manholes.
 - 2. Catch basins.
 - 3. Culverts.
 - 4. Headwalls.
 - 5. Underground storage tanks.
 - 6. Wing walls and flared end sections.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of regional and state AHJ, and local municipality.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- C. Protect flanges, fittings, and specialties from moisture and dirt.
- D. Store plastic piping protected from direct sunlight and blowing dust and other deleterious agents. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Pipe material shall be as indicated on the Drawings.
- B. Pipe material shall be in accordance with the M.A.G. Specifications or local municipal requirements as specified below:
 - 1. Corrugated Metal Pipe (CMP) pipe and fittings shall be watertight and comply with M.A.G. Section 621 and 760 or the requirements of the local municipality.
 - 2. High Density Polyethylene (HDPE) pipe and fittings shall be watertight and comply with M.A.G. Section 738 or the requirements of the local municipality.
 - 3. Reinforced Concrete Pipe (RCP) shall be watertight and comply with M.A.G. Section 735 or the requirements of the local municipality.
- C. Manholes: As indicated on Drawings.
- D. Dual Chamber Dry Wells: As indicated on Drawings.
- E. Catch Basins: As indicated on Drawings.
- F. Culverts: Comply with ADOT Specifications and Details.
- G. Headwalls: Comply with ADOT Specifications and Details and the requirements of the local municipality.
- H. Wing Walls: Comply with ADOT Specifications and Details.
- I. Underground Storage Systems: As indicated on Drawings and complying with requirements of the local municipality.

- J. Cleanouts: As indicated on Drawings.
 - 1. Cleanout Applications for Underground Stormwater Drainage Piping:
 - a. At Grade in Earth: PVC cleanouts.
 - b. At Grade in Paved Areas: PVC cleanouts.
- K. Air Breaks: As indicated on Drawings.
- L. Flared End Sections: As indicated on Drawings.
- M. Soil Materials: Backfill, drainage course, impervious fill, and satisfactory soil materials shall be as specified in Section 31 20 00 "Earth Moving."
- N. Riprap: Comply with Section 31 37 00 "Riprap."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify existing invert elevations for storm drain construction prior to commencement of site work. Work for stormwater drainage installation shall begin at downstream connection point to allow for necessary adjustments to be made prior to installation of entire line. If Contractor fails to begin at the downstream connection point and works upstream, Contractor shall be responsible for necessary adjustments.

3.2 PREPARATION

- A. Water lines and stormwater drainage lines shall be separated to protect water lines from contamination by stormwater lines per M.A.G. spec 610.5 and M.A.G. Standard Detail 404.
 - 1. Uncover and expose existing utility and sewer lines where they are to be crossed above or below by new work being constructed to verify grades and to assure sufficient clearance.
 - 2. Pipe shall not be installed until crossings have been verified for clearance.
 - 3. If Contractor fails to follow this procedure, Contractor will be solely responsible for extra work and material required if modifications to the design are necessary.
- B. Take special care in locating and protecting existing utilities.
- C. Existing pipe to which connections are made shall be exposed to permit field changes in line, grade, or fitting.

- D. Storm manholes and drainage structures including, but not limited to, manholes, catch basins, and cleanouts that lie within areas affected by Work of this Project shall be adjusted to grade as indicated on Drawings.

3.3 EARTHWORK

- A. Excavation, trenching, and backfilling shall be in accordance with Section 31 20 00 "Earth Moving." Use excavation shoring, bracing, sheeting, barricading and plating necessary to perform work and protect excavation and personnel as required for safety and conformance to governing law, including OSHA Construction Standards, Subpart P, and Salt River Project Specification Section 314133 Trench Safety. Cost of protection systems shall be included in Contractor bid price.
- B. In areas where existing concrete paving has been removed and is to be replaced, replacement shall be in accordance with Section 32 13 13 "Concrete Paving."
- C. In areas where existing asphalt paving has been removed and is to be replaced, replacement shall be in accordance with Section 32 12 16 "Asphalt Paving."

3.4 INSTALLATION

- A. Installation of stormwater drainage lines shall be in accordance with M.A.G. Section 618 or the requirements of the local municipality.
- B. Installation of culverts shall be in accordance with ADOT Specifications and Details.
- C. Installation of dry wells shall be in accordance with the manufacturer's specifications and instructions and the requirements of the local municipality.
- D. HDPE pipe shall be installed per the manufacturer's recommendations and M.A.G. spec 618. HDPE pipe shall not be placed directly on rock or other rigid materials. Minimum cover for HDPE pipe shall be 12 inches to top of sub-grade in accordance with manufacturer's recommendations. Additional cover shall be placed over pipe for heavy construction load crossings per pipe manufacturer's recommendations.
- E. New HDPE pipe shall be connected to existing drainage facilities as indicated on Drawings and in accordance with pipe manufacturer's recommendations.

3.5 CLEANOUT INSTALLATION

- A. Cleanouts for Stormwater Drainage System:
 - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. In vehicular-traffic areas, use NPS 4 (DN 100) PVC pipe and fittings for piping branch fittings and riser extensions to cleanout.
 - a. Set cleanout frames and covers in a cast-in-place concrete anchor, minimum 18 by 18 by 12 inches (450 by 450 by 300 mm) in depth.

- b. Set top of cleanout cover flush with grade. .
- 3. In nonvehicular-traffic areas, use NPS 4 (DN 100) PVC pipe and fittings for piping branch fittings and riser extensions to cleanout.
 - a. Set cleanout frames and covers in a cast-in-place concrete anchor, minimum 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth.
 - b. Set top of cleanout plug 1 inch (25 mm) above grade.

3.6 FIELD QUALITY CONTROL

- A. Provide personnel and necessary equipment to perform a hydrostatic test of the piping with a water column having a minimum height of 10 feet.
- B. Prepare reports of testing activities.
- C. Do not allow or cause any work of this section to be covered up or enclosed until after it has been inspected, tested, and approved. Coordinate with the local municipality for inspections of work within rights-of-way.

3.7 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground storm sewer piping. Locate below finished grade, directly over piping.
 - 1. Underground warning tapes are specified in Section 31 20 00 "Earth Moving."

END OF SECTION

Project Name
Project Number

Deliverable
Issue Date

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