Revisions made to the original MasterSpec text are made solely by the Licensee and are not endorsed by, or representative of the opinions of, Deltek or The American Institute of Architects (AIA). Neither AIA nor Deltek are liable in any way for such revisions or for the use of this Section by any end user. A qualified design professional should review and edit the document to suit project requirements.

SECTION 221413 - FACILITY STORM DRAINAGE PIPING

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Specialty pipe and fittings.

Encasement for underground metal piping.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 221429 "Sump Pumps" for storm drainage pumps.

Section 334400 "Stormwater Utility Equipment" for storm drainage piping outside the building.

* + - 1. ACTION SUBMITTALS
				1. Product Data: For each type of product.

Retain "Shop Drawings" Paragraph below if retaining controlled-flow or siphonic roof drainage system.

* + - * 1. Shop Drawings: For [**controlled-flow**] [**siphonic**] roof drainage system. Include calculations, plans, and details.
			1. INFORMATIONAL SUBMITTALS

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: Detail storm drainage piping. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Structural members to which drainage piping will be attached or suspended from.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. QUALITY ASSURANCE
				1. Piping materials shall bear label, stamp, or other markings of specified testing agency.
			2. FIELD CONDITIONS

Retain this article if interruption of existing storm drainage service is required.

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

Notify [**Architect**] [**Construction Manager**] [**Owner**] no fewer than [**two**] <**Insert number**> days in advance of proposed interruption of storm drainage service.

Do not proceed with interruption of storm drainage service without [**Architect's**] [**Construction Manager's**] [**Owner's**] written permission.

1. PRODUCTS
	* + 1. PERFORMANCE REQUIREMENTS
				1. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

Revise pressure ratings in "Storm Drainage Piping" and "Storm Drainage, Force-Main Piping" subparagraphs below to suit Project. Coordinate with Section 221423 "Storm Drainage Piping Specialties." Storm drainage piping may require higher rating if used in high-rise buildings.

Storm Drainage Piping: [**10-foot head of water**] <**Insert pressure**>.

Storm Drainage, Force-Main Piping: [**50 psig**] [**100 psig**] [**150 psig**] <**Insert pressure**>.

* + - 1. SPECIALTY PIPE FITTINGS
				1. Dielectric Fittings:

General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

Unions in "Dielectric Unions" Subparagraph below are available in at least NPS 1/2 to NPS 2 (DN 15 to DN 50).

Dielectric Unions:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed.

Basis-of-Design Product: Subject to compliance with requirements, provide **Zurn Industries, LLC; Model DUXL** or comparable product by one of the following:

<**Insert manufacturer's name**>

Description:

Standard: ASSE 1079.

Revise pressure rating and temperature in first subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**150 psig minimum at 180 deg F**] [**150 psig**] [**250 psig**] <**Insert pressure**>.

End Connections: Solder-joint copper alloy and threaded ferrous.

* + - 1. ENCASEMENT FOR UNDERGROUND METAL PIPING

Retain this article if corrosion protection is required for underground metal piping.

* + - * 1. Standard: ASTM A674 or AWWA C105/A 21.5.
				2. Material: [**High-density, crosslaminated polyethylene film of 0.004-inch**] [**or**] [**linear low-density polyethylene film of 0.008-inch**] minimum thickness.
				3. Form: [**Sheet**] [**or**] [**tube**].
				4. Color: [**Black**] [**or**] [**natural**] <**Insert color**>.
1. EXECUTION
	* + 1. EARTH MOVING
				1. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."
			2. PIPING INSTALLATION
				1. 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 from layout are approved on coordination drawings.

* + - * 1. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
				2. 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.
				3. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
				4. Install piping to permit valve servicing.
				5. Install piping at indicated slopes.
				6. Install piping free of sags and bends.
				7. Install fittings for changes in direction and branch connections.
				8. Install piping to allow application of insulation.

Retain first paragraph below for projects in seismic areas if piping is required to withstand specific design loads.

* + - * 1. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
				2. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

Do not change direction of flow more than 90 degrees.

Use proper size of standard increasers and reducers if pipes of different sizes are connected.

Reducing size of drainage piping in direction of flow is prohibited.

* + - * 1. Lay buried building piping beginning at low point of each system.

Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

Maintain swab in piping and pull past each joint as completed.

* + - * 1. Install piping at the following minimum slopes unless otherwise indicated:

Revise "Building Storm Drain" and "Horizontal Storm Drainage Piping" subparagraphs below as required by authorities having jurisdiction.

Building Storm Drain: [**2**] <**Insert number**> percent downward in direction of flow for piping NPS 3 and smaller; [**1**] [**2**] <**Insert number**> percent downward in direction of flow for piping NPS 4 and larger.

Horizontal Storm Drainage Piping: [**2**] <**Insert number**> percent downward in direction of flow.

* + - * 1. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

Retain subparagraph below if piping will be in corrosive soil.

Install encasement on underground piping according to ASTM A674 or AWWA C105/A 21.5.

* + - * 1. Install steel piping according to applicable plumbing code.
				2. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
				3. Install aboveground ABS piping according to ASTM D2661.
				4. Install aboveground PVC piping according to ASTM D2665.
				5. Install underground [**ABS**] [**and**] [**PVC**] piping according to ASTM D2321.
				6. Install engineered [**controlled-flow**] [**siphonic**] drain specialties and storm drainage piping in locations indicated.

Retain first paragraph below if ductile-iron, force-main piping is required.

* + - * 1. Install underground, ductile-iron, force-main piping according to AWWA C600.

Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints.

Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

Retain subparagraph below if piping will be in corrosive soil.

Install encasement on piping according to ASTM A674 or AWWA C105/A 21.5.

Retain first paragraph below for copper, force-main tubing.

* + - * 1. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

Retain subparagraph below if piping will be in corrosive soil.

Install encasement on piping according to ASTM A674 or AWWA C105/A 21.5.

* + - * 1. Install force mains at elevations indicated.
				2. Plumbing Specialties:

Install backwater valves in storm drainage gravity-flow piping.

Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.

Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."

Install drains in storm drainage gravity-flow piping.

Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

* + - * 1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
				2. Install sleeves for piping penetrations of walls, ceilings, and floors.

Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Retain first paragraph below for piping that penetrates an exterior concrete wall or concrete slab.

* + - * 1. Install sleeve seals for piping penetrations of concrete walls and slabs.

Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

* + - * 1. Install escutcheons for piping penetrations of walls, ceilings, and floors.

Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

* + - 1. JOINT CONSTRUCTION
				1. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
				2. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.
				3. Hubless, Cast-Iron Soil Piping Coupled Joints:

Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

* + - * 1. 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:

Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

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.

* + - * 1. Join copper tube and fittings with soldered joints according to ASTM B828 procedure. Use ASTM B813, water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.
				2. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
				3. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
				4. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.

ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendices.

PVC Piping: Join according to ASTM D2855 and ASTM D2665 appendices.

Applicable Project codes and local authorities having jurisdiction may have different or additional requirements for joint bracing. Coordinate with Project code requirements and local authorities having jurisdiction and revise below to suit Project.

* + - * 1. Joint Restraints and Sway Bracing:

Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:

Provide axial restraint for pipe and fittings [**5 inches**] <**Insert dimensions**> and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.

Provide rigid sway bracing for pipe and fittings [**4 inches**] <**Insert dimensions**> and larger, upstream and downstream of all changes in direction 45 degrees and greater.

Provide rigid sway bracing for pipe and fittings [**5 inches**] <**Insert dimensions**> and larger, upstream and downstream of all changes in direction and branch openings.

* + - 1. SPECIALTY PIPE FITTING INSTALLATION
				1. Transition Couplings:

Install transition couplings at joints of piping with small differences in ODs.

In Drainage Piping: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

In Aboveground Force-Main Piping: Fitting-type transition couplings.

In Underground Force-Main Piping:

NPS 1-1/2 and Smaller: Fitting-type transition couplings.

NPS 2 and Larger: Pressure transition couplings.

* + - * 1. Dielectric Fittings:

Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

Dielectric Fittings for [**NPS 2**] <**Insert pipe size**> and Smaller: Use dielectric [**nipples**] [**unions**].

Dielectric Fittings for [**NPS 2-1/2 to NPS 4**] <**Insert pipe size range**>: Use dielectric [**flanges**] [**flange kits**] [**nipples**].

Dielectric Fittings for [**NPS 5**] <**Insert pipe size**> and Larger: Use dielectric flange kits.

* + - 1. VALVE INSTALLATION

Retain this article if valves are required.

* + - * 1. General valve installation requirements for general-duty valve installations are specified in the following Sections:

Section 220523.12 "Ball Valves for Plumbing Piping."

Section 220523.13 "Butterfly Valves for Plumbing Piping."

Section 220523.14 "Check Valves for Plumbing Piping."

Section 220523.15 "Gate Valves for Plumbing Piping."

* + - * 1. Shutoff Valves:

Install shutoff valve on each sump pump discharge.

Install [**gate**] [**full port ball valve**] for piping NS 2 and smaller.

Install [**gate**] <**Insert type**> valve for piping NPS 2-1/2 and larger.

* + - * 1. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.
				2. Backwater Valves: Install backwater valves in piping subject to backflow.

Horizontal Piping: Horizontal backwater valves.[ **Use normally closed type unless otherwise indicated.**]

Install backwater valves in accessible locations.

Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

* + - 1. INSTALLATION OF HANGERS AND SUPPORTS

Retain first paragraph below for projects in areas that require seismic restraints.

* + - * 1. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
				2. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

Install [**carbon-steel**] <**Insert material**> pipe hangers for horizontal piping in noncorrosive environments.

Install [**stainless-steel**] [**fiberglass**] pipe hangers for horizontal piping in corrosive environments.

Install [**carbon-steel**] <**Insert material**> pipe support clamps for vertical piping in noncorrosive environments.

Install stainless-steel pipe support clamps for vertical piping in corrosive environments.

Vertical Piping: MSS Type 8 or Type 42, clamps.

Install individual, straight, horizontal piping runs:

100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

Base of Vertical Piping: MSS Type 52, spring hangers.

* + - * 1. Install hangers for [**cast-iron**] [**galvanized steel**] [**ductile iron**] [**and**] [**copper**] soil [**tubing**] [**and**] [**piping**], with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				2. Install hangers for [**ABS**] [**and**] [**PVC**] piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				3. Support horizontal piping and tubing within 12 inches of each fitting[**, valve,**] and coupling.
				4. Support vertical [**cast-iron**] [**galvanized steel**] [**ductile iron**] [**and**] [**copper**] [**tubing**] [**and**] [**piping**] to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.
				5. Support vertical [**ABS**] [**and**] [**PVC**] piping with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
			1. CONNECTIONS

Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
				3. Connect storm drainage piping to roof drains and storm drainage specialties.

Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

Second option in first subparagraph below should be indicated on Drawings.

Install horizontal backwater valves [**with cleanout cover flush with floor**] [**in pit with pit cover flush with floor**] <**Insert description**>.

Comply with requirements for [**backwater valves**] [**cleanouts**] [**and**] [**drains**] specified in Section 221423 "Storm Drainage Piping Specialties."

* + - * 1. Connect force-main piping to the following:

Revise "Storm Sewer" and "Sump Pumps" subparagraphs below to suit Project.

Storm Sewer: To exterior force main.

Sump Pumps: To sump pump discharge.

* + - * 1. Where installing piping adjacent to equipment, allow space for service and maintenance.
				2. Make connections according to the following unless otherwise indicated:

Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

* + - 1. IDENTIFICATION
				1. Identify exposed storm drainage piping.
				2. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."
			2. FIELD QUALITY CONTROL

Portions of testing and inspecting requirements in this article are taken from model plumbing codes. Revise if requirements vary.

* + - * 1. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

* + - * 1. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

Expose work that was covered or concealed before it was tested.

Test Procedure:

Test storm drainage piping[**, except outside leaders,**] on completion of roughing-in.

Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

Prepare reports for tests and required corrective action.

* + - * 1. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

Expose work that was covered or concealed before it was tested.

Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

Prepare reports for tests and required corrective action.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + - * 1. Piping will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. CLEANING AND PROTECTION
				1. Clean interior of piping. Remove dirt and debris as work progresses.
				2. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
				3. Place plugs in ends of uncompleted piping at end of day and when work stops.
			2. PIPING SCHEDULE

Retain and revise applicable piping applications in this article. Coordinate with materials specified.

* + - * 1. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground storm drainage piping [**NPS 6** **and smaller**] <**Insert pipe size range**> shall be[ **any of**] the following:

Retain one or more of first six subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

Hubless, cast-iron soil pipe and fittings; [**CISPI,**] [**heavy-duty,**] hubless-piping couplings; and coupled joints.

Galvanized-steel pipe, drainage fittings, and threaded joints.

Copper tube and fittings in first subparagraph below are only available in NPS 1-1/4 to NPS 8 (DN 32 to DN 200).

Copper Type DWV tube, copper drainage fittings, and soldered joints.

[**Solid-wall**] [**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.

[**Solid-wall**] [**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.

Dissimilar Pipe-Material Couplings: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground, storm drainage piping [**NPS 8** **and larger**] <**Insert pipe size range**> shall be[ **any of**] the following:

Retain one or more of first five subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

Hubless, cast-iron soil pipe and fittings; [**CISPI,**] [**heavy-duty,**] hubless-piping couplings; and coupled joints.

Galvanized-steel pipe, drainage fittings, and threaded joints.

Copper tube and fittings in first subparagraph below are only available in NPS 1-1/4 to NPS 8 (DN 32 to DN 200).

Copper Type DWV tube, copper drainage fittings, and soldered joints.

[**Solid-wall**] [**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.

Dissimilar Pipe-Material Couplings: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground storm drainage piping [**NPS 6** **and smaller**] <**Insert pipe size range**> shall be[ **any of**] the following:

Retain one or more of first four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

[**Extra Heavy**] [**Service**] class, cast-iron soil pipe and fittings; [**gaskets; and gasketed**] [**caulking materials; and caulked**] joints.

Hubless, cast-iron soil pipe and fittings; [**CISPI,**] [**heavy-duty,**] [**cast-iron,**] hubless-piping couplings; and coupled joints.

[**Solid-wall**] [**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.

[**Solid-wall**] [**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.

Dissimilar Pipe-Material Couplings: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground, storm drainage piping [**NPS 8** **and larger**] <**Insert pipe size range**> shall be[ **any of**] the following:

Retain one or more of first four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

[**Extra Heavy**] [**Service**] class, cast-iron soil pipe and fittings; [**gaskets; and gasketed**] [**caulking materials; and caulked**] joints.

Hubless, cast-iron soil pipe and fittings; [**CISPI,**] [**heavy-duty,**] [**cast-iron,**] hubless-piping couplings; and coupled joints.

PVC piping in first subparagraph below is limited in size to NPS 12 (DN 300).

[**Solid-wall**] [**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.

Cellular-core, sewer and drain series, PVC pipe; PVC socket fittings; and solvent-cemented joints.

Dissimilar Pipe-Material Couplings: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground storm drainage force mains [**NPS 1-1/2 and NPS 2**] <**Insert pipe size range**> shall be[ **any of**] the following:

Retain one or both subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Hard copper tube, Type L copper pressure fittings, and soldered joints.

Galvanized-steel pipe, pressure fittings, and threaded joints.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground storm drainage force mains [**NPS 2-1/2 to NPS 6**] <**Insert pipe size range**> shall be[ **any of**] the following:

Retain one or more of first three subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Hard copper tube, Type L copper pressure fittings, and soldered joints.

Galvanized-steel pipe, pressure fittings, and threaded joints.

Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

Fitting-type transition couplings if dissimilar pipe materials.

Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground storm drainage force mains [**NPS 4** **and smaller**] <**Insert pipe size range**> shall be[ **any of**] the following:

Retain one or more of first four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

[**Hard**] [**Soft**] copper tube; Type L [**wrought-**]copper pressure fittings; and soldered joints.

Ductile-iron, mechanical-joint piping and mechanical joints.

Ductile-iron, push-on-joint piping and push-on joints.

Ductile-iron, grooved-joint piping and grooved joints.

Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

Retain " any of" option in paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Underground storm drainage force mains [**NPS 5** **and larger**] <**Insert pipe size range**> shall be[ **any of**] the following:

Retain one or more of first four subparagraphs below. If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

Hard copper tube; Type L [**wrought-**]copper pressure fittings; and soldered joints.

Ductile-iron, mechanical-joint piping and mechanical joints.

Ductile-iron, push-on-joint piping and push-on joints.

Ductile-iron, grooved-joint piping and grooved joints.

Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 221413