DESIGN GUIDELINES
AND
TECHNICAL STANDARDS
DIVISION 33 – UTILITIES

SECTION 33 1313 - FACILITY SANITARY SEWERS

1. General: This section includes performance requirements and minimum requirements for the following products and materials:

   a. Pipe and fittings.
   b. Non-pressure and pressure couplings.
   c. Expansion joints and deflection fittings.
   d. Backwater valves.
   e. Cleanouts.
   f. Encasement for piping.
   g. Manholes.

2. Definitions:

   a. DIP: Ductile Iron Pipe
   b. PVC: Polyvinyl chloride plastic pipe

3. Regulatory Requirements: Comply with the Metropolitan Water Reclamation District (MWRD) requirements, including inspections prior to and during work.

4. Performance Requirements:

   a. Pressure pipe pressure ratings: At least equal to system operating pressure, but not less than 150 psig.

5. Project Conditions:

   a. Site Information: Architect-Engineer shall coordinate site survey, research public utility records, and verify existing utility locations with NU representatives. Locate existing structures and piping to be closed and abandoned.

   b. Coordinate the Interruption of Existing Sanitary Sewerage Service with NU. Contract Documents should indicate that interruption of service to facilities occupied by NU or others is only permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

      i. Notify NU no fewer than fourteen (14) days in advance of proposed interruption of service.
ii. Do not proceed with interruption of service without NU's written permission.

6. Products: The following products and materials indicate NU preferences. Review specific project requirements with NU during the design phase of the project.

a. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings:
   i. Pipe and Fittings: ASTM A 74, service class.
   ii. Gaskets: ASTM C 564, rubber.
   iii. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

b. Ductile-Iron Pipe and Fittings:
   i. Push-on-Joint Piping:
      2. Standard Fittings: AWWA C110, ductile or gray iron.
   ii. Mechanical-Joint Piping:
      2. Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.
      4. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
      5. Gaskets: AWWA C111, ANSI A21.11 rubber, of shape matching pipe, fittings, and glands.

c. PVC Pipe and Fittings:
   i. PVC Type PSM Sewer Piping, 15-inch and smaller:
      1. Pipe: ASTM D 3034, SDR 26 PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
      2. Fittings: ASTM D 3034, PVC with bell ends.
ii. PVC Type PSM Sewer Piping, 18-inch and larger:
   1. Pipe: ASTM F 679, T-1 wall thickness, bell and spigot for gasketed joints.
   2. Fittings: ASTM F679

iii. PVC Pressure Piping:
   1. Pipe: AWWA C900, Class 150 Class 200 PVC pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: AWWA C900, Class 150 Class 200 PVC pipe with bell ends.

d. Non-Pressure-Type Transition Couplings:
   i. Comply with ASTMC 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.

ii. Sleeve Materials:
   1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 926, PVC.
   3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

e. Unshielded, Flexible Couplings: Elastomeric sleeve with stainless steel corrosion-resistant-metal tension band and tightening mechanism on each end.

f. Shielded, Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant stainless steel outer shield and corrosion-resistant stainless steel tension band and tightening mechanism on each end.

g. Pressure-Type Pipe Couplings:
   i. Metal, bolted, mechanical joint sleeve, reducing or transition coupling, for joining underground pressure piping. Include 200-psig minimum pressure rating and ends of same sizes as piping to be joined.
1. Gasket Material: Natural or synthetic rubber.

2. Metal Component Finish: Corrosion-resistant coating or material.

h. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

i. Backwater Valves:
   ii. PVC Backwater Valves: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

j. Cleanouts:
   i. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.


2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

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

k. Encasement for Piping:
   i. Standard: ASTM A 674 or AWWA C105.
   ii. Material: polyethylene film of 0.008-inch (0.20-mm) minimum thickness.
   iii. Form: Sheet or tube.
   iv. Color: Black or natural.

l. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   i. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
   ii. Riser Sections: Of length to provide depth indicated.
   iii. Top Section: Eccentric-cone type unless flat-slab-top type is required; with top of cone of size that matches grade rings.

v. Resilient Pipe Connectors: ASTM C 923 rubber boot, cast or fitted into manhole walls, for each pipe connection. Boot shall result in a water tight connection conforming to the performance requirements of ASTM C 443.

vi. Steps: Cast Iron steps conforming to the performance standards of ASTM C 478. Omit steps if total depth from floor of manhole to finished grade is less than 48. Cast or anchor steps into sidewalls at 16-inch intervals inches.

vii. Grade (Adjusting) Rings: Reinforced-concrete rings, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Maximum per Drawings.

m. Manhole Frames and Covers: Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

i. Material: ASTM A 48, Class 35 gray ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

n. Manhole-Cover Inserts: 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.

i. Type: Solid.

o. External Chimney Seal: Rubber sleeves shall be extruded from a high grade rubber compound meeting the applicable requirements of ASTM C923. Sleeves shall be double or triple pleated with a minimum unexpanded vertical height of 8 inches, a minimum thickness of 3/16 inch, capable of expanding not less than 2 inches vertically when installed.

i. Screws, bolts and nuts: Stainless steel, ASTM F-593 and 594 Type 304.

ii. Expansion Bands shall be16 gauge thickness, 1-3/4 inches wide and made of stainless steel meeting the requirements of ASTM A240, Type 304.

p. Protective Coatings: One- or two-coat, coal-tar epoxy; 15-mil minimum thickness, unless otherwise indicated; factory or field applied to the exterior and interior surfaces.

q. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum. Include channels and benches in manholes.

i. 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.
ii. Invert Slope: 1 percent through manhole.

iii. Benches: Concrete, sloped to drain into channel.

iv. Slope: 8 percent.

7. Field Quality Control:

   a. Inspections: Require inspection and report by Contractor of interior of piping to determine whether line displacement or other damage has occurred. Inspections should occur after approximately 24 inches of backfill is in place, and again at completion of Project.

      i. Contractor shall submit separate report for each system inspection.

      ii. Defects requiring correction include the following:

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

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

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

         4. Infiltration: Water leakage into piping.

         5. Exfiltration: Water leakage from or around piping.

      iii. Contractor shall replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

      iv. Contractor shall reinspect and repeat procedure until results are satisfactory.

   b. Testing: Contractor shall test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

      i. Contractor shall not enclose, cover, or put into service before inspection and approval.

      ii. Contractor shall test completed piping systems according to requirements of authorities having jurisdiction.

      iii. Contractor shall schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

      iv. Contractor shall submit separate report for each test.

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

1. Option: Test plastic gravity sewer piping according to ASTM F 1417

2. Option: Test clay gravity sewer piping according to ASTM C 828.

vii. 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.

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

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

x. Manholes: Perform hydraulic test according to ASTM C 969.

xi.Leaks and loss in test pressure constitute defects that must be repaired.

c. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

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DIVISION 33 – UTILITIES

SECTION 33 4100 – STORM UTILITY DRAINAGE PIPING

1. General: This section includes performance requirements and minimum requirements for gravity-flow, non-pressure storm drainage outside the building.

2. Definitions:
   a. PVC: Polyvinyl chloride plastic
   b. HDPE: High Density Polyethylene.
   c. RCP: Reinforce Concrete Sewer Pipe
   d. CSP: Non-reinforced Concrete Sewer Pipe

3. Performance Requirements – Gravity-Flow, Nonpressure, Drainage-Piping Pressure Ratings:
   a. At least equal to system test pressure.

4. Project Conditions:
   a. Site Information: Architect-Engineer shall coordinate site survey, research public utility records, and verify existing utility locations with NU representatives. Locate existing structures and piping to be closed and abandoned.
   b. Locate existing structures and piping to be closed and abandoned.
   a. Existing Storm Drainage Service: Contract Documents should indicate that interruption of service to facilities occupied by NU or others is only permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
      i. Notify NU no fewer than two days in advance of proposed interruption of service.
      ii. Do not proceed with interruption of service without NU's written permission.

5. Products:
   a. Pipes and Fittings:
      i. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings: ASTM A 74, gray iron, for gasketed joints.
         1. Gaskets: ASTM C 564, rubber, compression type, thickness to match class of pipe.
ii. Ductile Iron Pipe and Fittings: AWWA C151, for push-on joints.
   1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
   2. Gaskets: AWWA C111, rubber.

iii. Corrugated-Steel Pipe: Not permitted.

iv. Corrugated HDPE Drainage Tubing and Fittings: AASHTO M 252, Type S, with smooth waterway for coupling joints.
   1. Soiltight Couplings: AASHTO M 252, corrugated, matching tube and fittings to form soiltight joints.

v. Corrugated HDPE Pipe and Fittings: AASHTO M 294, Type S, with smooth waterway for coupling
   1. Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings to form soiltight joints.
   2. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings to form silttight joints.

vi. PVC Pressure Pipe: AWWA C900/C905, Class 150, for gasketed joints.
   1. PVC Pressure Fittings: AWWA C907, for gasketed joints.

vii. PVC Sewer Pipe and Fittings:
   1. PVC Sewer Pipe and Fittings, 15” and Smaller: ASTM D 3034, SDR 26, gasketed joints.

viii. PVC Sewer Pipe and Fittings, 18” and Larger: ASTM F 679, T-1 wall thickness, bell and spigot for gasketed joints.

ix. Nonreinforced-Concrete Sewer (CSP) Pipe and Fittings: Not permitted.

x. Reinforced-Concrete (RCP) Sewer Pipe and Fittings: ASTM C 76, Class III, with gasketed joints.
xi. Reinforced-Concrete Arch Pipe: ASTM C 506, Class IV, for banded joints.
   1. Sealing Bands: ASTM C 877, Type I.

xii. Reinforced-Concrete Elliptical Pipe: ASTM C 507, Class III, for banded joints.
   1. Pattern: Type HE, horizontal.
   2. Pattern: Type VE, vertical.
   3. Sealing Bands: ASTM C 877, Type I.

b. Special Pipe Couplings and Fittings:
   i. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

   ii. Sleeve Materials: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.
       5. Bands: Stainless steel, at least one at each pipe insert.

   iii. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
       1. Heavy-Duty, Shielded, Stainless-Steel Couplings, 10-inch and Smaller: With ASTM A 666, Type 301 or Type 304, stainless-steel shield; 2 or more stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
       2. Heavy-Duty, Shielded, Stainless-Steel Couplings, 12-inch and 15-inch: With ASTM A 666, Type 301 or Type 304, stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
iv. Unshielded Flexible Couplings: Elastomeric sleeve with stainless steel tension band and tightening mechanism on each end.


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

ii. Steps: Steel Reinforced Plastic or Cast Iron, individual steps. Wide enough to allow worker to place both feet on one step and is 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.

iii. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include indented top design with lettering "STORM SEWER" cast into cover.

iv. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.


i. Gaskets: ASTM C 443, rubber.

ii. Steps: Provide one of the following:

1. Fiberglass, individual steps or ladder of a width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step.

2. Steel Reinforced Plastic or Cast Iron individual steps. Wide enough to allow worker to place both feet on one step and is 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 invert to finished grade is less than 60 inches.

iii. Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service.

iv. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
v. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

vi. Protective Coating: Plant-applied, Bitumastic Coal Tar SSPC-Paint 16 10-mil minimum thickness applied to exterior surface.

e. Stormwater Inlets:

i. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

ii. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

iii. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

f. Cleanouts:

i. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

   1. Light Duty: In earth or grass foot-traffic areas.
   2. Medium Duty: In paved foot-traffic areas.
   3. Heavy Duty: In vehicle-traffic service areas.
   5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

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

   1. Light Duty: In earth or grass foot-traffic areas.
   2. Medium Duty: In paved foot-traffic areas.
   3. Heavy Duty: In vehicle-traffic service areas.
iii. Gray-Iron Area Drains: ASME A112.21.1M, round, gray-iron body with anchor flange and round, secured, gray-iron grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated. Use units with top-loading classifications according to the following applications:

1. Medium Duty: In paved foot-traffic areas.
2. Heavy Duty: In vehicle-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
3. Ballast: Increase thickness of concrete, as required to prevent flotation.

g. Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total lengths indicated.

i. Sloped-Invert, Polymer-Concrete Systems: Include the following components:

1. Channel Sections: Interlocking-joint, precast, modular units with end caps, rounded bottom, with built-in invert slope of 0.6 percent minimum and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
   a. Frame: Include gray-iron or steel frame for grate.
2. Grates with manufacturer’s designation "Heavy Duty," with slots or perforations that fit recesses in channels.
   a. Material: Provide fiberglass, galvanized steel, or stainless steel.
3. Locking Mechanism: Manufacturer’s standard device for securing grates to channel sections.

h. Plastic, Channel Drainage Systems: Modular system of plastic channel sections, grates, and appurtenances; designed so grates fit into frames without rocking or rattling. Include number of units required to form total lengths indicated.

i. Fiberglass Systems: Include the following components:

1. Channel Sections: Interlocking-joint, fiberglass modular units, with built-in invert slope of approximately 1 percent and with end caps. Include rounded or inclined inside bottom surface, with outlets in number, sizes, and locations indicated.
2. Factory- or field-attached frames that fit channel sections and grates.
a. Material: Galvanized steel Stainless steel Bronze

3. Grates with slots or perforations that fit frames.

4. Drainage Specialties: Include the following plastic components:
   a. Large Catch Basins: 24-inch- square plastic body, with outlets in number and sizes indicated. Include gray-iron frame and slotted grate.
   b. Small Catch Basins: 12-by-24-inch plastic body, with outlets in number and sizes indicated. Include gray-iron frame and slotted grate.

6. Identification:
   a. Requirements include installing green warning tapes directly over piping and at outside edges of underground structures.
      i. Use warning tape or detectable warning tape over ferrous piping.
      ii. Use detectable warning tape over nonferrous piping and over edges of underground structures.

7. Field Quality Control:
   a. Contractor shall clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
      i. In large, accessible piping, brushes and brooms may be used for cleaning.
      ii. Place plug in end of incomplete piping at end of day and when work stops.
      iii. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
   b. Inspections: Contractor shall 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.
      i. Submit separate reports for each system inspection.
      ii. Defects requiring correction include the following:
1. Alignment: Less than full diameter of inside of pipe is visible between structures.

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

3. Crushed, broken, cracked, or otherwise damaged piping.

4. Infiltration: Water leakage into piping.

5. Exfiltration: Water leakage from or around piping.

   iii. Contractor shall replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

   iv. Contractor shall reinspect and repeat procedure until results are satisfactory.

c. Testing: Contractor shall test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

   i. Contractor shall not enclose, cover, or put into service before inspection and approval.

   ii. Contractor shall test completed piping systems according to authorities having jurisdiction.

   iii. Contractor shall schedule tests and inspections by authorities having jurisdiction with at least 24 hours’ advance notice.

   iv. Contractor shall submit separate reports for each test.

   v. Contractor shall replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION