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**STORM SEWERS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Storm Sewers
- B. Abandonment of Storm Sewers

**1.02 DESCRIPTION OF WORK**

- A. Construct storm sewers.
- B. Abandon storm sewers.

**1.03 SUBMITTALS**

Comply with Division 1 - General Provisions and Covenants.

**1.04 SUBSTITUTIONS**

Comply with Division 1 - General Provisions and Covenants.

**1.05 DELIVERY, STORAGE, AND HANDLING**

Comply with Division 1 - General Provisions and Covenants.

**1.06 SCHEDULING AND CONFLICTS**

Comply with Division 1 - General Provisions and Covenants.

**1.07 SPECIAL REQUIREMENTS**

None.

**1.08 MEASUREMENT AND PAYMENT****A. Storm Sewer:****1. Trenched:**

- a. Measurement:** Each type and size of pipe installed in a trench will be measured in linear feet along the centerline of the pipe from center of intake or manhole to center of intake or manhole. Where the end of the pipe discharges to a ditch or waterway, measurement will be to the end of the pipe, exclusive of aprons. Lengths of elbows and tees will be included in the length of pipe measured.
- b. Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe.
- c. Includes:** Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; joint wrapping; wyes and other fittings; pipe joints; pipe connections; testing; and inspection.

**1.08 MEASUREMENT AND PAYMENT (Continued)****2. Trenchless:**

- a. Measurement:** Each type and size of pipe installed by trenchless methods will be measured in linear feet along the centerline of the pipe.
- b. Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe.
- c. Includes:** Unit price includes, but is not limited to, furnishing and installing pipe; trenchless installation materials and equipment; pit excavation; dewatering; placing and compacting backfill material; pipe connections; testing; and inspection.

**B. Storm Sewer with Casing Pipe:****1. Trenched:**

- a. Measurement:** Each type and size of pipe installed with a casing pipe in a trench will be measured in linear feet along the centerline of the casing pipe from end of casing to end of casing.
- b. Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe.
- c. Includes:** Unit price includes, but is not limited to, furnishing and installing both carrier pipe and casing pipe; trench excavation; dewatering; furnishing, placing, and compacting bedding and backfill material; furnishing and installing annular space fill material; casing spacers; pipe connections; testing; and inspection.

**2. Trenchless:**

- a. Measurement:** Each type and size of pipe installed by trenchless methods with a casing pipe will be measured in linear feet along the centerline of the casing pipe from end of casing to end of casing.
- b. Payment:** Payment will be made at the unit price per linear foot for each type and size of carrier pipe.
- c. Includes:** Unit price includes, but is not limited to, furnishing and installing both carrier pipe and casing pipe; trenchless installation materials and equipment; pit excavation; dewatering; placing and compacting backfill material; casing spacers; furnishing and installing annular space fill material; pipe connections; testing; and inspection.

**C. Linear Trench Drain:**

- 1. Measurement:** Measurement will be in linear feet from end to end.
- 2. Payment:** Payment will be at the unit price per linear feet of linear trench drain installed.
- 3. Includes:** Price includes, but is not limited to, furnishing and installing the linear trench drain including all appurtenances; furnishing and placement of PCC transition; furnishing, excavation, and backfill of discharge pipe; connection to manhole or intake, if required; installation of apron, if required.

**D. Removal of Storm Sewer:**

- 1. Measurement:** Each type and size of pipe removed will be measured in linear feet from end to end.
- 2. Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe removed.
- 3. Includes:** Unit price includes, but is not limited to, removal, disposal, and capping (if specified) of pipe; and furnishing, placing, and compacting backfill material.

**1.08 MEASUREMENT AND PAYMENT (Continued)**

**E. Connection to Existing Manhole or Intake:** Comply with [Section 6010.1.08.G](#).

**F. Storm Sewer Abandonment, Plug:**

1. **Measurement:** Each plug will be counted.
2. **Payment:** Payment will be made at the unit price for each plug installed.
3. **Includes:** Unit price includes, but is not limited to, trench excavation (if necessary), cutting pipe (if required), furnishing and placing plug materials, and placing and compacting backfill material.

**G. Storm Sewer Abandonment, Fill and Plug:**

1. **Measurement:** Each size of storm sewer to be abandoned by filling and plugging will be measured in linear feet.
2. **Payment:** Payment will be at the unit price per linear foot for each size of pipe filled and plugged.
3. **Includes:** Unit price includes but is not limited to, trench excavation (if necessary), cutting pipe (if required), furnishing and placing pipe fill material, furnishing and placing plug materials, and placing and compacting backfill material.

**H. Aprons:** Comply with [Section 4030](#) for pipe aprons, apron footings, and apron guards.

**PART 2 - PRODUCTS****2.01 STORM SEWERS****A. Reinforced Concrete Pipe (RCP):**

1. Comply with ASTM C 76.
2. Minimum Class III, Wall B (Iowa DOT Class 2000D).
3. Use tongue and groove joints wrapped with engineering fabric, unless a rubber O-ring or profile gasket complying with ASTM C 443 is specified.

**B. Reinforced Concrete Arch Pipe (RCAP):**

1. Comply with ASTM C 506.
2. Minimum Class A-III (Iowa DOT Class 2000D).
3. Use tongue and groove joints wrapped with engineering fabric, unless a rubber O-ring or profile gasket complying with ASTM C 443 is specified.

**C. Reinforced Concrete Elliptical Pipe (RCEP):**

1. Comply with ASTM C 507.
2. Minimum Class HE III (Iowa DOT Class 2000D) or Class VE III (Iowa DOT Class 2000D).
3. Use tongue and groove joints wrapped with engineering fabric, unless a rubber O-ring or profile gasket complying with ASTM C 443 is specified.

**D. Reinforced Concrete Low Head Pressure Pipe (RCLPP):**

1. Comply with ASTM C 361; minimum Class C 25.
2. Use tongue and groove joints. Comply with ASTM C 361 for rubber O-rings or profile gaskets.

**E. Polyvinyl Chloride Pipe (PVC):**

1. Use pipe complying with the following:
  - a. Types of PVC pipes:
    - 1) Corrugated exterior, smooth interior, ASTM F 949.
    - 2) Solid wall, ASTM D 3034 or ASTM F 679.
    - 3) Closed profile, ASTM F 1803.
    - 4) Composite, ASTM D 2680.
  - b. PVC plastic meeting ASTM D 1784, Cell Classification 12454.
  - c. Minimum pipe stiffness of 46 psi.
  - d. Integral bell and spigot joints with elastomeric seals according to ASTM D 3212 and ASTM F 477.
2. Use of this pipe material requires specific approval by the Engineer.

**2.01 STORM SEWERS (Continued)****F. High Density Polyethylene Pipe (HDPE):**

1. Use pipe complying with the following:
  - a. AASHTO M 294, Type S corrugated exterior and smooth interior.
  - b. Minimum pipe stiffness at 5% deflection according to ASTM D 2412.
  - c. Integral bell and spigot joints with elastomeric seals complying with ASTM F 477.
  - d. Maximum 5% deflection of the average inside diameter by testing after installation according to [Section 4060, 3.05](#).
2. Use of this pipe material requires specific approval by the Engineer.

**G. Corrugated Metal Pipe (CMP):**

1. Use pipe complying with the following:
  - a. AASHTO M 36, Type I.
  - b. Zinc coating complying with AASHTO M 218.
  - c. Corrugated steel circular section with annular or helical corrugations.
  - d. Gage of pipe according to [Iowa DOT Standard Road Plan DR-104](#) or as specified in the contract documents.
  - e. Coupling bands with annular or helical corrugations to match pipe ends.
2. Use of this pipe material requires specific approval by the Engineer.

**H. Spiral Rib Pipe:**

1. Use pipe complying with the following:
  - a. ASTM A 760 Type 1R.
  - b. Corrugation profile of 3/4 inch by 3/4 inch by 7 1/2 inches.
  - c. Type 2 aluminized steel complying with ASTM A 929.
  - d. Minimum thickness of 0.064 inch. Use gage of pipe according to manufacturer's requirements.
  - e. Coupling bands complying with manufacturer's recommendations.
2. Use of this pipe material requires specific approval by the Engineer.

**I. Coated Corrugated Metal Pipe:**

1. Use in corrosive soil or effluent conditions, or where specified in the contract documents or required by the Engineer.
2. Comply with AASHTO M 274. Use gage of pipe according to [Iowa DOT Standard Road Plan DR-104](#) or as specified in the contract documents.
3. Use of this pipe material requires specific approval by the Engineer.

**J. Corrugated Metal Arch Pipe (CMAP):**

1. Use pipe complying with the following:
  - a. AASHTO M 36, Type II.
  - b. Zinc coating complying with AASHTO M 218.
  - c. Corrugated steel Type I pipe reformed into a pipe-arch having an approximately flat bottom.
  - d. Coupling bands with annular corrugations or helical corrugations to match pipe ends.
  - e. Gage of pipe according to [Iowa DOT Standard Road Plan DR-104](#).
2. Use of this pipe material requires specific approval by the Engineer.

**2.01 STORM SEWERS (Continued)****K. Spiral Rib Arch Pipe:**

1. Use pipe complying with the following:
  - a. ASTM A 760 Type IIR.
  - b. Corrugation profile of 3/4 inch by 3/4 inch by 7 1/2 inch.
  - c. Type 2 aluminized steel complying with ASTM A 929.
  - d. Minimum thickness of 0.064 inch. Use gage of pipe complying with manufacturer's requirements.
  - e. Coupling bands complying with the manufacturer's recommendations.
2. Use of this pipe material requires specific approval by the Engineer.

**L. Polypropylene Pipe:**

1. Comply with the following for 12 inch to 30 inch pipe:
  - a. Double walled pipe meeting ASTM F 2764.
  - b. Minimum pipe stiffness per ASTM D 2412, 46 psi.
  - c. Integral bell and spigot joint complying with ASTM D 3212 and ASTM F 477.
2. Comply with the following for 30 inch to 60 inch pipe:
  - a. Triple walled pipe meeting ASTM F 2764.
  - b. Minimum pipe stiffness per ASTM D 2412, 46 psi.
  - c. Integral bell and spigot joint complying with ASTM D 3212 and ASTM F 477.
3. Use of this pipe material requires specific approval by the Engineer.

**M. Bituminous Joint Primer:** Material intended for use in priming concrete joints. Comply with the requirements of ASTM D 41.

**N. Engineering Fabric:** Comply with [Iowa DOT Article 4196.01](#).

**O. Non-Shrink Grout:** Comply with [Iowa DOT Materials I.M. 491.13](#).

**2.02 LINEAR TRENCH DRAIN**

Comply with approved manufacturer's requirements and [Iowa DOT Materials I.M. 449 \(MAPLE\)](#), as well as complying with [Figure 6010.521](#). Provide certification indicating continuous trench drain meets AASHTO M 306 for 40,000 pound proof load.

**2.03 CASING PIPE**

Comply with [Section 3020, 2.02](#) for casing pipe requirements.

**2.04 PIPE APRONS**

Comply with the requirements of [Section 4020, 2.01](#) and [Section 4030, 2.01](#) for the pipe material of which the apron is constructed. Supply concrete pipe aprons according to [Figure 4030.222](#) and [Figure 4030.223](#). Supply CMP pipe aprons according to [Figure 4030.225](#).

**2.05 APRON FOOTINGS**

Comply with the requirements of [Section 6010](#) for reinforcing steel and structural concrete used in apron footings.

**2.06 APRON GUARD**

Use smooth or deformed steel bars, ASTM A 615, Grade 40 or Grade 60, or merchant quality, in the construction of the apron guard. Hot dip galvanize the apron guard according to ASTM A 123.

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**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Verify measurements at site; make necessary field measurements to accurately determine pipe makeup lengths or closures.
- B. Examine site conditions to ensure construction operations do not pose hazards to adjacent structures or facilities.

**3.02 PIPE INSTALLATION****A. General:**

- 1. Clean pipe interior and joints prior to lowering into trench. Keep pipe clean during construction.
- 2. Begin at the lowest point in the line. Lay groove or bell end pointing upstream unless otherwise specified.
- 3. Place pipe with lifting holes at the top of the pipe and fill lift hole with non-shrink grout or manufactured plugs.
- 4. Assemble joints as specified by the pipe manufacturer.
- 5. Use a saw to cut ends of pipe flush with inside wall of manholes, intakes, and structures. Do not use hammer or other means to break pipe.
- 6. Provide manholes and intakes as specified in the contract documents.
- 7. Use watertight stopper, plug, or other approved means to protect the exposed upstream ends of the pipe and prevent soil sediment from entering the storm sewer system.

**B. Trenched:**

- 1. Excavate trench and provide pipe bedding and backfill material as specified in [Section 3010](#).
- 2. Prepare trench bottom to design line and grade so that only minor movement of the pipe is necessary after installation.
- 3. Lay pipe to design line and grade. Set field grades to invert of pipe.
- 4. Provide uniform bearing for full pipe barrel length. Excavate bell holes as necessary for uniform support of pipe barrel on bedding material.
- 5. Do not lay pipe in water or on saturated soil or bedding, or allow water to rise in trench around pipe prior to placing backfill material.
- 6. Do not disturb installed pipe and bedding when using movable trench boxes and shields. Block or anchor pipe as necessary to prevent joint displacement.

**C. Trenchless:** Comply with [Section 3020](#).**3.03 STORM SEWER INSTALLED WITHIN A CASING PIPE**

Comply with [Section 3020, 3.04](#) for installation of storm sewer within casing pipe.

**3.04 LINEAR TRENCH DRAIN**

- A. Install according to the manufacturer's requirements and the contract documents.
- B. Use duct tape or wood block to prevent intrusion of concrete during installation and paving.
- C. Connect to existing intake or manhole according to [Section 6010, 3.05](#) or discharge to an open drainageway/ditch.

**3.05 PIPE JOINTING****A. General:**

- 1. Clean joint surfaces to remove soil or foreign material prior to jointing pipe.
- 2. Assemble joints according to pipe manufacturer's recommendations. Use equipment that does not apply damaging forces to pipe joints.

**B. Reinforced Concrete Pipe (RCP), Reinforced Concrete Arch Pipe (RCAP), and Reinforced Concrete Elliptical Pipe (RCEP):**

- 1. Comply with [Figure 4020.211](#) for pipe joint wrapping. Secure engineering fabric in place to prevent displacement while placing backfill material.
- 2. If a rubber O-ring or profile gasket is specified for RCP, coat the rubber gasket and joint with soap-based lubricant immediately prior to closing the joint.
- 3. Place pipe such that joint openings on the outside or inside of the pipe do not exceed 1/8 inch at the bottom and 5/8 inch at the top.

**C. Reinforced Concrete Low Head Pressure Pipe (RCLPP); Polyvinyl Chloride Pipe (PVC) and Corrugated PVC Pipe; Polypropylene Pipe; and High Density Polyethylene Pipe (HDPE):** Coat gasket and joint with soap-based lubricant immediately prior to closing the joint.**D. Corrugated Metal Pipe (CMP) and Corrugated Metal Arch Pipe (CMAP):** Lap coupling bands to form a tightly closed joint upon installation.**E. Connections between Dissimilar Pipes:**

- 1. Use manufactured adapters or couplings approved by the Engineer.
- 2. Where adapters or couplings are not available, the Engineer may authorize use of a concrete collar as shown in [Figure 4020.211](#).

**3.06 APRONS**

- A. Install pipe aprons where specified in the contract documents. Use the same installation methods as used on the pipe to which the apron is being attached. Dewater area as necessary to prevent installing the apron in water or on saturated soil or bedding. Do not allow water to rise around the apron prior to backfilling the area.
- B. Install apron footings where specified in the contract documents. Construct according to [Section 6010](#) and the contract documents. Dewater area as necessary to prevent installing the apron footing in water or on saturated soil or bedding. Do not allow water to rise around the apron footing prior to backfilling the area.



**3.06 APRONS (Continued)**

- C. Anchor the last three concrete pipe sections and the apron together with two pipe connections per joint. Comply with [Iowa DOT Standard Road Plan DR-121](#).
- D. Attach corrugated metal aprons to the pipe with a manufacturer's approved bolt, weld, or clamp to fasten directly to the pipe.
- E. Install apron guard where specified in the contract documents. Construct according to [Figure 4030.224](#) or [4030.225](#). Repair any damage to the galvanized coating that occurs due to storage, handling, or installation.

**3.07 TOLERANCES**

The following tolerances apply to utilities installed by open trench construction. For trenchless construction, comply with [Section 3020](#).

- A. Do not allow horizontal and vertical alignment to vary from design line and grade at any structure by more than 1% of the inside diameter of the pipe or 1/4 inch, whichever is larger.
- B. Do not allow the horizontal alignment of the pipe to vary from design line at any point along the pipe by more than 1% of the inside diameter of the pipe.
- C. Low spots holding water exceeding the following depths for each pipe size will be considered unacceptable and must be removed and reinstalled to proper grade.

Pipe Diameter	Maximum Low Spot Depth
8"	1/2"
10"	1/2"
12"	3/4"
15"	3/4"
18" and Larger	5% of Pipe Diameter*

\* Measured to the nearest 1/2"

**3.08 CONFLICTS**

- A. Horizontal Separation of Gravity Storm Sewers from Water Mains:** Separate storm sewers and water mains by at least 10 feet measured edge to edge unless it is impossible to do so. When not possible to maintain a 10 feet horizontal separation, maintain a minimum separation of 3 feet and utilize one of the following within 10 feet measured edge to edge:
  1. Construct the water main of ductile iron pipe with gaskets impermeable to hydrocarbons.
  2. Enclose the water main in a watertight casing pipe with evenly spaced annular gap and watertight end seals.
  3. Construct storm sewer pipe of water main materials.
  4. Construct storm sewers of reinforced concrete pipe with gaskets manufactured according to ASTM C 443.
- B. Separation of Storm Sewer Force Mains from Water Mains:** Separate storm sewer force mains and water mains by a horizontal distance of at least 10 feet unless:
  1. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of [Section 5010, 2.01](#) and
  2. The sewer force main is laid at least 4 linear feet from the water main.

**3.08 CONFLICTS (Continued)****C. Vertical Separation of Storm Sewers and Water Main Crossovers:**

1. Vertically separate storm sewers from water mains by at least 18 inches measured between the outside edges of the water main and the storm sewer. Maintain the maximum feasible separation distance in all cases. Ensure the sewer and water pipes are adequately supported. Use a low permeability soil for backfill material within 10 feet of the point of crossing.
2. When impossible to maintain an 18 inch vertical separation when the water main crosses over the storm sewer, maintain a minimum vertical separation of 6 inches and utilize one of the following within 10 feet measured edge-to-edge centered on the crossing:
  - a. Construct the water main of ductile iron pipe with gaskets impermeable to hydrocarbons.
  - b. Enclose the water main in a watertight casing pipe with evenly spaced annular gap and watertight end seals.
  - c. Construct storm sewer pipe of water main materials.
  - d. Construct storm sewers of reinforced concrete pipe with gaskets manufactured according to ASTM C 443.

**3.09 STORM SEWER ABANDONMENT****A. Plug:**

1. Prior to placing the sewer plug, the Engineer will verify the sewer line is not in use.
2. Construct sewer plug by completely filling the end of the pipe with concrete. Force concrete into the end of the pipe for a distance of 16 inches, or one-half the pipe diameter, whichever is greater.

**B. Fill:**

1. Prior to filling the sewer, the Engineer will verify the sewer line is not in use.
2. If specified in the contract documents, fill the line to be abandoned with flowable mortar, foamed cellular concrete, or CLSM (comply with [Section 3010](#)) by gravity flow or pumping.
3. Batching, mixing, and placing may be started when temperature is 34°F and rising. Cease mixing and placing when temperature is 38°F or less and falling.

**3.10 CONNECTION TO EXISTING MANHOLE OR INTAKE**

Comply with [Section 6010, 3.05](#).

**3.11 CLEANING, INSPECTION, AND TESTING**

Clean, inspect, and test according to [Section 4060](#).

END OF SECTION