

SECTION 2400 STORM SEWERS

PART 1 GENERAL

1.01 Scope

- A. Provide all labor, materials, and equipment necessary for the complete installation of storm sewers and related appurtenances in accordance with the Contract Documents and these specifications. Unless otherwise noted within these specifications, the word “sewers” shall refer to pipe sewers, box culvert sewers, or open channels.
- B. All materials shall be at the strength or class indicated. Higher strength materials may be furnished at the Contractor's option at no additional cost to the City.
- C. The manufacturer and the Contractor shall use equipment and methods adequate to protect materials during moving, storage, or installation. Damaged materials that cause reasonable doubt as to their ability to perform as designed shall be rejected, and the Contractor shall remove the materials from the construction site as soon as possible. Upon completion of the work, the Contractor shall leave the entire area within the limits of the contract in a clean and sightly condition.
- D. All materials shall be stored to prevent deterioration or intrusion of foreign matter. No deteriorated or damaged material shall be used.
- E. Upon the request of the City Engineer, the Contractor shall provide three (3) copies of certified test reports indicating the material conforms to the specifications as outlined in the following sections. The manufacturer shall perform all tests in conformance with applicable standards. Testing may be witnessed by the City Engineer or approved independent testing laboratory.

1.02 This Section Addresses

- A. Installation of storm sewer pipe and related accessories.
- B. Installation of concrete collars.

1.03 Related Work and Referenced Standards

- A. The following standards and related Specification Sections are referenced directly in this Section. The latest version of these standards shall be used. If conflicting standards are referenced, the more stringent standard shall apply.
 - 1. KDOT Standard Specifications for Road and Bridge Construction (latest edition)
 - 2. Section 2100 – SITE PREP, GRADING AND EARTHWORK (in process)
 - 3. Section 2130 – TRENCHING, STRUCTURE EXCAVATION, AND BACKFILL (in process)
 - 4. Section 2500 – STORM SEWER STRUCTURES
 - 5. Section 2550 – CHANNEL LINING AND OUTFALL STABILIZATION
 - 6. Section 2600 – PAVING
 - 7. Section 2800 – TURFGRASS SEEDING
 - 8. Section 2805 – NATIVE PRAIRIEGRASS SEEDING
 - 9. Section 2810 – SODDING

1.04 Submittals

- A. Submit manufacturer’s product data and certifications.

PART 2 MATERIALS

2.01 Reinforced Concrete Pipe

A. Pipe:

1. Reinforced concrete pipe shall conform to the following ASTM Standards and be of the minimum strength designated herein or such higher strength as may be required by the Plans:

- a. Round Pipe: ASTM C 76, Class II (minimum), Wall B (minimum)
- b. Arch Culvert Pipe: ASTM C 506, Class A-II
- c. Elliptical Pipe: ASTM C 507, Class HE-II

2. Except for fittings and closure pieces, each joint of pipe shall not be less than eight feet long for pipe diameters 48 inches or less and shall not be less than six feet long for pipe diameters larger than 48 inches.

B. Reinforcement:

1. Circumferential reinforcement shall be full-circle type.
2. Part-circle reinforcement will not be approved.
3. All reinforcing shall be located and spaced as recommended by the pipe manufacturer.

C. Joints

1. Plastic Joint Compound:

- a. Plastic Joint Compound shall conform to the requirements in the most recent edition of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation.

2. Rubber Gasket Joints:

- a. Rubber gasket joints shall conform to ASTM C 443.

3. Preformed Flexible Joint Sealant:

- a. This sealant shall be either rope form or flat tape form conforming to ASTM C 990. Primer, if recommended by the manufacturer, shall be applied within the manufacturers' time requirements on all bell and spigot joint surfaces. Joint shall be thoroughly sealed and watertight.

4. Joint Ties:

- a. Haala ties as manufactured by Haala Industries (Tel: 507.794.5821; Website: <https://www.haala.com>) or approved equivalent. See City of Manhattan Standard MSD 2450 for additional requirements.

2.02 Corrugated Metal Pipe (CMP)

A. Pipe Usage:

1. Corrugated metal pipe shall not be used within City right-of-way unless approved by the City Engineer.

B. Corrugated metal pipe shall not be utilized unless approval has been given by the City Engineer.

C. Pipe, coupling bands, and end section conform to the following requirements:

1. Material

- a. Aluminized Steel Type 2 AASHTO M274, ASTM A 929
- b. Polymer-Coated Steel AASHTO M246, ASTM A 742
- c. Aluminum Alloy AASHTO M197, ASTM B 744

2. Pipe

- a. Steel (Aluminized Steel, Type 2, CSP and Spiral Rib) AASHTO M36, ASTM A 760
- b. Steel (Polymer-Coated, GSP, Spiral Rib, Smooth Interior CSP) AASHTO M36, AASHTO M245, ASTM A 745
- c. Aluminum (CMP, Spiral Rib) AASHTO M196, ASTM A 788

3. Minimum wall thickness of the pipe shall be as follows:

Circular Culvert Pipe (2-2/3" x 1/2" Corrugations)	
Under Roadways or In Street Right-of-Ways	
Diameter	Minimum Thickness
12"-21"	.079"
24"-30"	.079"
36"-54"	.109"
60"-72"	.138"
84"	.168"

Circular Culvert Pipe (3" x 1" and 5" x 1" Corrugations)	
Under Roadways or In Street Right-of-Ways	
Diameter	Minimum Thickness
36"-54"	.079"
60"-84"	.109"

Arch Culvert Pipe (2-2/3" x 1/2" Corrugations)	
Under Roadways or In Street Right-of-Ways	
Diameter	Minimum Thickness
15"	.064"
18"	.064"
21"	.064"
24"	.079"
30"	.079"
36"	.109"
42"	.109"
48"	.109"
54"	.109"
60"	.138"

*Subject to manufacturing tolerances.

4. Joints:

- a. Joints shall have a gasket and may be either bell and spigot joints or made with external coupling bands. The bands shall be drawn and secured on the pipe by connecting devices as furnished by the manufacturer.
- b. Pipe ends for annular corrugation shall be identical to the rest of the pipe barrel (plain ends), or in the case of helical pipe, the pipe ends at the joint shall be reformed to an annular corrugation and flange (reformed end).
- c. Gaskets shall be furnished in accordance with the Plans and Special Provisions. Coupling bands shall be reviewed and approved by the City Engineer prior to installation.

2.03 High Density Polyethylene (HDPE) Pipe

A. Pipe Usage:

1. High density polyethylene pipe (HDPE) shall not be used within City right-of-way unless approved by the City Engineer. If approved by the City Engineer, HDPE in accordance with ASTM F2648, latest version, may be used in lieu of ASTM F2306 and AASHTO M294 in drainage applications that are designated as private.

B. Material:

1. Pipe manufactured for this specification shall comply with and be certified to meet the requirements for test methods, dimensions and markings found in ASTM F 2306 and AASHTO M-294, current additions.
2. Pipe and blow molded fittings shall be made from PE compounds which conform to the requirements of cell class 435400C in the latest version of ASTM D3350.

C. Pipe Sizes:

1. Nominal sizes for this specification include 15-60 inch diameters designated in AASHTO M294 and ASTM F 2306 as full circular cross section with an outer corrugated pipe wall and essentially smooth inner wall (waterway).
2. Pipe corrugations shall be annular and pipe interior shall be smooth.

D. Joints:

1. Joints shall have a water-tight gasket, elastomeric seal (ASTM F477), unless otherwise specified and may be either bell and spigot joints or made with external coupling bands. The fittings and couplings bands shall be fabricated from the same material as the pipe conforming to AASHTO M294. The coupling bands shall cover at least two full corrugations of each section of pipe and shall prevent infiltration of soil into the pipe.

E. Certification:

1. All high-density polyethylene (HDPE) pipe used for culvert and storm sewer applications shall conform to the requirements of AASHTO M294 and ASTM F 2306, current edition.
2. Pipe shall be provided only by manufacturers that are certified through the National Transportation Product Evaluation Program (NTPEP) Third Party Certification program.

2.04 A-2000 PVC PIPE

A. Pipe Usage:

1. A-2000 PVC pipe shall not be used within City right-of-way unless approved by the City Engineer.

B. Material:

1. PVC corrugated pipe with a smooth interior shall conform to the requirements of ASTM F949.
2. Pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects.
3. Pipe shall be manufactured to 46 PSI stiffness when tested in accordance with ASTM D2412.
4. There shall be no evidence of splitting, cracking when the pipe is tested per ASTM D2412 in accordance with ASTM F949 Section 7.5 and ASTM F794 Section 8.5.
5. The pipe shall be made of PVC compound having a minimum cell classification of 12454 as defined by ASTM D1784.

C. Joints:

1. All fittings for PVC corrugated sewer pipe with a smooth interior shall conform to ASTM F949, Section 5.2.3 or F794, Section 7.2.4.
2. To ensure compatibility, the pipe manufacturer shall provide all fittings.
3. All joints shall be made with integrally-formed bell and spigot gasketed connections.
4. The manufacturer shall provide documentation showing no leakage when gasketed pipe joints are tested in accordance with ASTM D3212.
5. Elastomeric seals (gaskets) shall meet the requirements of ASTM F477.

2.05 Polypropylene Pipe (PP)

A. Pipe Usage:

1. Polypropylene pipe shall not be used within City right-of-way unless approved by the City Engineer.

B. PP pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330 for pipe diameters between fifteen (15) inches and sixty (60) inches.

C. Fittings shall conform to ASTM F2882 and AASTTO M330. Bell and spigot connections shall utilize a spun-on, welded or integral bell and spigots with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated coupling shall be split collar, engaging at least two (2) full corrugations.

2.06 End Sections

- A. End Sections shall conform to the most recent edition of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation.

2.07 Granular Bedding Material

- A. Refer to Section 2130 – TRENCHING, STRUCTURE EXCAVATION, AND BACKFILL.

2.08 Flowable Fill

- A. Refer to Section 2130 – TRENCHING, STRUCTURE EXCAVATION, AND BACKFILL.

PART 3 INSTALLATION

3.01 Preparation

- A. Verify existing utility locations, depths, and sizes prior to beginning construction. Immediately notify the City Engineer if conflicts not depicted in the Drawings are encountered.

3.02 Trench Excavation

- A. Refer to Section 2120 Trench and Structure Excavation, Backfill and Compaction and Engineering Standard Drawing MSD 2460.

3.03 Laying and Jointing

- A. All installation shall be in accordance with the pipe/fitting manufacturer's written recommendations and this Specification. If there is a conflict between the manufacturer's written recommendations and this Specification, the manufacturer's written recommendations shall prevail.
- B. Handling and Protection:
 - 1. All pipe shall be protected during installation against shock and free fall, and be installed without cracking, chipping, breaking, bending, or damage to coating materials. Damaged pipe materials shall be replaced with new materials.
- C. Grade Control:
 - 1. Maximum deviation from indicated alignment of any pipe after installation and backfilling shall not be greater than 0.1 foot. All pipe shall have a continuous slope, free from depressions that will not drain. The Contractor shall establish such grade control devices as are necessary to maintain the above tolerances.
- D. Laying:
 - 1. The laying of pipe in finished trenches shall commence at the lowest point, and pipe shall be installed with the bell end forward or upgrade. All pipe shall be laid with ends abutting and true to line and grade. Pipe laid shall be carefully centered to form a sewer with a uniform invert.
- E. Bedding:
 - 1. Bedding shall be rodded, spaded, and consolidated as necessary to provide firm uniform support for the pipe, and not subject pipe to settlement or displacement.
- F. Jointing:
 - 1. Preparatory to making filled, bonded, and watertight sealed pipe joints, all surfaces of the portions of the pipe to be jointed shall be clean and dry. Lubricants, primers, adhesives, and other substances that are used shall be compatible with the jointing material recommended or specified.
 - 2. Other than for trimming sewer pipe to be flush with the inside walls of storm sewer structures, no pipes may be trimmed unless ordered by the City Engineer.
 - 3. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing, and for as long a period as required to protect the pipe joints and concrete in structures.
 - 4. As soon as possible after the joint is made, sufficient bedding material shall be placed alongside each side of the pipe to offset conditions that might tend to move the pipe off line and grade.
 - 5. Concrete Pipe:
 - a. Plastic Joint Compound: Plastic joint compound shall be applied to the tongue and spigot prior to its insertion into the bell or groove. A sufficient amount of sealant shall be used to fill the annular joint space with some excess. Wipe the outside surface of the joint with additional material to assure a complete seal.
 - b. Flexible Gaskets: Flat gaskets may be cemented to the pipe tongue or spigot. O-ring gaskets shall be recessed in a groove on the pipe tongue or spigot and confined by the bell or groove after the joint is completed. Roll-on gaskets shall be placed around the tongue or spigot and rolled into position as the joint is assembled. Flat gaskets and O-ring gaskets shall be lubricated as recommended by the manufacturer.

- 1) Flat gasket: Flat flexible gaskets shall conform to ASTM C 443. If there is no recess provided for the gasket, the surface of the tongue shall be cleaned and rubber adhesive applied. Using quick-drying adhesive, gaskets may be applied ahead of the laying operation or in the plant.
 - 2) O-ring gasket: O-ring or roll-on flexible gaskets shall conform to ASTM C 361, Section 4.10. The entire surface of the bell that comes in contact with the rubber gasket shall be well lubricated with a soap lubricant. The entire gasket shall be greased with soap. Only the soap lubricant supplied by the pipe manufacturer shall be used. Adhesive type cements shall not be used.
6. Corrugated Metal Pipe:
- a. Corrugated metal pipe joints shall have a gasket and may be either bell and spigot joints or made with external coupling bands. The bands shall be drawn and secured on the pipe by connecting devices as furnished by the manufacturer. Pipe ends for annular corrugation shall be identical to the rest of the pipe barrel (plain ends), or in the case of helical pipe, the pipe ends at the joint shall be reformed to an annular corrugation and flange (reformed end). Gaskets shall be furnished in accordance with the Plans and Special Provisions. Coupling bands shall be reviewed and approved by the City Engineer prior to installation.
7. HDPE Pipe:
- a. HDPE pipe shall be installed in accordance with ASTM D2321.
 - b. HDPE pipe shall be assembled, installed, and backfilled in accordance with the manufacturer's instructions. Joints shall have a gasket and may be either bell and spigot joints or made with external coupling bands. The fittings and couplings bands shall be fabricated from the same material as the pipe conforming to AASHTO M294. The coupling bands shall cover at least two full corrugations of each section of pipe and shall prevent infiltration of soil into the pipe. Gaskets shall be furnished in accordance with the Plans and Special Provisions. Coupling bands shall be reviewed and approved by the City Engineer prior to installation.
 - c. During construction of the project in areas subjected to heavy construction equipment traffic, pipe sizes 12" - 42" shall have a minimum cover of 3 feet, and pipe sizes 48"- 120" shall have a minimum cover of 4 feet.
 - d. Provisions shall be made to prevent pipe flotation until installation is complete.
8. A-2000 PVC:
- a. Thermoplastic pipe and fittings shall be installed in accordance with ASTM D2321.
 - b. Provisions shall be made to prevent pipe flotation until installation is complete.
9. Polypropylene Pipe (PP):
- a. PP pipe shall be installed in accordance with ASTM D2321, "Standard Practice for Underground Installation of thermoplastic pipe for sewers and other gravity flow applications", latest addition, with the exception that the initial backfill may extend to the crown of the pipe. Soil classifications are per the latest version of ASTM D2321. Class IVB materials (MH.CH) as defined in previous versions of ASTM D2321 are not appropriate backfill materials.
 - b. Provisions shall be made to prevent pipe flotation until installation is complete.
10. Structure Connections:
- a. Pipes connected to structures shall be cut parallel with the inside face of the structure for structures having plane walls and parallel with the spring line of the pipe for structures having curved walls. Projection of the pipe beyond the inside face shall not exceed 1 inch (measured at the springline for structures having curved walls).

11. Restrained Joint Tie Rods for Steep Installations

- a. Restrained joint ties rods shall be installed in accordance with City of Manhattan Standard MSD 2450.

12. Pipe collars:

- a. Pipe collars shall be installed in accordance with City of Manhattan Standard MSD 2450.

3.04 Backfill of Trenches

- A. General: Refer to Section 2104 Trench and Structure Excavation, Backfill and Compaction.

3.05 Record (As-Built) Drawings

- A. Coordinate progress and backfilling of buried piping with the City Surveyor. The Surveyor requires sufficient notice to survey location(s) and elevations of installed infrastructure for Record Drawings.
- B. Record (As-built) Drawings shall be prepared by the Owner unless otherwise specified in the Contract Documents.

3.06 Mandrel Testing of Plastic Pipe

- A. All HDPE, A-2000 PVC, and PP shall be tested by pulling a mandrel through the installed pipe. Mandrel testing shall be completed on at least 10% of the overall project plastic pipe.

PART 4 MEASUREMENT & PAYMENT

4.01 General

- A. All storm sewer Work for which there is no designated Pay Item shall be considered SUBSIDIARY to other items for which the Work was related to, unless otherwise specified. No separate measurement and payment will be made to SUBSIDIARY Work.
- B. Payment will be made at the respective unit or lump sum price listed in the Contract Documents, and shall be full compensation for all labor, materials, and equipment necessary to complete the respective unit in place.
- C. At the City Engineer's option, partial payment may be made for any item listed in the Contract Documents, providing that the Contractor is diligently and satisfactorily pursuing full completion of such partially complete item in accordance with the approved progress schedule.

4.02 Measurement

- A. Pipe:
 - 1. By the linear foot of each size and type.
 - 2. Measurement will be to the nearest linear foot for each line between structures and made to the inside face of the connecting structure at the centerline of pipe.
 - 3. Precast or prefabricated end sections will be excluded from the pipe measurement.
 - 4. Excavation, bedding, and backfill shall be included in the cost per linear foot of pipe per each size and type.
 - 5. Flowable fill installation, if completed, shall not be included in the cost per linear foot of pipe and will be paid for separately.
- B. Precast End Sections:

Project Name: <INSERT FORMAL PROJECT NAME>

Project No: <INSERT PROJECT NO(s)>

1. By the number of each size and type.

C. Joint Ties:

1. By the number of each joint tied.

D. Pipe Collars:

1. By the number of each pipe collar based on the pipe size.

4.03 Pay Items

A. The following are channel lining, bank and outfall stabilization Bid Items for which measurement and payment will be made:

1. Storm Sewer (<specified size>(<specified type>): Paid for on a per lineal foot basis.
2. End Section (<specified size>(<specified type>): Paid for on a per each basis.
3. Storm Sewer Joint Ties: Paid for on a per pipe joint basis.
4. Pipe Collars (<specify pipe size>(<specify type>): Paid for on a per each basis.
5. Connect to Existing Structure: Paid for on a per each basis.

END OF SECTION

SECTION 2500 STORM SEWER STRUCTURES

PART 1 GENERAL

1.01 Scope

- A. Provide all labor, materials and equipment as required for the construction of cast-in-place and precast concrete storm sewer structures and other concrete structures incidental to the public stormwater system.
- B. Masonry or brick storm sewer structures shall not be allowed under these Specifications.

1.02 This Section Addresses

- A. Manufacture and installation of precast concrete inlets, manholes and junction boxes.
- B. Manufacture and installation of precast reinforced concrete boxes (RCBs).
- C. Construction of cast-in-place concrete storm structures and headwalls.

1.03 Related Work

- A. The following standards and related Specification Sections are referenced directly in this Section. The latest version of these standards shall be used. If conflicting standards are referenced, the more stringent standard shall apply.
 - 1. Section 2100 – SITE PREP, GRADING AND EARTHWORK (in process)
 - 2. Section 2130 – TRENCHING, STRUCTURE EXCAVATION, AND BACKFILL (in process)
 - 3. Section 2400 – STORM SEWERS
 - 4. Section 2550 – CHANNEL LINING AND OUTFALL STABILIZATION
 - 5. Section 2600 – PAVING
 - 6. Section 2800 – TURFGRASS SEEDING
 - 7. Section 2805 – NATIVE PRAIRIEGRASS SEEDING
 - 8. Section 2810 – SODDING

1.04 Submittals

- A. Product technical data including manufacturer's installation instructions and acknowledgement that products submitted meet requirements of standards referenced.
- B. Fabrication and/or layout drawings which include detailed diagrams of inlets and manholes showing typical components and dimensions. Indicate knockout elevations, flowline elevations, top of structure elevations, etc.

PART 2 MATERIALS

2.01 Concrete Mixes

- A. Concrete shall be standard mix as detailed in Section 2600 Paving, unless otherwise specified.

2.02 Reinforcing Steel

- A. Reinforcing bars shall conform to ASTM A 615 or AASHTO M 31, Grade 60. Welded steel wire fabric shall conform to ASTM A 1064 or AASHTO M 55.

2.03 Precast Concrete Structures

A. Manholes:

1. Precast manhole structures shall conform to ASTM C 478.

B. Rectangular Structures:

1. Shall conform to the inside dimension indicated on the Plans and be designed for the following loads:
 - a. HS-20 live load for all structures in/or under pavement, shoulders, driveways, and other traffic areas.
 - b. 2,000-lb wheel live load for curb opening inlets and junction boxes in non-traffic areas.
 - c. 50 pcf equivalent fluid pressure for soil pressure on vertical walls.
 - d. 120 pcf for unit weight of soil cover on top slabs.

C. Joints:

1. Joints between concrete structures shall be filled with plastic joint compound or preformed flexible joint sealant conforming to ASTM C 990 as stated herein.
2. Minimum cross-sectional area of the preformed flexible joint sealant between all concrete structural components shall be two beads of either 1 inch square or 1.25 inches in diameter.

D. Manhole Adjustment Rings:

1. Rings shall be constructed of concrete.
2. The top and bottom of all adjustment rings shall be sealed using a preformed flexible joint sealant such as Kent-Seal, Ram-Nek, E-Z Stick or approved equivalent. The minimum dimension shall be one inch.
 - a. The epoxy paste shall be a two component, moisture insensitive, containing no solvents, and capable of bonding with all materials it is to be used on, like Epoxytec Micor C.P.P or approved equal.
 - b. Minimum cross-sectional area of preformed compound between concrete adjustment rings shall be two beads of either 1 inch square or 1.25 inches in diameter.

E. External Manhole Chimney Frame Seal:

1. External frame seal shall consist of a flexible rubber sleeve, interlocking adjustment extension(s), and stainless steel compression bands.
2. The flexible rubber sleeve and extension shall be extruded or molded from a high-grade rubber compound conforming to the applicable requirements of ASTM C 923 with a minimum tensile strength of 1500 psi and minimum elongation at break of 350%.
3. At a minimum, the compression bands shall be 16-gauge stainless steel conforming to ASTM A 240, Type 304, with a minimum width of one inch.
4. Screws, nuts, and bolts shall be stainless steel conforming to ASTM F 593 and 594, Type 304. The compression bands shall have the capacity to tighten with enough pressure to make a watertight seal around the rubber chimney sleeve.

F. Concrete Mix:

1. All concrete shall be air entrained. Minimum strength requirements shall be as specified in Section 2600 – PAVING, unless otherwise specified in the Drawings.

G. Manhole Castings:

1. Rings and Covers:

- a. Minimum cross-sectional area of preformed flexible joint sealant between the concrete adjustment ring and the manhole casting shall be two beads of either 1 inch square or 1.25 inches in diameter.
- b. Rings and covers for inlets shall be best quality grey cast iron conforming to ASTM A 48, Class 35B having clear openings equal to the dimensions shown on the drawings.
- c. All manhole lids shall fit securely into the rings with no evidence of warp or other signs of improper fit.
- d. Castings of rings and covers shall be of the shape, dimension, minimum weight, and type as indicated on Plans or Standard Drawings and be free from manufacturing defects.
- e. If requested by special order, castings shall be cleaned and painted with one coat of tar prior to delivery.
- f. Bearing surfaces between all rings and covers for installation in all areas shall be machined to provide even seating and interchangeability of like pieces.
- g. All manhole rings and covers placed in paved areas shall be rated for H2O traffic.
- h. Cam lock covers or similar shall not be placed in roadway pavement unless shown on the Plans or directed by the Engineer.
- i. All covers shall have provisions for opening, such as concealed pick holes.

H. Steps:

1. Cast-Iron Steps are not allowed.
2. Steel core, plastic coated steps:
 - a. Steel core plastic coated steps shall meet the following minimum requirements and are only allowed when specified in the Drawings.
 - 1) The plastic coating shall be a copolymer polypropylene meeting ASTM D 4101.
 - 2) The steel core shall be a minimum of 1/2 inch in diameter and Grade 60.
 - 3) The requirements of ASTM C 478 shall be met except minimum pull-out strength shall be 1,000 pounds.

PART 3 INSTALLATION

3.01 Concrete Structures

- A. Concrete construction shall conform to the current ACI 301 Specifications for Structural Concrete.
- B. Precast Structures:
 1. The Contractor may, at his option, use precast concrete inlets, junction boxes, and box culverts, in lieu of the cast-in-place structures indicated on the Plans. Solid concrete brick or block may be used to block inlets and similar structures to grade during placement of base slab concrete.
 2. Precast concrete box culvert, inlet, and junction box sections shall be installed on a 4-inch leveling course of untreated compacted aggregate conforming to Section 2600 – PAVING. Leveling courses shall extend 1 foot past the line of the section and be finished to a true plane surface to provide uniform bearing for the precast section.
 3. Top of curb inlets located along sloping road gradient shall be sloped to match the adjacent curb profile.
- C. Finishing:

1. Formed Surfaces: Immediately following removal of the forms, fins and irregular projections shall be removed. Form tie connections, holes, honeycomb spots, and other defects shall be chipped to ensure the voided area is exposed and shall be chipped back to solid material. These areas shall be thoroughly cleaned, saturated with water, and painted with a grout approved by the Engineer. The repaired surfaces shall be cured in accordance with these Specifications.
2. Exposed Slabs: Finish for exposed slabs shall be wood float texture. Exposed edges shall be beveled or edged with a radial tool.

D. Form Removal:

1. Forms shall remain in place until the concrete has attained sufficient strength to support loads imposed by backfilling, construction, and traffic. Within 24 hours of form removal, small holes and pockmarks of exposed walls shall be filled with Portland cement grout and rubbed smooth. Concrete voids and honeycombs shall be chipped open with a light hammer to expose weak areas for inspection. At the direction of the Engineer, expansive repair grout shall be used for partial reconstruction of otherwise sound structures.
 - a. Walls: Forms shall remain in place for a minimum of 5 days or until the concrete reaches a minimum strength of 2000 psi.
 - b. Slabs: Form shall remain in place for a minimum of 7 days or until the concrete reaches a minimum strength of 3000 psi.
2. All forming material shall be removed from structure before acceptance.

E. Manhole Riser Adjustments:

1. Manhole rings and covers shall be adjusted to match the slope and height, or grade, of pavements. In ADA accessible route locations, the surface pitch of the manhole ring and cover shall not mismatch the pavement slope by more than 1/4 inch. In no case shall the surface pitch of the manhole ring and cover mismatch the pavement slope by more than 1/2 inch. The difference in height between the top of manhole cover and the top of precast cone shall not exceed 24 inches.
2. In lieu of replacing concrete adjustment rings that are properly seated and structurally sound but have a small fracture, an external chimney frame seal may be fitted to secure a watertight seal between the casting (manhole ring and cover) and the concrete cone barrel section.

F. Invert Channels:

1. Form concrete invert channels in manholes, inlets, and junction boxes to make changes in direction of flow with smooth curves of as large a radius as permitted by the inside dimension of the structure.
2. Grade changes and transitions shall be smooth and uniform, and all parts of the invert channel and adjacent floor shall slope to drain. Channel bottom shall be finished smooth without roughness or irregularity.
3. The cross-sectional radius of the invert channel shall match the radius of the adjacent piping.

G. Excavation, Backfill, and Compaction:

1. Refer to Section 2100 Grading and Site Prep.

3.02 Measurement

- A. The quantities of accepted work will be measured in the following units. All measurements will be plan measure except for authorized changes.

1. Precast Concrete Box Culverts:

- a. By the linear foot of each size and type.
 - b. Measurement will be along the center line of the culvert between the back faces of the headwalls.
 - c. Headwalls will be measured separately as "Structures".
 - d. Concrete for Seal Course in Cubic Yards
 - e. Foundation Stabilization in Cubic Yards
 - f. Bridge Backwall Protections System in Square Yards
 - g. Class III Excavation in Cubic Yards
 - h. Granular Backfill in Cubic Yards
2. Structures:
- a. Inlets, manholes, headwalls, endwalls, culvert end sections, curb inlets, area inlets, and other similar structures will be measured by the number of each size and type as listed in the Contract Documents.
3. Cast in Place Structures:
- a. Cast in Place Structures shall be measured individually by the materials that are used and are as follows:
 - 1) Concrete in Cubic Yards
 - 2) Concrete for Seal Course in Cubic Yards
 - 3) Reinforcing Steel in Pounds
 - 4) Foundation Stabilization in Cubic Yards
 - 5) Bridge Backwall Protection System in Square Yards
 - 6) Class III Excavation in Cubic Yards
 - 7) Granular Backfill in Cubic Yards

PART 4 MEASUREMENT & PAYMENT

4.01 General

- A. All Work related to concrete storm sewer structures for which there is no designated Pay Item shall be considered SUBSIDIARY to other items for which the Work was related to, unless otherwise specified. No separate measurement and payment will be made to SUBSIDIARY Work. All castings shall be considered SUBSIDIARY to the respective storm sewer structure.
- B. Payment will be made at the respective unit or lump sum price listed in the Contract Documents, and shall be full compensation for all labor, materials, and equipment necessary to complete the respective unit in place.
- C. At the City Engineer's option, partial payment may be made for any item listed in the Contract Documents, providing that the Contractor is diligently and satisfactorily pursuing full completion of such partially complete item in accordance with the approved progress schedule.

4.02 Measurement

- A. The quantities of accepted work will be measured in the following units. All measurements will be plan measure except for authorized changes.
 1. Precast Concrete Box Culverts:
 - a. By the linear foot of each size and type.

- b. Measurement will be along the center line of the culvert between the back faces of the headwalls.
 - c. Headwalls will be measured separately as "Structures".
 - d. Concrete for Seal Course in Cubic Yards
 - e. Foundation Stabilization in Cubic Yards
 - f. Bridge Backwall Protections System in Square Yards
 - g. Class III Excavation in Cubic Yards
 - h. Granular Backfill in Cubic Yards
2. Structures:
- a. Inlets, manholes, headwalls, endwalls, culvert end sections, curb inlets, area inlets, and other similar structures will be measured by the number of each size and type as listed in the Contract Documents.
3. Cast in Place Structures:
- a. Cast in Place Structures shall be measured individually by the materials that are used and are as follows:
 - 1) Concrete in Cubic Yards
 - 2) Concrete for Seal Course in Cubic Yards
 - 3) Reinforcing Steel in Pounds
 - 4) Foundation Stabilization in Cubic Yards
 - 5) Bridge Backwall Protection System in Square Yards
 - 6) Class III Excavation in Cubic Yards
 - 7) Granular Backfill in Cubic Yards

4.03 Pay Items

- A. The following are channel lining, bank and outfall stabilization Bid Items for which measurement and payment will be made:
- 1. Curb Inlet (<specify type>)(<specify width>): Paid for on a per each basis.
 - 2. Area Inlet (<specify type>)(<specify size>): Paid for on a per each basis.
 - 3. Manhole (<specify type>)(<specify diameter>): Paid for on a per each basis.
 - 4. Extra Depth Manhole (<specify diameter>): Paid for on a vertical foot basis.
 - 5. Junction Box (<specify size>): Paid for on a per each basis.
 - 6. Reinforced Concrete Box (Precast)(<specify size>): Paid for on a per lineal foot basis.
 - 7. Adjust Top of Existing Structure: Paid for on a per each basis.
 - 8. Concrete (<specify grade>)(AE): Paid for on a per cubic yard basis.
 - 9. Reinforcing Steel (<specify grade>)(<specify type>): Paid for on a per pound basis.
 - 10. Class III Excavation: Paid for on a per cubic yard basis.
 - 11. Foundation Stabilization: Paid for on a per cubic yard basis.
 - 12. Concrete for Seal Course (Set Price): Paid for on a per cubic yard basis.
 - 13. Granular Backfill (Wingwalls)(Set Price): Paid for on a per cubic yard basis.
 - 14. Bridge Backwall Protection: Paid for on a per square yard basis.
 - 15. Guard Fence (<specify type>): Paid for on a per lineal foot basis.

END OF SECTION

SECTION 2550 CHANNEL LINING AND OUTFALL STABILIZATION

PART 1 GENERAL

1.01 Scope

- A. Provide all labor, materials, and equipment necessary for construction and installation of permanent channel liners and permanent stabilization of channel banks and storm sewer outfalls.

1.02 This Section Addresses

- A. Construction of concrete channel liners.
- B. Installation of permanent turf reinforcement mats (herein referenced as “TRM”).
- C. Installation of aggregate ditch liners.
- D. Installation of riprap for bank stabilization, riprap basins and riprap aprons.
- E. Articulating concrete block mats (hereinafter referenced as “ACB”) are acceptable products for the appropriate application. ACBs are not addressed within the Section. When ACBs are incorporated within a City of Manhattan Project, the Project Engineer will provide a Technical Specification Section or Performance Specification (based on ASTM D6684 and other acceptable standards within the industry) that identifies acceptable products, or the minimum required attributes of the proposed ACB product to be used along with the installation requirements and basis of measurement and payment.

1.03 Related Work and Referenced Standards

- A. The following standards and related Specification Sections are referenced directly in this Section. The latest version of these standards shall be used. If conflicting standards are referenced, the more stringent standard shall apply.
 - 1. KDOT Standard Specifications for Road and Bridge Construction (latest edition)
 - 2. AASHTO M 31 – Standard Specification for Deformed and Plain Carbon and Low-Alloy Steel bars for Concrete Reinforcement
 - 3. AASTHO M 55 – Standard Method of Test for Steel Welded Wire Reinforcement, Plain, for Concrete
 - 4. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 5. ASTM A1064 – Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 6. ASTM D6460 – Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion
 - 7. Section 2100 – SITE PREP, GRADING AND EARTHWORK (in process)
 - 8. Section 2130 – TRENCHING, STRUCTURE EXCAVATION, AND BACKFILL (in process)
 - 9. Section 2150 – TEMPORARY POLLUTION PREVENTION AND CONTROL
 - 10. Section 2152 – STORMWATER POLLUTION PREVENTION PLAN
 - 11. Section 2400 – STORM SEWERS
 - 12. Section 2500 – STORM SEWER STRUCTURES
 - 13. Section 2600 - PAVING
 - 14. Section 2800 – TURFGRASS SEEDING
 - 15. Section 2805 – NATIVE PRAIRIEGRASS SEEDING
 - 16. Section 2810 – SODDING

1.04 Submittals

- A. Product data for manufactured materials such as TRMs and geotextiles.
- B. Aggregates and riprap: Provide gradation and test data or certifications regarding soundness and wear.

1.05 Regulatory Requirements

- A. Conform to all applicable laws, regulations and codes having jurisdiction over the Work specified herein.

PART 2 MATERIALS

2.01 Concrete Liner Materials

- A. Concrete: Concrete shall be in accordance with [Section 2600 PAVING](#), unless otherwise specified.
- B. Reinforcement: Reinforcing steel shall conform to ASTM A615 or AASHTO M31, Grade 60. Welded steel wire fabric shall conform to ASTM A1064 or AASHTO M55.
- C. Aggregate Base: See “Aggregates and Riprap” below.
- D. [Joint Sealant](#):

2.02 Turf Reinforcement Mats (TRM)

- A. General: Provide high performance, permanent, three-dimensional mat specifically designed for permanent erosion control applications on steep slopes, water containment structures, and vegetated waterways. Mat shall consist of nylon, polyolefin, polyester, or polypropylene monofilament fiber woven into a uniform, dimensionally stable matrix. Use Manufacturer’s standard anchoring staples or stakes.
- B. Products shall be NTPEP listed, KDOT approved, and meet the requirements of applicable portions of KDOT Standard Specifications – Subsection 2113 for Long-Term Class 2 Flexible Channel Liners and the following Shear Stress stability requirements under fully vegetated conditions in accordance with ASTM D-6460. TRM Liner Types:
 - 1. Type G: Stable for up to 6 lbs./sq. ft.
 - 2. Type H*: Stable for up to 8 lbs./sq. ft.
 - 3. Type I*: Stable for up to 10 lbs./sq. ft.
 - 4. Type J*: Stable for up to 12 lbs./sq. ft.

**Note: Use 100% synthetic products for these applications.*

- C. See the Drawings for the specific TRM Liner Type(s) to be used. Acceptable Products shall be those KDOT approved in PQL-34B (dated 08/01/05) for the respective Class 2 Flexible Liner Type(s) listed in KDOT Specification Table 2113-2. Additional acceptable (PENDING) products include:
 - 1. Insta-Turf Shear Force 10 – acceptable for Types G through I inclusively.
 - 2. Insta-Turf Shear Force 12 – acceptable for Types G through J inclusively.

2.03 Geotextiles

- A. Separator Fabric: Fabric shall be a geosynthetic product manufactured as an erosion control underlayment for aggregate ditch linings and riprap. Products shall be NTPEP listed and may be either woven or non-woven, but shall meet the following requirements:
 - 1. Woven fabric meeting Class 1 or Class 2 based on AASHTO M288 (2021), and with the following properties:

Project Name: <INSERT FROMAL PROJECT NAME>

Project No: <INSERT PROJECT NO(s)>

- a. Grab Tensile Strength (ASTM D4632):..... 270 x 250 lbs. min.
 - b. Elongation (ASTM D4632):15% x 15% max.
 - c. Trapezoidal Tear Strength (ASTM D5433):..... 100 x 60 lbs. min.
 - d. CBR Puncture (ASTM D6241): 900 lbs. min.
 - e. UV Resistance (500 hrs) (ASTM D4355): 90% x 90% min.
 - f. AOS (ASTM D4751):.....#70 US Sieve min.
 - g. Permittivity (ASTM D4491):..... 0.28 Sec⁻¹ min.
2. Non-woven fabric meeting Class 1 or Class 2 based on AASHTO M288 (2021) with the following properties:
- a. Grab Tensile Strength (ASTM D4632):..... 160 x 160 lbs. min.
 - b. Elongation (ASTM D4632):50% x 50% max.
 - c. Trapezoidal Tear Strength (ASTM D5433):..... 60 x 60 lbs. min.
 - d. CBR Puncture (ASTM D6241): 410 lbs. min.
 - e. UV Resistance (500 hrs) (ASTM D4355):70% min.
 - f. AOS (ASTM D4751):.....#80 US Sieve min.
 - g. Permittivity (ASTM D4491):..... 1.3 Sec⁻¹ min.

2.04 Aggregates and Riprap

- A. Aggregate Base (beneath concrete liners): City of Manhattan AB-1. See Section #####.
- B. Aggregate Filter Blanket: Unless otherwise specified, provide Type I Filter Stone conforming to KDOT Standard Specifications – Subsection 1114, or approved equivalent.
- C. Riprap:
 - 1. Provide sound, broken concrete or limestone conforming to KDOT Standard Specifications – Subsection 1114. See Drawings for required gradation.
 - 2. Stone for riprap shall consist of quarried rock and be sound, durable, and angular in shape.
 - 3. No more than 10 percent shall have an elongation greater than 3:1, and no stone shall have an elongation greater than 4: 1.
 - 4. Material shall be free from cracks, seams, or other defects. Shale and stone with shale seams are not acceptable.
 - 5. The minimum unit weight of the stone shall be 155 pounds per cubic foot as computed by multiplying the specific gravity times 62.4 pounds per cubic foot.
- F. Aggregate Ditch Liner: Provide crushed dolomite or limestone conforming to KDOT Standard Specifications – Subsection 1114. See Drawings for required gradation.

PART 3 EXECUTION

3.01 General

- A. Permanent channel liners, bank stabilization and storm sewer outlet stabilization shall be installed as quickly at site and environmental conditions permit.
- B. Where said improvements cannot be placed in a timely manner, temporary measures shall be installed to protect the downstream sites and local streams and waterbodies. See Section 2150 – TEMPORARY POLLUTION PREVENTION AND CONTROL.
- C. Underlayment beneath aggregate ditch liners, riprap aprons, basins and bank stabilization shall consist either of a geotextile underlayment, aggregate filter blanket, or a combination of both. See Drawings.

3.02 Concrete Lining

A. Preparation:

1. Cut, trim and grade finished subgrade to the required elevation and slope. Moisten by sprinkling and compact as required.
2. Aggregate Base shall be installed when specified in the Drawings. Compact in place leaving a uniform surface ready for forms and concrete placement. Moisten surface immediately before placing concrete.
3. Forms shall be securely staked, braced, and set to line and grade.
4. Reinforcement and tie bars shall be held in position by bar chairs, concrete brick, or other approved devices. Reinforcement shall be clean, free of loose scale, dirt and other foreign coatings.

B. Placing and Finishing:

1. Place, consolidate, and strike off concrete to the thickness indicated on the drawings.
2. Concrete shall be tamped or vibrated to eliminate all voids and bring sufficient mortar to the top for finishing in accordance with [Section 2600 PAVING](#).
3. Surface finish shall be a wood-float finish.
4. Round all edges and joints with a 1/4-inch radius edging tool, except contraction joints may be sawed to a depth of 30 percent of the thickness of the concrete lining after concrete has hardened but before uncontrolled cracking occurs.
5. Apply curing membrane as specified in [Section 2600 PAVING](#).
6. Apply joint sealant as specified in [Section 2600 PAVING](#).

3.03 Geotextile Underlayment

- A. Unless otherwise specified, install geotextile underlayment wherever new or expanded aggregate ditch liners and riprap basins, aprons and bank stabilization are shown to be constructed in the Drawings.
- B. The geotextile shall be stored, handled, and installed in accordance with the Manufacturer's written recommendations.
- C. Place geotextile on prepared subgrade.
 1. Subgrade shall be undercut and compacted, as required, based on the overall sectional thickness of the rock armor to be placed to allow the top of the finished aggregate or riprap surface to be true to grade and match surrounding surfaces.
 2. Subgrade shall be finished to the required slope and shape with a smooth, uniform surface, free of exposed rocks, vegetation, roots, clods, and other deleterious materials that might damage the geotextile or prevent proper installation.
 3. Geotextile shall be unrolled in the parallel direction of the waterflow.
 4. Place the geotextile in close contact with the subgrade. Remove folds and excessive wrinkles without tightly stretching the fabric.
 5. Overlap ends and sides of adjacent sections of geotextile runs by a minimum of 12-inches, unless otherwise recommended by the Manufacturer or unstable soil conditions warrant an increased overlap distance. Upstream runs shall overlap the top of the downstream runs and each upper parallel run along banks shall overlap the adjacent downslope run, all creating in a "shingle effect" at the overlaps.
 6. Secure in place with Manufacturer's staples or pins in accordance with written recommendations.
 7. Geotextile shall be trenched in and anchored into the ground around the outside perimeter of the aggregate liner/riprap area in accordance with the Manufacturer's written recommendations.
 8. Prevent tearing of the geotextile underlayment throughout the installation process and during placement of aggregate/riprap cover. Damaged geotextile shall either be replaced or patched in an

acceptable manner. Patches shall extend a minimum of 3-feet beyond the extents of the damage.

- D. Do not allow construction vehicles and heavy equipment to operate directly on exposed geotextile underlayment surface.
- E. Placement of aggregates and riprap following geotextile installation shall follow the geotextile Manufacturer's written protocols.

3.04 Aggregate Filter Blanket

- A. Unless otherwise specified, place a minimum 6-inch-thick aggregate filter blanket over the geotextile underlayment as a cushion layer in the following conditions:
 - 1. Where identified in the Drawings.
 - 2. As a cushion layer where KDOT Heavy Series Riprap and Light Series 24-inch and 18-inch Riprap will be dropped or dumped onto geotextile underlayment from heights greater than 1-foot above the underlayment.
 - 3. As a cushion layer where KDOT Light Series Facing Stone Riprap and KDOT Aggregate Ditch Liner Aggregate will be dropped or dumped onto geotextile underlayment from heights greater than 3-feet above the underlayment.
- B. Place aggregate filter blanket in such a manner that avoids displacing or damaging underlayment. Prevent excessive pumping of an unstable subgrade when operating heavy equipment on the aggregate filter blanket.

3.05 Riprap Placement

- A. Confirm geotextile underlayment and/or aggregate filter blanket is in place and to correct grade and ready to receive riprap.
- B. Place riprap liner at pipe outlets and at other locations indicated on the Drawings.
- C. Excavate a trench along upstream and downstream edges of the riprap liner location(s) to permit toeing in the riprap liner at locations otherwise subject to undermining during storm events.
- D. Dump and spread riprap in a manner that maintains a relatively uniform liner depth and surface contour.
 - 1. Riprap shall be placed to full-course thickness in one operation and in such a manner as to avoid displacing geotextile underlayment. The Contractor shall place the riprap in such a way as to not tear, puncture, or shift the geotextile. Riprap shall not be dropped more than 1-foot when being placed directly on the fabric.
 - 2. Placing of riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation will not be permitted.
 - 3. It is the intent of these specifications to produce a fairly compact riprap protection in which all sizes of material are placed in their proper proportions. Hand placing or rearranging of individual stones by mechanical equipment may be required to the extent necessary to secure the specified results.
- E. When placing riprap on channel banks and steep slopes, begin with placement at the toe of slope. Progressively place riprap up the slope. Prevent rolling stones down the slope.
- F. Minimize segregating riprap units of differing sizes to maintain an even distribution of the various sizes throughout the liner and maximize interlocking of units and minimize voids.
- G. Ram and compact to provide a tight surface.
- H. Top of riprap shall generally match top of adjacent finish grades.

3.06 Aggregate Ditch Liner

- A. Confirm geotextile underlayment and/or aggregate filter blanket is in place and to correct grade and ready to receive aggregate ditch liner.
- B. Place aggregate along the ditch section to the full extent of what is shown in the Drawings.
- C. Dump and spread aggregate in a manner that maintains a relatively uniform liner depth and surface contour.
 - 1. The Contractor shall place the aggregate ditch liner in such a way as to not tear, puncture, or shift the geotextile.
 - 2. Aggregate ditch liner shall not be dropped more than 3-feet when being placed directly on the fabric.
- D. Unless otherwise approved by the City Engineer, place aggregate beginning in the ditch bottom and working up the side slopes from there.
- E. Minimize segregating aggregates of differing sizes to maintain an even distribution of the various sizes throughout the liner and maximize interlocking of stones.

3.07 TRM Installation

- A. Coordinate with turf planting operations. See Section 2800 – TURFGRASS SEEDING if TRM is installed with seeded turfgrass and Section 2810 – SODDING if TRM is installed with sod.
- B. Install in accordance with the manufacturer’s recommendations and information shown on the Drawings.
- C. Install in the following locations and where shown on the Drawings:
 - 1. Unless otherwise specified, install at all disturbed areas immediately downstream from 15-inch and larger diameter storm sewer pipe outlets and all new riprap aprons and basins for a minimum distance of 20-feet.
 - 2. Install in drainage channels in locations shown on the Drawings.
- D. Soil Surface Preparation:
 - 1. Undercut finish topsoil grade as required to allow TRM and related topdressing to match finish grade in a neat, clean, uniform manner.
 - 2. Topsoil surface on which the TRM will be installed shall be finished to the required slope and shape with a smooth, uniform surface, free of exposed rocks, vegetation, roots, clods, and other deleterious materials that might prevent proper installation of the TRM and thorough ground contact.
- E. Unless otherwise specified, the TRM shall be unrolled in the parallel direction of the waterflow.
- F. Construct anchor trenches around the perimeter of the area to be overlaid with TRM and insert TRM into the trench and backfill in accordance with the Manufacturer’s written recommendations.
- G. Upstream TRM runs shall overlap the top of the adjacent downstream runs a minimum of 3-inches (unless otherwise specified by the Manufacturer), creating in a “shingle effect” at the overlaps.
- H. Staple, anchor, or pin TRM into the underlying topsoil in accordance with the Manufacturer’s written recommendations.
- I. Topdress TRM with friable topsoil to a maximum depth of 1-inch above the top of the mat. Work topsoil into voids of mat and lightly tamp in place. Avoid displacement of mat.
 - 1. Seeding: Apply seed and fertilizer in accordance with Section 32 9200 – SEEDING. Lightly rake seed and fertilizer into topsoil fill. Cover with Type E or Type F temporary erosion control product in accordance

with Section 2150 – TEMPORARY POLLUTION PREVENTION AND CONTROL, unless otherwise specified.

2. Sodding: Apply fertilizer and place sod in accordance with Section 2810 – SODDING. Peg or staple sod into the TRM where specified.

3.08 Protection

- A. Protect Work associated with the channel linings, bank and outfall stabilization until said improvements are fully complete. Repair and restore or replace damaged sections of these improvements that occur prior to Project Substantial Completion. If the improvements are integral with a turfgrass system, the protection period will extend to Substantial Completion or the applicable Turf Warranty Period, whichever is longer.

PART 4 MEASUREMENT & PAYMENT

4.01 General

- A. All permanent erosion control Work for which there is no designated Pay Item shall be considered SUBSIDIARY to other items for which the Work was related to, unless otherwise specified.
- B. Maintenance and any required repair, restoration or replacement of damaged permanent erosion control measures will be SUBSIDIARY to respective bid items.
- C. Payment will be made at the respective unit or lump sum price listed in the Contract Documents, and shall be full compensation for all labor, materials, and equipment necessary to complete the respective unit in place.
- D. At the City Engineer’s option, partial payment may be made for any item listed in the Contract Documents, providing that the Contractor is diligently and satisfactorily pursuing full completion of such partially complete item in accordance with the approved progress schedule.

4.02 Pay Items

- A. Permanent channel lining and outfall stabilization Bid Items paid for on an area basis (sq. yd., sq. ft., etc.) will be measured for payment based on the final surface plane of the visually exposed surface. No additional measurement will be made for overlaps, anchorage, and other auxiliary requirements for construction of the permanent channel liners and stabilization improvements.
- B. The following are channel lining, bank and outfall stabilization Bid Items for which measurement and payment will be made:
 1. Concrete Ditch Liner (<specified thickness>): Paid for on a per square yard basis. Cost includes concrete, reinforcement, aggregate base and all other work incidental to Concrete Ditch Liner.
 2. Geotextile Underlayment: Paid for on a per square yard basis.
 3. Aggregate Filter Blanket: Paid for on a per square yard basis.
 4. Riprap (<specified gradation>): Paid for on a per square yard basis.
 5. Aggregate Ditch Liner (<specified gradation>): Paid for on a per square yard basis.
 6. Turf Reinforcement Mat (<specified type>): Paid for on a per square yard basis.

END OF SECTION