715-DPW-000 PIPE CULVERTS, AND STORM AND SANITARY SEWERS

The Standard Specifications are revised as follows:

SECTION 714, BEGIN LINE 1, INSERT AND DELETE AS FOLLOWS:

**SECTION 714 – REINFORCED CONCRETE BOX STRUCTURES**

**714.01 Description**

This work shall consist of the construction of a cast-in-place or precast

reinforced concrete box structure and such parts of similar structures composed of concrete in accordance with these specifications and ~~105.03~~ *the General Conditions and Contract Documents*.

The Contractor may be allowed to substitute a three-sided structure in accordance with 723 which shall be subject to a revision of the waterway permits, and shall be as 10 approved by the Engineer

**714.02 Materials**

Materials shall be in accordance with the following:

Chemical Anchor System .................................................... 901.05

Coarse Aggregates, Class A or Higher, Size No. 91 ........... 904.03

Concrete .............................................................................. 702

Epoxy Coated Reinforcing Bars .......................................... 910.01

Flowable Backfill ................................................................ 213

Geotextile ............................................................................ 918.02(b)

Hydrated Lime..................................................................... 913.04(a)

Joint Membrane System for Precast Reinforced

Concrete Box Structure Sections .................................. 907.07

Masonry Cement ................................................................. 901.01(c)

Mortar Sand ......................................................................... 904.02(e)

Natural Sand ........................................................................ 904.02(a)

Pipe Joint Sealant ................................................................ 907.11

Portland Cement .................................................................. 901.01(b)

Precast Reinforced Concrete Headwalls, Wingwalls,

Footings, and Spandrel Walls ....................................... 907.06

Precast Reinforced Concrete Structure Sections ................. ~~907.05~~\*

Reinforcing Bars.................................................................. 910.01

Riprap .................................................................................. 904

Sealer ................................................................................... 909.09 or 909.10

WWR, Smooth and Deformed............................................. 910.01

Structure Backfill ................................................................ 904.05

*\* Precast reinforced concrete structure sections shall be in accordance with: ASTM C 1433 or ASTM C 1577; Chapter 400 of the City of Indianapolis Storm Water Design and Construction Specifications Manual; and, additional requirements set forth herein.*

SECTION 714, AFTER LINE 71, INSERT AS FOLLOWS:

**CONSTRUCTION REQUIREMENTS**

**714.03 General Requirements**

Unless otherwise specified, the applicable requirements of 702 and 703 shall

apply to the construction of box structures, structure extensions, and concrete parts of similar structures. Excavation and disposal shall be in accordance with the applicable requirements of 206. Areas designated for waterproofing shall be waterproofed in accordance with 702.23. All underground drains encountered during excavation for the structure shall be perpetuated as dictated by field conditions. Drainage openings through masonry shall be in accordance with 702.16. Handling of box structures shall be in accordance with 907.05. Handling of wingwalls shall be in accordance with 907.06.

When riprap is specified, geotextile shall first be placed on the in-situ soil in accordance with 616.11. Riprap shall then be placed in accordance with 616.

*Precast reinforced concrete box sections shall be produced with male and female ends, designed to allow box sections to be laid together in a continuous line. Reinforced concrete box joints shall be sealed using either trowelable grade butyl rubber or asphaltic mastic to form a soil-tight seal. Reinforced concrete box joints shall be wrapped around their entire diameter with a 1 ft.-wide non-woven geotextile fabric wrap.*

**714.04 Design Requirements**

Where reinforcing bars are used, reinforcing bar splicing and spacing shall be in

accordance with *ASTM C 1433 or* the AASHTO LRFD Bridge Design Specifications, except as modified herein.

*The minimum cover of concrete over the steel reinforcement shall be 1 in. The inside steel reinforcement shall extend into the male portion of the joint. The outside steel reinforcement shall extend into the female portion of the joint. The clear distance of the end reinforcement steel wires shall not be less than ½ in. or more than 2 in. from the end of the box section.*

**(a) Box Structure**

A box structure may be designed in accordance with *ASTM C 1433 or* ASTM C 1577 if the box section is listed therein. A box structure section not listed therein shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications with the following exceptions.

SECTION 714, AFTER LINE 135, INSERT AND DELETE AS FOLLOWS:

**(c) Working Drawings**

Working drawings shall be submitted in accordance with ~~105.02~~ *the General Conditions and Contract Documents* for fabrication of a precast reinforced concrete box structure greater than 12 ft span, a box structure of a size not described in *ASTM C 1433 or* ASTM C 1577, headwalls, wingwalls, and footings. Design calculations shall be submitted with the working drawings. Detailed plans for falsework and centering will not be required. Working drawings shall include all details, dimensions, and quantities necessary to construct the structure, headwalls, wingwalls, or footings and shall include, but not be limited to, the following information.

SECTION 715, BEGIN LINE 1, INSERT AND DELETE AS FOLLOWS:

**SECTION 715 – PIPE CULVERTS, AND STORM AND SANITARY SEWERS**

**715.01 Description**

This work shall consist of the construction or reconstruction of pipe culverts,

storm or sanitary sewers, slotted drain pipe, or slotted vane drain pipe in accordance with ~~105.03~~ *the General Conditions and Contract Documents*.

**MATERIALS**

**715.02 Materials**

Pipe materials, minimum thickness or strength classification, and protective treatments for pipes except underdrains and drain tile will be determined based on height of cover, required service life, site abrasiveness, and structure pH criteria shown on the plans *and additional requirements set forth within the City of Indianapolis Storm Water Design and Construction Specifications Manual*. Pipe with material thickness, strength classification, or protective coatings in excess of the minimum required by the above noted criteria may be used. When metal pipe is selected, the same base metal and coating shall be used for the structure or a pipe extension.

Concrete used for anchors, collars, grated box end sections, encasements, and sealing existing pipes shall be class A. Corrugated polyethylene pipe, type S has a smooth interior liner with a corrugated outer wall. Type SP pipe is a type S pipe with perforations.

Materials shall be in accordance with the following:

B Borrow ............................................................................. 211

Concrete .............................................................................. 702

Flowable Backfill ................................................................ 213

Geotextiles........................................................................... 918.02

Pipe Joint Sealant ................................................................ 907.11

Reinforcing Bars.................................................................. 910.01

Rubber Type Gaskets .......................................................... 907.13

Straps, Hook Bolts, and Nuts............................................... 908.12

Structure Backfill ................................................................ 904

The maximum particle size of backfill material for corrugated pipe shall be less than ½ the corrugation depth.

*The minimum pipe diameter for all pipe material shall be 12 in., except for Class II metal, which shall be 15 in.*

*The structural design of all pipe materials shall be in accordance with the most restrictive of either manufacturer’s recommendations or AASHTO structural design requirements.*

*Bituminous coatings and pavings shall be in accordance with 908.07.*

*Exterior field applied coatings of asphaltic mastic or tar base material shall be required for all galvanized structural plates with less than 5 ft of cover in accordance with AASHTO M 243.*

*To satisfy minimum structural requirements, aluminum-alloy pipe, aluminum coated steel pipe, precoated steel pipe, and galvanized steel pipe materials shall be in accordance with Tables 501-06, 501-07, 501-08 and 501-09 within Chapter 500 of the City of Indianapolis Storm Water Design and Construction Specifications Manual. The minimum gauge shall be the greater of those outlined below or those minimum gauges required in the Manual.*

*Polyethylene pipe and fittings shall be made from high molecular weight high density polyethylene material in accordance with the applicable cell class requirements. Polyethylene material used in storm sewer pipe manufacture shall be virgin resin.*

*Reinforced concrete storm sewer pipe shall be strength Classes III, IV or V in accordance with ASTM C 76. A minimum “B” wall thickness shall be required. Reinforced concrete horizontal elliptical pipe shall be a minimum Class HE-II in accordance with the requirements of ASTM C 507.*

*Elliptical reinforcement shall be permitted only by written approval of the OWNER. Longitudinal reinforcement shall be continuous and reinforcement shall have a minimum concrete cover of 0.75 in.*

*Upon request by the OWNER, the manufacturer shall furnish certifications on the type of cement, aggregate and steel used in the furnished pipe.*

*Lift holes will not be allowed for reinforced concrete pipe less than 36 in.-diameter. A maximum of two lift holes may be provided for each section of reinforced concrete pipe larger than 36 in.-diameter. Lift holes shall be repaired in a clean, workman-like manner using a conical-shaped precast concrete plug, sealed into place using mastic or non-shrink cement grout.*

**(a) Type 1 Pipe**

*Type 1 pipe shall be specified where DPW Class No. 2 pipe materials are required in accordance with the City of Indianapolis Storm Water Design and Construction Specifications Manual. Open culverts, except those driveway culverts located within the public right-of-way shall be constructed of Type 1 pipe materials. Open culverts shall be defined as those drainage conduits which are open on both ends, and intended to provide for free passage of surface water runoff under highways, streets, roads, drives, shoulders, railroads, or other embankments. The minimum required service life for Type 1 pipe materials shall be 50 years.*

Type 1 pipe shall be used for culverts under mainline pavement and public road

approaches *and 36 in.-diameter and larger culverts under residential driveways and industrial entrance/exit drives in the public right-of-way* and shall be in accordance with the following:

~~Clay Pipe, Extra Strength .................................................... 907.08~~

Corrugated Aluminum Alloy Pipe and Pipe-Arches ........... 908.04

*Corrugated Aluminum Alloy Helical Ribbed (Type IR)*

*Pipe and Pipe-Arches ……………………….............. 908.04*

~~Corrugated Polyethylene Pipe, Type S ................................ \*~~

~~Corrugated Polypropylene Pipe ........................................... \*~~

Corrugated Steel *(Aluminum Coated Type II)*

Pipe and Pipe-Arches:.............................................. 908.02

~~Non-Reinforced Concrete Pipe, Class 3 .............................. 907.01~~

Polymer Precoated Galvanized Corrugated Steel

Pipe and Pipe-Arches................................................ 908.08

~~Profile Wall Polyethylene Pipe, Closed............................... \*~~

~~Profile Wall Polyethylene Pipe, Ribbed .............................. \*~~

~~Profile Wall PVC Pipe......................................................... \*~~

*Reinforced Concrete Box Structure Sections………..……….714*

Reinforced Concrete Horizontal Elliptical Pipe .................. 907.03

Reinforced Concrete Pipe .................................................... 907.02

*Reinforced Concrete Three-Sided Structure Sections……….723*

~~Smooth Wall Polyethylene Pipe .......................................... \*~~

~~Smooth Wall PVC Pipe ....................................................... \*~~

~~Spiral Rib Steel Pipe............................................................. 908.02~~

Structural Plate Pipe and Pipe-Arches ................................. 908.09

~~\* All thermoplastic pipes shall be from the Department’s list of approved thermoplastic pipe and liner pipe in accordance with 907.16.~~

*Precoated galvanized corrugated steel pipe, aluminum coated Type II corrugated steel pipe, corrugated aluminum alloy helical ribbed pipe (Type IR) pipe and corrugated aluminum alloy pipe shall be half bituminous-coated with paved invert and 14 gauge.*

*Aluminum coated steel Type II corrugated pipe shall be fabricated in accordance with ASTM A 760, except that all pipe and pipe coupling bands shall be formed from aluminum coated steel in accordance with ASTM A 929.*

*Type 1 pipe shall be used for 12 in.- to 30 in.-diameter culverts under residential driveways and industrial entrance/exit drives in the public right-of-way and shall be in accordance with the following:*

*Reinforced Concrete Horizontal Elliptical Pipe .................. 907.03*

*Reinforced Concrete Pipe .................................................... 907.02*

**(b) Type 2 Pipe**

*Type 2 pipe shall be specified where DPW Class No. 1 pipe materials are required in accordance with the City of Indianapolis Storm Water Design and Construction Specifications Manual. All public drainage facilities shall be constructed of Type 2 pipe materials. Public drainage facilities shall mean any storm water facility located within the public right-of-way or a drainage easement, either existing or proposed, as required by any ordinance, rule regulation or policy of City of Indianapolis, its departments, boards or agents. The minimum required service life for Type 2 pipe materials shall be 75 years.*

Type 2 pipe shall be used for *public drainage facilities, including* storm sewers and shall be in accordance with the following:

*Aluminum Alloy Helical-Ribbed Pipe (16 gauge, Type IR)..908.04*

~~Clay Pipe, Extra Strength .................................................... 907.08~~

Corrugated Polyethylene Pipe, Type S ................................ \*

Corrugated Polypropylene Pipe ........................................... \*

Fully Bituminous Coated and Lined Corrugated Steel

Pipe and Pipe-Arches (*Fully Paved)*..........................908.07

*Fully Bituminous Coated and Lined Corrugated Steel*

*Pipe and Pipe-Arches (Half Paved)…………………..908.07*

~~Non-Reinforced Concrete Pipe, Class 3 .............................. 907.01~~

~~Polymer Precoated Galvanized Corrugated Steel~~

~~Pipe and Pipe-Arches Type IA and Type IIA ..........908.08~~

~~Profile Wall Polyethylene Pipe, Closed .............................. \*~~

Profile Wall Polyethylene Pipe, Ribbed .............................. \*

Profile Wall PVC Pipe......................................................... \*

*Reinforced Concrete Box Structure Sections………..……….714*

Reinforced Concrete Horizontal Elliptical Pipe .................. 907.03

Reinforced Concrete Pipe .................................................... 907.02

*Reinforced Concrete Three-Sided Structure Sections……….723*

Smooth Wall Polyethylene Pipe .......................................... \*

Smooth Wall PVC Pipe ....................................................... \*

\* All thermoplastic pipes shall be from the ~~Department’s~~ *OWNER’s* list of approved thermoplastic pipe and liner pipe in accordance with 907.16.

*For 12 in.- to 36 in.-diameter Type 2 pipes, fully bituminous coated and lined corrugated steel pipe shall be 14 gauge, aluminum coated, Type II or pre-coated galvanized steel pipe and fully bituminous coated, half paved steel helical pipe (Type IR) shall be 14 gauge, aluminum coated, Type II.*

*For 42 in.-diameter and larger Type 2 pipes, fully bituminous coated and lined corrugated steel pipe shall be 12 gauge, aluminum coated, Type II or pre-coated galvanized steel pipe and fully bituminous coated, half paved steel helical pipe (Type IR) shall be 12 gauge, aluminum coated, Type II.*

*Polyethylene and PVC pipe materials may not be specified for Type 2 pipes larger than 36 in.-diameter, except for materials previously approved by the OWNER and listed in Chapter 400: Additional Approved Products of the City of Indianapolis Storm Water Design and Construction Specifications Manual.*

**(c) ~~Type 3 Pipe~~ *Blank***

~~Type 3 pipe shall be used for culverts under all drives and field entrances. All~~

~~Type 1 pipe materials are acceptable.~~

**(d) Type 4 Pipe**

Type 4 pipe shall be used for drain tile and longitudinal underdrains *and specified where DPW Class No. 1 pipe materials are required.* ~~and~~ *Type 4 pipe* shall be in accordance with *Chapter 400 of the City of Indianapolis Storm Water Design and Construction Specifications Manual and* the following:

~~Clay Pipe\*\* ......................................................................... 907.08~~

Corrugated Polyethylene Drainage Tubing ......................... \*

Corrugated Polyethylene Pipe, Type S\*\* ............................ \*

Corrugated Polyethylene Pipe, Type SP.............................. \*

~~Drain Tile\*\* ........................................................................ 907.10~~

~~Non-Reinforced Concrete Pipe............................................ 907.01~~

~~Perforated Clay Pipe\*\* ........................................................ 907.09~~

Perforated PVC Semicircular Pipe ...................................... \*

Profile Wall PVC Pipe......................................................... \*

\* All thermoplastic pipes shall be from the ~~Department~~*OWNER*’s list of approved thermoplastic pipe and liner pipe in accordance with ~~907.16~~ *the City of Indianapolis Storm Water Design and Construction Specifications Manual, Chapter 400*.

~~\*\* These materials shall be used for drain tiles only.~~

*The water inlet area of perforated drainage tiles shall be at least 1 square inch per foot of conduit length. Round perforations shall not exceed 3/16 in.-diameter, except where fabric filters or other filtration protection is provided. Slotted perforations shall not exceed 1/8-in. in width.*

*Polyethylene pipe used for subsurface tiles shall be double-walled pipe (corrugated outer wall and smooth inner wall). PVC pipe used for subsurface tiles shall be in accordance with ASTM 3034, at a minimum.*

*Double-walled corrugated polyethylene tile manufactured in accordance with ASTM F 667 and PVC tile manufactured in accordance with ASTM F 949, ASTM D 3033 and ASTM D 3034 shall be required for installations of subsurface drainage tile with less than 18 in. of earth or equivalent cover.*

**(e) ~~Type 5 Pipe~~ *Blank***

~~Type 5 pipe shall be used for broken-back pipe runs where coupled or jointed pipe is desirable and shall be in accordance with the following:~~

~~Corrugated Aluminum Alloy Pipe and Pipe-Arches ........... 908.04~~

~~Corrugated Polyethylene Pipe, Type S ................................ \*~~

~~Corrugated Polypropylene Pipe ........................................... \*~~

~~Corrugated Steel Pipe and Pipe-Arches............................... 908.02~~

~~Fully Bituminous Coated and Lined Corrugated~~

~~Steel Pipe and Pipe-Arches...................................... 908.07~~

~~Polymer Precoated Galvanized Corrugated Steel~~

~~Pipe and Pipe-Arches............................................... 908.08~~

~~Profile Wall Polyethylene Pipe, Closed............................... \*~~

~~Profile Wall Polyethylene Pipe, Ribbed .............................. \*~~

~~Profile Wall PVC Pipe......................................................... \*~~

~~Smooth Wall Polyethylene Pipe .......................................... \*~~

~~Smooth Wall PVC Pipe ....................................................... \*~~

~~Spiral Rib Steel Pipe............................................................ 908.02~~

~~\* All thermoplastic pipes shall be from the Department’s list of approved thermoplastic pipe and liner pipe in accordance with 907.16~~

**(f) Slotted Drain Pipe**

Slotted drain pipe shall be used to drain paved median and concrete gutter areas.

Slotted drain pipe shall be in accordance with 908.14.

**(g) Slotted Vane Drain Pipe**

Slotted vane drain pipe shall be used to drain driveway areas. Slotted vane drain pipe shall be in accordance with 908.14.

**(h) End Bent Drain Pipe**

End bent drain pipe shall be perforated profile wall PVC pipe, perforated smooth wall PVC pipe, or corrugated polyethylene drainage tubing Type SP from the Department’s list of approved thermoplastic liner pipe in accordance with 907.16.

**(i) Underdrain Outlet Pipe**

Pipe shall be profile wall PVC pipe or smooth wall pipe for outlets from the Department’s list of approved thermoplastic pipe and liner pipe in accordance with 907.16.

**(j) Grated Box End Sections**

Grating for box end sections shall be in accordance with 910.22. Threaded inserts for type II grated box end sections shall have a minimum pull-out capacity of 6,000 lbs. The 1/2 in. round bolts shall have hex heads, cut washers, and where necessary, shall be furnished with the grating. The aggregate leveling bed required for precast units shall be coarse aggregate No. 8 in accordance with 904.03. The hardware cloth used to cover the weep holes, may be plastic with 1/4 in. mesh or galvanized steel wire No. 4 mesh with a minimum wire diameter of 1/32 in. It shall be firmly anchored to the outside of the structure and shall be centered on the holes.

A type C certification in accordance with 916 shall be provided for the materials in this section unless otherwise specified.

**(k) Pipe End Sections**

Metal pipe end sections shall be in accordance with 908.06. Precast concrete pipe end sections shall be in accordance with 905.06.

**(l) Roadway Drain Casting Extensions**

Pipe used for extending roadway drain castings located in a bridge deck shall be in accordance with 907.23, 907.28, or 908.10. Pipe support brackets and all hardware shall be galvanized in accordance with ASTM A 153, class D or ASTM B 695, class 40, type I. A type C certification in accordance with 916 shall be provided for the pipe brackets.

**(m) Drainage Pipe through Concrete Masonry**

Pipe used as drainage pipe through concrete masonry as described in 702.16 shall be either profile wall or smooth wall PVC from the QPL of Thermoplastic Pipe and Liner Pipe Sources in accordance with 907.16, or steel in accordance with 908.11.

**(n) Bridge Deck Drain System**

Pipe and fittings used in an enclosed bridge deck drainage system shall be cast iron soil pipe in accordance with 908.10 or reinforced thermosetting resin pipe in accordance with 907.28. All mounting hardware shall be installed in accordance with the pipe manufacturer’s recommendations. All mounting hardware shall be galvanized in accordance with ASTM B 695, class 40, type I. A type C certification in accordance with 916 shall be provided for the pipe brackets.

***(o) Jacking and Boring Operations***

*Jacking and boring operations shall be in accordance with the Citizens Energy Group Sanitary Standards Manual and 716.*

*The pipe materials accepted for jacking and boring, shall be as follows:*

1. *Iron Pipe*

*Class 50, 51, 52, or 54 ductile iron pipe in accordance with AWWA C 151, and cast iron pipe in accordance with AWWA C151.*

*2. Steel Pipe*

*Electric-fusion, arc-welded steel pipe in accordance with ASTM A 139, grade B, or approved equal.*

*3. Reinforced Concrete Pipe*

*Reinforced concrete pipe of 30 in. inside diameter and over may be jacked, and shall be Class lll or higher with gasketed, tongue and groove joints. All pipes shall have steel reinforcement concentric with the pipe wall, and additional reinforcement at the end of the pipe. The pipe shall be in accordance with ASTM C 76, and shall have a minimum 28-day compressive strength of 5000 psi.*

*Joint steel shall extend as deep as possible into the bell and spigot without destroying the continuity of the pipe joint. Bentonite fittings of sufficient size and frequency shall be provided based upon an evaluation of site conditions by the contractor, with consideration given to criteria for final acceptance of the installed system by the OWNER. A steel ring joint may be used in lieu of tongue and groove.*

*4. Other Materials*

*Other materials such as HOBAS fiberglass pipe will be approved for jacking and boring operations on a case basis by the OWNER, provided sufficient specifications and documentation of the accepted use of the alternative material has been reviewed and approved by the OWNER.*

**CONSTRUCTION REQUIREMENTS**

**715.03 General Requirements**

*Construction shall be in accordance with Chapter 500 of the City of Indianapolis Storm Water Design and Construction Specifications Manual for DPW Pipe Classes No. 1 and No. 2.* The construction requirements, method of measurement, basis of payment, and pay items described herein shall *also* apply, except for the following, which are described

in their respective sections.

~~Drain Tile ............................................................................ 719~~

Structural Plate Pipe and Pipe-Arches ................................. 717

Underdrains ......................................................................... 718

*Installation of subsurface tiles shall be in accordance with ASTM F 499.*

A pipe order shall be prepared and submitted prior to delivery of pipe to the project site. The order shall include the following:

(a) structure number and location;

(b) manhole, inlet, or catch basin type, if applicable;

(c) pipe length, as determined by construction engineering;

(d) pipe size, as shown on the plans;

(e) pipe material including all information required to verify conformance with

cover and service life criteria; and

(f) number and type of end sections or quantity of concrete, A, structures.

When riprap is specified, geotextile shall first be placed on the in-situ soil in accordance with 616.11. Riprap shall then be placed in accordance with 616.

**715.04 Excavation**

Unless otherwise directed, the trench cross sectional dimensions shall be as shown on the plans. The trench bottom shall give full support to the pipe as shown on the plans. Recesses shall be cut to receive any projecting hubs or bells.

Where pipe is to be placed in fill sections, a portion of the fill shall be constructed prior to installation of the pipe as shown on the plans.

Where rock or boulder formation is encountered at or above the proposed trench bottom elevation, the trench shall be excavated at least 8 in. below the proposed grade, backfilled with structure backfill, and compacted in accordance with 211.04.

In case a firm foundation is not encountered at the required grade, the unstable material shall be removed to such depth that when replaced with suitable material, usually B borrow, compacted, and properly shaped, it will produce a uniform and stable foundation along the entire length of the pipe. A timber mat shall be placed to hold the pipe to line and grade if it is necessary.

All trenches shall be kept free from water until any joint filling material has hardened sufficiently not to be harmed.

**715.05 Laying Pipe**

Each section of pipe shall have a full firm bearing throughout its length, true to the line and grade given. All pipes which settle or which are not in alignment shall be taken up and re-laid. Pipe shall not be laid on a frozen trench bottom. Fully bituminous coated and lined pipe and pipe-arches shall only be placed when the ambient temperature is 35°F or above.

Concrete ~~and clay~~ pipe shall be laid with hub upgrade, with the spigot end fully extended into the adjacent hub, and with all ends fitted together tightly.

Concrete pipe shall not be laid in muck or sulphate soils.

*Subsurface tiles shall be bedded with a INDOT No. 8 stone gravel envelope. Except as specified within the City of Indianapolis Storm Water Design and Construction Specifications Manual, a minimum depth of 18 in. of earthen or equivalent cover over the top of the tile shall be required.*

Except for circular concrete pipe, pipe joints designed to accommodate seals or pipe joints requiring seals shall be sealed with approved rubber type gaskets, caulking, pipe joint sealant, elastomeric material, or sealing compound. Circular concrete pipe joints shall be sealed with rubber type gaskets. *Concrete pipe shall be furnished with a bell or groove on one end of a unit of pipe, and a spigot or tongue on the adjacent end of the adjoining pipe. Joints shall have a groove on the spigot end for placement of a rubber gasket in accordance with ASTM C 443. The gasket shall be a continuous ring which fits snugly into the annular space between the overlapping surfaces of the assembled pipe joint to form a flexible, soil-tight seal.*

If the infiltration of water is a factor, each joint, regardless of the type used, shall be sealed with a compression type joint sealer in accordance with ASTM C 425 or ASTM C 443, whichever is applicable.

Joints and stub-tee connections for thermoplastic pipe shall be in accordance with the requirements of the respective material specifications for each type of pipe.

Connections of thermoplastic pipe to manholes, catch basins, and inlets shall be in accordance with the manufacturer’s recommendations.

Prior to being lowered into the trench, corrugated metal pipe sections shall be examined closely and so fitted that they will form a true line of pipe when in place. Sections which do not fit together properly shall not be used.

At the time of acceptance, all pipe shall have been cleaned and be free from silt and other foreign matter.

Prior to constructing a pipe extension, the existing structure shall be cleaned of all foreign materials. Existing anchors, end sections, or headwalls shall be removed as shown on the plans or as directed. All existing pipes which are damaged by the removal operation shall be replaced. Removed materials shall be disposed of in accordance with 202.

**715.06 Joining Pipe**

Band couplers for AASHTO M 36 type I and type II corrugated steel pipe and pipe-arches shall have corrugations that mesh with the corrugations of the pipe sections being joined or the annular rerolled ends of those pipe sections. Band couplers with projections or dimples may be used with pipe having either annular or helical corrugations only when corrugated band couplers will not provide a matching connection to both pipes. Band couplers for AASHTO M 36 type IA and IIA corrugated steel pipe and pipe-arches shall have corrugations that mesh with the corrugations of the pipe or shall be gasketed flat bands. Couplers for AASHTO M 36 type IR ribbed steel pipe shall be in accordance with AASHTO M 36 and the manufacturer’s recommendations.

*External coupling bands in accordance within ASTM B 745 and ASTM A 760 will be accepted for use in the construction of corrugated metal pipe joints. Coupling bands shall be fabricated with annular corrugations to lap an equal portion of each adjoining pipe section, and be of the same gage and coating material as the pipe structure. Each pipe end shall be reformed to have a minimum of two annular corrugations. A tightly-closed joint shall be formed in order to create a soil-tight seal. The pipe ends shall be matched at the joint such that the difference in diameter between abutting pipes is no more than ½ in. around the entire pipe circumference. Corrugated metal pipe couplings will be required to be wrapped with a strip of nonwoven geotextile fabric around the entire pipe diameter to prevent infiltration of bedding and backfill materials. The minimum width of this fabric shall be 1 ft plus the band width, to allow a minimum 6 in. overlap of each band edge. Rubber "o" ring gaskets may be used in place of geotextile fabric wrap at the corrugated metal pipe joint provided that o-rings are placed on each end corrugation and hugger-type bands are used that seat into the second corrugation from the end of the pipe on both pipes at the joint. Bolted connectors are required on the bands such that compression of the o-rings occurs. O-ring diameters shall be in accordance with the manufacturer's recommendations.*

*High density polyethylene pipe shall possess male and female pipe ends which allow the construction of overlapping, gasketed pipe joints, in accordance with the requirements of ASTM D 3212. The gasket material shall be in accordance with all requirements of ASTM F 477. As an alternative, pipe joints utilizing external coupling bands will be accepted, provided the coupling bands are in accordance with the minimum AASHTO to form a soil-tight seal.*

*The assembly of joints for PVC pipe shall be in accordance with the pipe manufacturer’s recommendations and ASTM D 3212. Flexible, gasketed joints shall be the compression-type, so that the gasket inside the bell is compressed radially on the pipe spigot to form a soil-tight seal. The gasket shall be in accordance with all requirements of ASTM F 477. Field-cutting of pipe shall be completed in a neat, trim manner using a hand or power saw.*

*Subsurface tile shall be joined using external coupling bands, bell and spigot joints, or solvent cement joints in accordance with the referenced ASTM Standards and the manufacturer’s recommendations. Pre-formed wyes, tees, elbows and other special pipe fittings will be accepted for use provided they are manufactured and installed in accordance with ASTM and manufacturer requirements. Solvent cement joints of PVC sewer pipe and fittings shall be installed in accordance with ASTM D 2564, ASTM F 493, ASTM F 656.*

*Subsurface tiles systems shall be provided with a wye cleanout connector at a minimum interval of 400 ft.*

At the connection of a pipe extension to an existing structure where the joint system of the pipe extension differs from that in place, or if a satisfactory joint cannot be obtained between the two structures, a concrete collar shall be constructed. Portions of the existing structure shall be removed as shown on the plans, or as necessary, to ensure proper fit of the extension to the existing pipe. If not shown on the plans, the collar shall have a width of at least 18 in. and a thickness of at least 6 in. around the entire joint.

If rigid pipe connections are of lesser strength than that of the main barrel of a pipe structure, these connections shall be encased with concrete at least 6 in. thick.

Any pipe which is damaged during installation shall be repaired or replaced as directed.

Slotted drain pipe or slotted vane drain pipe shall be constructed in 20 ft sections with shop fabricated elbows. The upgrade end of slotted drain pipe shall be plugged with a metal cap before backfilling. The upgrade end of slotted vane drain pipe shall be plugged with class A concrete. Such concrete shall extend 6 in. inside the upgrade end of the pipe.

**715.07 Tee and Stub-Tee Connections**

~~At locations shown on the plans, or where directed, a stub-tee connection of the~~

~~size specified shall be furnished and placed as a tee connection to corrugated metal pipe, corrugated metal pipe-arch, concrete pipe, reinforced concrete pipe, or reinforced concrete horizontal elliptical pipe.~~

~~The stub-tee connection to a corrugated metal pipe, ribbed metal pipe, or corrugated metal pipe-arch shall be constructed of corrugated or ribbed metal and the length of the stub shall be no less than that which readily accommodates the connecting band. It shall be made by shop welding a stub of corrugated or ribbed metal pipe to the respective corrugated metal pipe or pipe-arch or ribbed metal pipe at the time of fabrication. Where field conditions warrant, stub-tee or other connections may be field connected by using shop fabricated saddle connectors. Welds, flame cut edges, and damaged spelter coating shall be regalvanized or painted with zinc dust-zinc oxide paint in accordance with Federal Specification TT- P-641, type II or MIL-P-21035. Where applicable, damaged bituminous coating shall be repaired with asphalt mastic in accordance with AASHTO M 243. The pipe connection to the stub shall be made by means of connecting bands of required size or by means of concrete collars as directed.~~

~~The stub-tee connection to concrete pipe, reinforced concrete pipe, or reinforced concrete horizontal elliptical pipe may be field constructed or factory constructed. The concrete used in the stub shall be of the same proportions as that used in the construction of such pipe. The length of the concrete stub shall be no less than 6 in. and no more than 12 in. The pipe connection to the concrete stub shall be made by means of a cement mortar bead or concrete collar or as directed.~~

*Precast manholes, or precast box inlets shall be required within all storm sewer systems at changes in grade, alignment, size and pipe material type, as outlined within Chapter 500 of the City of Indianapolis Storm Water Design and Construction Specifications Manual, unless previously approved by the OWNER. Manufactured wyes, tees, elbows, or adapters will not be accepted for use in place of precast storm sewer manholes and box inlets unless previously approved by the OWNER.*

**715.08 Blank**

**715.09 Backfilling**

All pipes shall be backfilled with structure backfill or flowable backfill. Structure backfill shall be placed in accordance with 211. Flowable backfill shall be placed in accordance with 213.07 as shown on the plans or as directed.

Prior to placing flowable backfill, all standing water shall be removed from the trench. If the water cannot be removed from the trench, structure backfill shall be used in lieu of flowable backfill to an elevation 2 ft above the groundwater. The remainder of the trench shall be backfilled as shown on the plans.

All pipes, except underdrains, will be visually inspected for acceptance a minimum of 30 days after the completion of backfill operations. Pipes that cannot be visually inspected shall be video inspected for acceptance using equipment in accordance with 718.07. The ENGINEER will determine the sections of pipe to be video inspected.

For pipes that were video inspected, a copy of the video inspection shall be provided in a format acceptable to the ENGINEER. The video inspection shall be provided prior to performing the mandrel testing or if mandrel testing is not required, prior to acceptance of the pipe.

For pipe not requiring mandrel testing that is determined to be unacceptable by the ENGINEER, the unacceptable pipe shall be replaced between the nearest pipe joints or to the nearest structure, or a remediation plan shall be prepared by a professional engineer and submitted to the ENGINEER for final determination.

After the visual or video inspection, the CONTRACTOR shall check pipe deflection by performing a mandrel test as directed on pipes manufactured from materials listed in the following table. The ENGINEER will determine the runs of pipe installations to be mandrel tested with a minimum of 10% of the total length of each material to be inspected.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PIPES REQUIRED TO BE MANDREL TESTED | | | | | | |
| Pipe Material | | | | Standard  Specifications | | |
| Corrugated Polyethylene Pipe | | | | 907.17(b) | | |
|  | Corrugated Polypropylene Pipe | |  |  | 907.19 |  |
|  | Profile Wall | Polyethylene Pipe | | 907.20 | | |
| Smooth Wall Polyethylene Pipe | | | | 907.21 | | |
| Profile Wall PVC Pipe | | | | 907.22 | | |
| Smooth Wall PVC Pipe | | | | 907.23 | | |

The mandrel shall have a minimum of nine arms or prongs and a diameter that is 95% of the nominal pipe diameter. The CONTRACTOR shall provide a proving ring that is 95% of the nominal pipe diameter for each mandrel.

The CONTRACTOR shall pull the mandrel through the pipe by hand. If the mandrel does not pass through the pipe, the CONTRACTOR shall measure and report the minimum diameter of the deficient pipe to the ENGINEER.

If the minimum diameter of the deficient pipe is between 92.5% and 95.0% of the nominal pipe diameter, the CONTRACTOR shall provide an evaluation of the deficient pipe prepared by a professional engineer. The evaluation shall consider the severity of the deflection and its effects on structural integrity, environmental conditions, and the design service life of the pipe. A report summarizing the evaluation and including the professional engineer’s recommendation for acceptance, remediation, or replacement of the pipe shall be submitted to the ENGINEER for final determination.

If the minimum diameter of the deficient pipe is equal to or less than 92.5% of the nominal pipe diameter, the deficient pipe shall either be replaced or a remediation plan shall be prepared by a professional engineer and submitted to the ENGINEER for final determination.

The deficient pipe shall be replaced if the professional engineer’s remediation plan recommends replacement of the pipe or if the pipe has been damaged.

Deficient pipe shall at a minimum be replaced between the nearest pipe joints or to the nearest structure. Replaced or remediated pipe sections shall be mandrel tested a minimum of 30 days after the completion of backfill operations.

Commercial and private drive pipes are excluded from the mandrel testing and video inspection requirements.

Where material other than structure backfill or flowable backfill is allowed and used for backfilling, it shall be of such nature that compacts readily. That portion around and for 6 in. above the top of the pipe shall be free from large stones. This material shall be placed in layers not to exceed 6 in., loose measurement, and each layer compacted thoroughly by means of mechanical tamps. Where coarse aggregate is used for structure backfill, geotextile shall be installed.

An adequate earth cover, as shown on the plans, shall be placed over the structure before heavy equipment is operated over it.

Backfill for slotted drain pipe and slotted vane drain pipe shall consist of class A concrete on both sides of the pipe. During the backfilling and paving operations, the slot shall be covered to prevent infiltration of material into the pipe.

**715.10 Pipe End Sections, Anchors, Grated Box End Sections, and Safety**

**Metal End Sections**

*Protection of storm sewer pipe and open culvert ends is required to ensure maintenance of free-flowing inlets and outflows, to prevent flotation of the structure, and to protect against a migration of backfill materials. End treatments will include, but may not be limited to, stabilization of surrounding embankments and provisions for end sections, footing supports and end anchors. End treatments shall be constructed in accordance with Section 407 of the City of Indianapolis Storm Water Design and Construction Specifications Manual.*

Pipe end sections, anchors, grated box end sections, and safety metal end sections*, and other types of end treatments* shall be constructed as shown on the plans or as directed.

Straps or hook bolts required for anchors shall be as shown on the plans. Anchor straps shall be placed at both the upstream and downstream end of each corrugated aluminum alloy, corrugated steel, or structural plate pipe or pipe-arch with a diameter or span of 42 in. or greater. Hook bolts and anchor straps shall be placed at both the upstream and downstream end of each corrugated aluminum alloy, corrugated steel, or structural plate pipe or pipe-arch with a diameter or span of 84 in. or greater.

A dimpled connection band shall be used for connecting pipe end sections and safety metal end sections to ends of corrugated metal pipe whose end corrugations are not perpendicular to the centerline of the pipe.

Grated box end sections shall be constructed according to the required pipe size and surface slope of the grated box end section specified at each location. Precast units shall be cast as a single complete unit except for the toewall which shall be cast in place. They shall be set and leveled on a 6 in. thick bed of coarse aggregate. If precast units are used and the adjoining pipe is to be field connected directly to the precast unit, the connection shall be made using a class A concrete collar of 6 in. minimum longitudinal and radial thickness. Inserts for approved lifting devices may be cast in the bottom slab of the precast sections. The number and location of lifting

devices needed for handling shall be determined by the fabricator. All reinforcement shall have a minimum cover of 1 1/2 in. and shall have a minimum lap of 21 in. The type A construction joint between the floor and the wall is optional for cast in place units.

*Subsurface tile that drains to an open ditch or swale shall be provided with animal guards in accordance with Section 503.07 of the City of Indianapolis Design and Construction Specifications Manual.*

**715.11 Re-Laid Pipe**

Where shown on the plans or as directed, existing pipe shall be taken up, re-laid, and if necessary, extended. Removal of the pipe shall be in accordance with 202.04 and the operations involved in its relaying shall be in accordance with similar operations contained herein for laying new pipe.

**715.12 Pavement Replacement**

Where a structure is to be placed under an existing pavement, the pavement removal and replacement shall be as shown on the plans *and specifications*.

~~The pavement replacement areas in asphalt pavements shall be filled with HMA for Structure Installation of the mixture type specified in the pay item in accordance with 402 except OG mixtures shall be in accordance with 401.05. An MAF in accordance with 402.05 will not apply. Mixtures will be accepted in accordance with 402.09. Each course shall be compacted by approved mechanical equipment in accordance with 409.03(d).~~

~~The pavement replacement areas in Portland Cement Concrete pavements shall be filled with PCCP in accordance with 502 except utilization of the Department provided spreadsheet is not required for the CMDS.~~

Partial loads of HMA or PCCP left over from structure installation processes shall not be incorporated into other work.

***715.13 Rejection***

*Pipe materials will be rejected due to the following conditions:*

1. *Aluminum alloy and galvanized steel pipe*

*Dents or bends in the metal; lack of integrity; illegible marking; ragged or diagonal sheared edges.*

1. *Corrugated steel pipe*

*Variations from a straight centerline; elliptical shape in a pipe intended to be round; dents or bends in the metal; bruised, broken or otherwise damaged metallic coatings or bituminous coating or liner; illegible markings; ragged or diagonal sheared edges; lack of rigidity; uneven laps in riveted or spot welded pipe; loose, unevenly line or unevenly spaced rivets; defective spot welds or continuous welds; loosely formed lockseams.*

1. *Polyethylene and PVC pipe*

*Variations from a straight centerline; elliptical shape in a pipe intended to be round; illegible markings; deep or excessive gouges or scratches on the pipe wall; fractures, punctures or cracks passing through the pipe wall; damaged or cracked ends where such damage would prevent making a satisfactory joint.*

1. *Reinforced concrete pipe*

*Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint; defects that indicate proportioning, mixing, and molding not in compliance with Section 10.1 of ASTM C 76; surface defects indicating honey-combed or open texture; damaged or cracked ends where such damage would prevent making a satisfactory joint; any continuous crack having a surface width of greater than 0.01 in., and extending for a length of 12 in. or more, regardless of position in the wall of the pipe; visible spacers or longitudinal reinforcement used to position the reinforcing cage shall not be cause for rejection for reinforced concrete pipe sections.*

***715.14 Markings***

*For aluminum alloy products, each plate shall be identified on the inside with the following information, at a minimum: name or trademark of plate manufacturer; name of fabricator, if other than manufacturer; year and month of manufacture; and, ASTM designation.*

*For galvanized structural plate products, each plate shall be identified on the inside with the following information at a minimum: name of manufacturer; specified zinc-coated thickness; specified coating weight (mass); identification showing heat number and coating lot number (may be omitted if fabricator's records tie the coating lot number to a specific heat number and manufacturer); and ASTM designation.*

*For corrugated metal pipe products, each corrugated sheet used in the fabrication of annular pipe, and each 2 to 5 feet of coiled sheet used in fabrication of helical pipe shall be identified with the following information: name of sheet manufacturer; alloy and temper; specified thickness; ASTM designation; and heat number.*

*For polyethylene pipe products,* *each length of pipe shall be clearly marked with the following information, at a minimum: manufacturer's name or identification symbol; nominal pipe size; and production/extrusion code.*

*For PVC pipe products, each length of pipe shall be marked with the following information at a minimum: name of manufacturer; tradename or trademark; nominal pipe size; production/extrusion code; material and cell class designation; and ASTM designation.*

*For reinforced concrete pipe products, each length of reinforced concrete pipe shall be marked with the following information, at a minimum: date of manufacture; ASTM class of pipe and specification designation; size of pipe; tradename or the manufacturer; and plant identification.*

*For reinforced concrete box sections, each length of a reinforced concrete box shall be marked with the following information, at a minimum: box section span and rise; ASTM table number; maximum and minimum design earth cover; specification designation; date of manufacture; name of trademark of manufacturer; and orientation of the top of the structure.*

*PVC and polyethylene subsurface drainage tile shall be marked per the respective ASTM standards.*

**~~715.13~~ *715.15* Method of Measurement**

The accepted quantities of circular pipe, deformed pipe, slotted drain pipe, slotted vane drain pipe, end bent drain pipe, sanitary sewer pipe, and pipe extensions will be measured by the linear foot, complete in place. The length of pipe to be measured for payment will be based on the net length of pipe used, which will be obtained by multiplying the nominal length of each pipe section by the number of sections used. If the pipe connects to manholes, inlets, or catch basins, the terminal sections will be field measured to the outside face of the structure. The length of beveled or skewed terminal sections of circular corrugated or ribbed metal pipe to be measured for payment will be the average of the top and bottom centerline lengths for beveled ends or of the sides for skewed ends. Measurement of deformed pipe will be made along the bottom centerline of the pipe.

Where used other than as a roadway drain extension pipe or as a bridge deck drain system, cast iron soil pipe will be measured by the pound based on the theoretical weight shown on the plans.

Roadway drain extension pipe will be measured per each drain extended.

Pipe used as drainage pipe through concrete masonry or pipe used for bridge deck drainage system will not be measured for payment.

Reinforcing bars, straps, and hook bolts used in anchors will not be measured for payment. Concrete used for backfill of slotted drain pipe and slotted vane drain pipe will not be measured for payment.

Excavation above the trench bottom elevation shown on the plans will not be measured for payment. Additional excavation below the proposed trench bottom elevation required to install the pipe at a lower elevation or to remove rock or unsuitable material will be measured in accordance with 203.27(b).

Pipe end sections, concrete anchors, and safety metal end sections will be measured by the number of units of each size installed. The size of the end section, concrete anchor, and safety metal end section will be considered as the nominal diameter of the pipe to which they are attached. A concrete anchor attached at one end of twin pipes will be measured as two concrete anchors. A concrete anchor attached at one end of triple pipes will be measured as three concrete anchors.

Tee, stub-tee, and wye branch connections will be measured along the centerline of the barrel. An additional 5 lft of the smaller diameter pipe will be included for making such connection.

Elbow connections will be measured along the centerline of such connection. An additional 2 lft of pipe of the same diameter as that of the elbow will be included for each such connection.

If increaser or reducer connections are made, measurement will be made on the basis of the larger diameter pipe for the full length of the section forming such connections.

Structure backfill will *not* be measured ~~in accordance with 211.09~~. Flowable backfill will *not* be measured ~~in accordance with 213.08~~.

Pavement replacement and subbase necessary due to structure placement under an existing pavement will be measured to the neat lines shown on the plans.

~~For structures for which the plans show pipes of differing sizes for either smooth, semi-smooth or corrugated interiors, and either the semi-smooth corrugated interior alternate is installed, measurement of structure backfill or flowable backfill will be based on the neat line dimensions shown on the plans for the smooth interior alternate.~~

Grated box end sections will be measured per each for the specified type, surface slope and pipe size.

Video inspection for pipe will be measured by the linear foot as determined by the electronic equipment.

Geotextile used to wrap backfill material will not be measured for payment.

*Precast reinforced concrete box structures and structure extensions will be measured in accordance with 714.11.*

*Precast reinforced concrete three-sided structures and structure extensions will be measured in accordance with 723.17.*

*Aggregate and geotextile for underdrains will be measured in accordance with 718.09.*

**~~715.14~~ *715.16* Basis of Payment**

The accepted quantities of pipe and pipe extensions will be paid for at the contract unit price per linear foot for pipe of the type, shape, and size specified, complete in place. Where used other than as a roadway drain casting extension pipe or as a bridge deck drain system, cast iron soil pipe will be paid for at the contract unit price per pound for the diameter specified.

Pipe end sections, concrete anchors, and safety metal end sections will be paid for at the contract unit price per each for the size specified, complete in place. A concrete anchor attached at one end of twin pipes will be paid for as two concrete anchors. A concrete anchor attached at one end of triple pipes will be paid for as three concrete anchors. Roadway drain casting extension pipe will be paid for at the contract unit price per each.

Pavement replacement necessary due to structure installation under an existing pavement will be paid for at the contract unit price per ton of HMA for structure installation of the type specified and per square yard for PCCP for structure installation. Subbase will be paid for in accordance with 302.09.

*The cost of* structure backfill will be ~~paid for in accordance with 211.10~~ *included in the cost of the pipe*. Where used as a substitute for structure backfill *or specified for pipe backfill*, *the cost of* flowable backfill will be ~~paid for as structure backfill~~ *included in the cost of the pipe*. ~~When specified for pipe backfill, flowable backfill will be paid for in accordance with 213.09.~~

*The cost of aggregate and geotextile for underdrains will be paid for in accordance with 718.10.*

If a pipe structure is lowered, relocated, or if unsuitable material is encountered so that additional excavation is necessary over and above that shown on the plans at the original location, such additional excavation will be *eligible for payment* ~~paid for at three times the contract unit price for the class of excavation involved~~. If the contract does not include rock excavation or unclassified excavation, rock removal below the proposed trench bottom elevation will be *eligible for payment* ~~paid for at three times the contract unit cost for common excavation~~. However, in each of the above cases, such excavation will not be paid for if the additional amount involved at such structure is 10 cu yd or less.

~~For structures for which the plans show pipes of differing sizes for smooth, semi-smooth or corrugated interiors, and either the semi-smooth or the corrugated interior alternate is installed, payment for pipe backfill will be made based on the neat line dimensions shown on the plans for the smooth interior alternate.~~

Grated box end sections will be paid for at the contract unit price per each for the specified type, surface slope, and pipe size.

Video inspections for pipe will be paid for at the contract unit price per linear foot completed.

*Precast reinforced concrete box structures and structure extensions will be paid for in accordance with 714.12.*

*Precast reinforced three-sided structures and structure extensions will be paid for in accordance with 723.18.*

Payment will be made under:

**Pay Item Pay Unit Symbol**

Concrete Anchor, \_\_\_\_\_\_\_\_\_ in. ………………………………..EACH

diameter

Concrete Anchor, Min. Area \_\_\_\_\_ sq ft……………………......EACH

Grated Box End Section, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_\_\_\_\_ in. ………..EACH

type slope diameter

Grated Box End Section, \_\_\_\_\_, \_\_\_\_\_, Min. Area \_\_\_\_\_ sq ft...EACH

type slope

HMA for Structure Installation, Type \_\_\_\_\_ ……………………..TON

mixture type

PCCP for Structure Installation …………………………………....SYS

Pipe End Section, \_\_\_\_\_\_\_\_\_ in. ………………………………..EACH

diameter

Pipe End Section, Min. Area \_\_\_\_\_ sq ft……………….……......EACH

Pipe Extension, Circular, \_\_\_\_\_\_\_\_ in., \_\_\_\_\_\_\_\_...........................LFT

diameter material

Pipe Extension, Deformed, Min. Area \_\_\_\_ sq ft, \_\_\_\_\_\_\_\_...........LFT

material

Pipe, Bridge Deck Drain System……..... …………………………....LS

Pipe, Drainage through Concrete Masonry...………………………....LS

Pipe, End Bent Drain, \_\_\_\_\_\_\_\_\_ in. …………………………..…..LFT

diameter

Pipe, Relaid, \_\_\_\_\_ in. x \_\_\_\_\_ in. …………………………………LFT

span rise

Pipe, Relaid, \_\_\_\_\_\_\_\_\_ in. …………………………………….…..LFT

diameter

Pipe, Roadway Drain Casting Extension...……..………………....EACH

Pipe, Sanitary Sewer, \_\_\_\_\_\_\_\_\_ in. …………………...……….…..LFT

diameter

Pipe, Slotted Drain, \_\_\_\_\_\_\_\_ in., \_\_\_\_\_\_\_\_ in. …............................LFT

diameter thickness

Pipe, Slotted Vane Drain, \_\_\_\_\_\_\_\_\_ in. ……………….……….…..LFT

diameter

Pipe, Type \_\_\_\_\_, Circular, \_\_\_\_\_\_\_\_ in. …………………………...LFT

diameter

Pipe, Type \_\_\_\_\_, Deformed, Min. Area \_\_\_\_\_ sq ft ..……………...LFT

Pipe, Underdrain Outlet, \_\_\_\_\_\_\_\_\_ in. ………………….......….…..LFT

diameter

Safety Metal End Section, \_\_\_\_\_\_, \_\_\_\_\_\_\_\_ in. ...............................LFT

slope diameter

Safety Metal End Section, \_\_\_\_\_\_, Min. Area \_\_\_\_ sq ft................EACH

slope

Soil Pipe, Cast Iron, \_\_\_\_\_\_\_\_\_ in. …………………..............….…..LBS

diameter

Video Inspection for Pipe .....................................................................LFT

The cost of reinforcing bars, straps, and hook bolts used in anchors shall be included in the cost of the concrete anchor. The cost of the toe plate anchor and galvanized bolts required for pipe end sections and safety metal end sections shall be included in the cost of the pay items. The cost of pipe support brackets and all hardware used to attach the roadway drain casting extension pipe to the drain casting and the pipe support bracket to the structural member and to the drain extension pipe shall be included in the cost of the pay items. The cost of the pipe, all necessary fittings, all mounting hardware, design costs, and all other costs to provide the bridge deck drain system shown on the plans shall be included in the lump sum cost of the bridge deck drain system. The cost of concrete backfill for slotted drain pipe and slotted vane drain pipe shall be included in the cost of the pay items.

B borrow obtained from planned excavation may be used to backfill culverts. No deduction will be made from the excavation or borrow quantities.

If existing concrete building foundations, concrete walls, concrete columns, or concrete steps not visible and not shown on the plans are encountered within the limits of the trench, the removal of such items, as required, will be paid for in accordance with 203.28.

The cost of sawing of pavement, excavation above the trench bottom elevation shown on plans, backfilling with material ~~other than structure backfill or flowable backfill~~, dewatering, shoring, timber mats, class A concrete required for collar construction or sealing existing pipe, joint materials, replacing pipe which is damaged during installation or re-laying operations, sanitary sewer testing required by the local utility, and all other necessary incidentals shall be included in the cost of the pay items in this section. The cost of removal of pavement, existing pipe, end sections, anchors, or headwalls, concrete collars, encasements, and the disposal of surplus materials shall be included in the cost of the pay items.

The cost of concrete, grating, pipe tubing, reinforcing bars, aggregate leveling bed, hardware cloth, and necessary incidentals, for construction of grated box end sections will be included in the cost of the grated box end section.

Geotextile required for coarse aggregate structure backfill will not be paid for separately. The cost of the geotextile shall be included in the cost of ~~structure backfill~~ *the pipe.*

The cost of providing video inspection equipment, technician, and a copy of the video inspection shall be included in the cost of video inspection for pipe.

No additional payment will be made for repair, remediation, or replacement of pipes, backfill, video inspection of the repaired, remediated, or replaced pipe, and all other work associated with the repair, remediation, or replacement of unacceptable pipes.

The cost of mandrel testing shall be included in the cost of the pipe.

SECTION 718, BEGIN LINE 138, DELETE AS FOLLOWS:

~~Structure backfill will be measured in accordance with 211.09.~~ HMA for underdrains will be measured by the ton.

SECTION 718, BEGIN LINE 173, DELETE AS FOLLOWS:

~~Structure backfill will be paid for in accordance with 211.10.~~

SECTION 723, BEGIN LINE 1, INSERT AND DELETE AS FOLLOWS:

**SECTION 723 – REINFORCED CONCRETE THREE-SIDED STRUCTURES**

**723.01 Description**

This work shall consist of constructing a reinforced concrete three-sided arch- topped structure or structure extension with headwalls and wingwalls, a reinforced

concrete three-sided flat-topped structure or structure extension with headwalls and wingwalls, or a reinforced concrete true arch shape structure or structure extension with spandrel walls and wingwalls in accordance with ~~105.03~~ *the General Conditions and Contract Documents*. The reinforced concrete three-sided structure, structure extension, headwalls, wingwalls, footings, and spandrel walls may be precast or cast-in-place.

The CONTRACTOR may be allowed to substitute a box structure in accordance with

714 which shall be subject to a revision of the waterway permits, and shall be as approved by the Engineer. *The box structure shall be of equivalent hydraulic capacity to that of the three- sided structure shown on the plans. The structure shall be sumped as shown on the plans*.

**MATERIALS**

**723.02 Materials**

Materials shall be in accordance with the following:

Chemical Anchor System .................................................... 901.05

Coarse Aggregates, Class A or Higher, Size No. 91 ........... 904.03

Concrete .............................................................................. 702

Epoxy Coated Reinforcing Bars .......................................... 910.01(b)9

Flowable Backfill ................................................................ 213

Geotextile ............................................................................ 918.02

Hydrated Lime..................................................................... 913.04(a)

Masonry Cement ................................................................. 901.01(c)

Mortar Sand ......................................................................... 904.02(e)

Natural Sand ........................................................................ 904.02(a)

Non-Epoxy PCC Sealer…………………………………….909.10

Pipe Joint Sealant ................................................................ 907.11

Portland Cement .................................................................. 901.01(b)

Precast Reinforced Concrete Headwalls, Wingwalls,

Footings, and Spandrel Walls ....................................... 907.06

Precast Reinforced Concrete Structure Sections ................. ~~907.05~~\*

Reinforcing Bars.................................................................. 910.01

Riprap .................................................................................. 904

Sealer ................................................................................... 909.09 or 909.10

WWR, Smooth and Deformed............................................. 910.01

Structure Backfill ................................................................ 904

*\* Precast reinforced concrete three-sided structure sections shall be in accordance with: ASTM C 1433 or ASTM C 1577; Chapter 400 of the City of Indianapolis Storm Water Design and Construction Specifications Manual; and, additional requirements described herein.*

SECTION 723, AFTER LINE 158, INSERT AND DELETE AS FOLLOWS:

**(c) Working Drawings**

Working drawings shall be submitted in accordance with ~~105.02~~ *the General Conditions and Contract Documents* for fabrication of a precast or cast-in-place reinforced concrete three-sided structure, precast or cast- in-place reinforced concrete three-sided structure extension, precast or cast-in-place headwalls, precast or cast-in-place wingwalls, and precast or cast-in-place spandrel walls. The working drawings shall include all details, dimensions, and quantities necessary to construct the structure, headwalls, wingwalls, or spandrel walls and shall include, but not be limited to, the following information.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_