AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
J	1 | 2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0001	23-Feb-2023	W81G6621404557	

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
U.S. ARMY ENGINEER DISTRICT, CHICAGO 231 SOUTH LASALLE STREET SUITE 1500 CHICAGO IL 60604-1437	W912P6	See Item 6	

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		
	X	9A. AMENDMENT OF SOLICITATION NO. W912P622B0006
	X	9B. DATED (SEE ITEM 11) 01-Feb-2023
		10A. MOD. OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [ ] is extended, [X] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

REFERENCE: INVITATION FOR BIDS NO. W912P622B0006 STORMWATER IMPROVEMENTS - SECTION 219, HAMMOND, LAKE COUNTY, INDIANA (USACE ACQUISITION)

A. The Bid Opening Date and Time is NOT EXTENDED by this Amendment. Therefore, Bidders are required to submit their Bid packages prior to 2:00 p.m. (Central Time) on March 3, 2023. For further details regarding bid submission, please refer to Solicitation Section 00 22 13 – "Supplementary Instructions to Bidders."

- THIS AMENDMENT CONTINUES ON THE NEXT PAGES -

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) TEL: EMAIL:	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED 23-Feb-2023

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

The following items are applicable to this modification:

SUMMARY OF CHANGES

B. AMENDED SPECIFICATION SECTION: The following Specification Section has been revised. The revised section is enclosed hereunder and replace the previously furnished section.

SECTION 33 40 00 STORMWATER UTILITIES has been revised to add weir gate requirements under paragraph 2.11, Weir Gate, and all subparagraphs thereunder.

C. POINT OF CONTACT: The Point of Contact (POC) for this Amendment is Ericka Hillard at (312) 846-5378; email: ericka.d.hillard@usace.army.mil.

END OF AMENDMENT NO. 0001

(The aforementioned Specification Section follows)

SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 40 00

STORMWATER UTILITIES

11/21

ATTACHMENTS:

LID Verification Report

-- End of Section Table of Contents --

SECTION 33 40 00

STORMWATER UTILITIES
11/21

PART 1 GENERAL

Storm Sewer work shall conform with the 2022 INDOT Standard Specifications Section 714 and 715.

All work and materials shall conform with the City of Hammond Design & Construction Standards, Current Edition

1.1 UNIT PRICES

1.1.1 Pipe Culverts and Storm Drains

The length of pipe installed will be measured along the centerlines of the pipe from end to end of pipe without deductions for diameter of manholes. Pipe will be paid for at the contract unit price for the number of linear feet of culverts or storm drains placed in the accepted work.

1.1.2 Box Culverts

The length of box culvert installed will be measured along the centerline of the box from end to end of the box culvert. Box Culvert will be paid for at the contract unit price for the number of linear feet of box culverts placed in the accepted work.

1.1.3 Storm Drainage Structures

The quantity of manholes and inlets will be measured as the total number of manholes and inlets of the various types of construction, complete with frames and gratings or covers and, where indicated, with fixed side-rail ladders, constructed to the depth as shown on the plans. Manholes and inlets will be measured per the bid schedule in the contract per EACH. Manholes and inlets constructed to depths greater than the depth specified above will be paid for as units at the contract unit price for manholes and inlets.

1.1.4 Walls and Headwalls

Walls and headwalls will be measured by the number of cubic yards of reinforced concrete, plain concrete, or masonry used in the construction of the walls and headwalls. Wall and headwalls will be paid for at the contract unit price for the number of walls and headwalls constructed in the completed work.

1.1.5 Flared End Sections

Flared end sections will be measured by the unit. Flared end sections will be paid for at the contract unit price for the various sizes in the accepted work.

1.1.6 Sheeting and Bracing

Payment will be made for that sheeting and bracing ordered to be left in place, based on the number of square feet of sheeting and bracing remaining below the surface of the ground.

1.1.7 Rock Excavation

Payment will be made for the number of cubic yards of material acceptably excavated, as specified and defined as rock excavation in Section 31 00 00 EARTHWORK , measured in the original position, and computed by allowing actual width of rock excavation with the following limitations: maximum rock excavation width, 30 inches for pipe of 12 inch or less nominal diameter; maximum rock excavation width, 16 inches greater than outside diameter of pipe of more than 12 inch nominal diameter. Measurement will include authorized overdepth excavation. Payment will also include all necessary drilling and blasting, and all incidentals necessary for satisfactory excavation and disposal of authorized rock excavation. No separate payment will be made for backfill material required to replace rock excavation; include this cost in the unit price bid per cubic yard for rock excavation. In rock excavation for manholes and other appurtenances, 1 foot will be allowed outside the wall lines of the structures.

1.1.8 Backfill Replacing Unstable Material

Payment will be made for the number of cubic yards of select granular material required to replace unstable material for foundations under pipes or drainage structures, which will constitute full compensation for this backfill material, including removal and disposal of unstable material and all excavating, hauling, placing, compacting, and all incidentals necessary to complete the construction of the foundation satisfactorily.

1.1.9 Concrete Ditch Lining

Payment will be made for the number of linear feet of concrete ditch lining including any steel reinforcing accepted in the completed work measured along the centerline of the ditch.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C560	(2014) Cast-Iron Slide Gates

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges
AASHTO M 190	(2004; R 2019) Standard Specification for Asphalt-Coated Corrugated Metal Culvert Pipe and Pipe Arches

AASHTO M 243	(1996; R 2021) Standard Specification for Field-Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches

ASTM INTERNATIONAL (ASTM)

ASTM A48/A48M	(2003; R 2021) Standard Specification for Gray Iron Castings
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A798/A798M	(2017) Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A807/A807M	(2019) Standard Practice for Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C12	(2021) Standard Practice for Installing Vitrified Clay Pipe Lines
ASTM C32	(2013; R 2017) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C55	(2017) Standard Specification for Concrete Building Brick
ASTM C62	(2017) Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C76	(2020) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C76M	(2020) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C139	(2017) Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C270	(2019a; E 2019) Standard Specification for Mortar for Unit Masonry
ASTM C425	(2021) Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C443	(2021) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C443M	(2021) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
ASTM C478/C478M	(2020) Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C506	(2020) Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C506M	(2020) Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C655	(2019a) Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C655M	(2019a) Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C828	(2011; R 2021) Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C923/C923M	(2020) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C990	(2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C990M	(2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric)
ASTM C1103	(2019) Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C1103M	(2019) Standard Practice for Joint

	Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM D1751	(2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2321	(2020) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3212	(2020) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F1417	(2011a; E 2020) Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air

INDIANA DEPARTMENT OF TRANSPORTATION (INDOT)

INDOT	(2022) Standard Specifications

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Leakage Test; G, AE

SD-07 Certificates

Hydrostatic Test on Watertight Joints; G, AE

Frame and Cover or Gratings; G, AE

SD-08 Manufacturer's Instructions

Placing Pipe and Box Culvert; G, AE

SD-11 Closeout Submittals

Post-Installation Inspection Report; G, AE

LID Verification Report; G, CS

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage and unload and store materials with minimumal handling. Do not store materials directly on the ground. Keep the inside of pipes and fittings free of dirt and debris. Before, during, and after installation, protect plastic pipe and fittings from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe in accordance with the manufacturer's recommendations and discard if the storage period exceeds the recommended shelf life. Discard solvents in use when the recommended pot life is exceeded.

1.4.2 Handling

Handle materials in a manner that ensures delivery to the trench in sound, undamaged condition. Carry pipe to the trench.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe sizes for culverts and storm drains are indicated on the drawings.

2.1.1 Concrete Pipe

The work shall be performed in accordance with the INDOT Standard Specifications, except that the trench excavation, pipe bedding, and backfill material, not including structure backfill, shall be included in the unit cost of the pipe, and shall not be measured nor paid for directly.

Pipe with material thickness, strength classification, or protective coatings more than the minimum required by the above noted criteria may be used.

Concrete used for anchors, collars, end sections, headwalls, encasements, seawalls, and sealing existing pipes shall be Class A Concrete.

Unless otherwise directed by the ENGINEER, 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 B borrow for structure backfill,

and then compacted with mechanical tamps or vibrators in 6-inch loose lifts.

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, compacted, and properly shaped, it will produce a uniform and stable foundation along the entire length of the pipe. Such replacement material shall be Embankment specification material, B borrow, or aggregate as directed by the ENGINEER and paid as undercut.

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

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 at no additional cost. Pipe shall not be laid on a frozen trench bottom.

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. Pipe joints designed to accommodate seals or pipe joints requiring seals shall be sealed with approved rubber type gaskets, caulking, bituminous mastic pipe joint sealer, elastomeric material, or sealing compound.

All pipes installed connected to other pipes or structures shall make a water tight connection and show no sign of leaking. At the time of acceptance, all pipe shall have been cleaned and be free from silt and other foreign matter. Any pipe which is damaged during installation shall be repaired or replaced as directed at no additional cost.

Pipe installations shall be backfilled as shown on the plans or as directed. B borrow for structure backfill shall be placed in accordance with Section 211.04 of the STANDARD SPECIFICATIONS. Prior to and during placement of bedding material and backfill, all standing water shall be removed from the trench.

Where material other than B borrow for structure backfill or flowable mortar is permitted or required and used for backfilling, it shall be of such nature that compacts readily and the 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.

Full depth No. 53 Base stone section shall be placed over all structures and pipe before heavy equipment is driven over it.

Concrete storm sewer pipe Type 2 shall be Reinforced Concrete Pipe.

Transition fittings shall be FERNCO 1002 Series couplings for clay to Cast Iron/Plastic/Steel pipe transitions. All fittings and materials needed to make pipe connections shall be included in the cost of the pipe.

Connecting existing pipes to new structures or pipes includes the re-use of existing pipe to be reinstalled or reconnected to a structure as shown on the plans and shall be included in the cost of the structure.

2.1.1.1 Reinforced Culvert and Storm Drain Pipe

Manufactured in accordance with and conforming to ASTM C76M ASTM C76, Class as indicated, or ASTM C655M ASTM C655, D-Load OR as indicated.

2.1.1.2 Reinforced Arch Culvert and Storm Drain Pipe

Manufactured in accordance with and conforming to ASTM C506M ASTM C506, OR as indicated.

2.2 PIPE JOINTS

Provide joints that have been tested for and meet the requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

2.2.1 Concrete Pipe

2.2.1.1 Rubber Gasket Joints

Provide rubber gasket joints of a design and physical requirements conforming to ASTM C443. Provide rubber gaskets that meet the oil resistant gasket requirements of ASTM C443M ASTM C443.

2.2.1.2 Preformed Flexible Sealant Joints

Provide joints made with preformed flexible joint sealant conforming to ASTM C990.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, provide concrete and reinforced concrete conforming to the requirements for 4000 psi concrete under Section 03 30 00 CAST-IN-PLACE CONCRETE. Provide air content by volume of concrete mixture, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Determine air content in accordance with ASTM C231/C231M. Provide a minimum concrete covering over steel reinforcing of not less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. For concrete deposited directly against the ground, provide a covering thickness of at least 3 inches between steel and ground. Provide expansion-joint filler material conforming to ASTM D1751, or ASTM D1752, or provide be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.

2.3.2 Mortar

Mortar is not allowed for pipe joints. Provide mortar for pipe connections to drainage structures and brick or block construction conforming to ASTM C270, Type M, except that the maximum placement time will be 1 hour. Provide a sufficient quantity of water in the mixture to produce a stiff workable mortar but in no case may the quantity exceed 5 gallons of water per sack of cement. Use water that is clean and free of harmful acids, alkalis, and organic impurities. Use the mortar within 30 minutes after the ingredients are mixed with water.

2.3.3 Precast Concrete Segmental Blocks

Provide precast concrete segmental block conforming to ASTM C139, not more than 8 inches thick, not less than 8 inches long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

2.3.4 Brick

Provide brick conforming to ASTM C62, Grade SW; ASTM C55, Grade S-I or S-II; or ASTM C32, Grade MS. Provide mortar for jointing and plastering consisting of one part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. Provide joints that arecompletely filled and that are smooth and free from surplus mortar on the inside of the structure. Plaster brick structures with 1/2 inch of mortar over the entire outside surface of the walls. Lay brick in stretcher courses with a header course every sixth course for square or rectangular structures. Lay brick radially with every sixth course a stretcher course for round structures.

2.3.5 Precast Reinforced Concrete Manholes

Provide precast reinforced concrete manholes conforming to ASTM C478/C478M . Provide joints between precast concrete risers and tops that are full-bedded in cement mortar and smoothed to a uniform surface on both interior and exterior of the structure.

2.3.6 Frame and Cover or Gratings

Submit certification on the ability of frame and cover or gratings to carry the imposed live load indicated on the drawings. Provide frame and cover or gratings made of cast gray iron, ASTM A48/A48M, Class 35B; cast ductile iron, ASTM A536, Grade 65-45-12; or cast aluminum, ASTM B26/B26M, Alloy 356.0-T6. Provide curb inlet grates conforming to the weight, shape, size, and waterway openings indicated on the plans. Stamp or cast the word "Storm Sewer" into covers so that it is plainly visible. Frame and cover lids shall include the "City of Hammond" lettering and fish logo per the standard detail drawing included on the plans.

2.3.7 Steel Ladder

Provide a steel ladder where the depth of the storm drainage structure exceeds 12 feet. Provide ladders not less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. Provide two stringers that are a minimum 3/8 inch thick and 2-1/2 inches wide. Galvanize ladders and inserts after fabrication in conformance with ASTM A123/A123M.

2.3.8 Resilient Connectors

Provide flexible, watertight connectors conforming to ASTM C923/C923M for connecting pipe to manholes and inlets.

2.3.9 Flared End Sections

2.3.9.1 Concrete Flared End Sections

Provide sections of a standard design fabricated with reinforced concrete.

2.3.10 Flap Gates

SLIP-IN INLINE CHECK VALVES
PART 1: GENERAL
1.01 SUBMITTALS
A. Submit product literature that includes information on the performance and operation of the valve, materials of construction, dimensions and weights, elastomer characteristics, headloss, flow data and pressure ratings.
B. Upon request, provide shop drawings that clearly identify the valve materials of construction and dimensions.
1.02 QUALITY ASSURANCE
A. Supplier shall have at least twelve (12) years experience in the design and manufacture of elastomeric check valves.
B. Manufacturer shall have designed, fabricated and have at least five (5) current installation of elastomeric check valves . Manufacturer must provide documentation, including project name, location, and references.
C. Manufacturer shall have conducted independent hydraulic testing to determine headloss, jet velocity and vertical opening height characteristics on a minimum of three
(3) sizes of Valves. The testing must have been conducted for free discharge (pressurized and open channel flow discharging to atmosphere) and submerged conditions.
PART 2: PRODUCTS
2.01 ELASTOMERIC CHECK VALVES
A. Check Valves are to be all rubber and the flow operated check type with slip-in cuff connection. The entire Valve shall be ply reinforced throughout the body, saddle and bill, which is cured and vulcanized into a one-piece unibody construction. A separate valve body or pipe used as the housing is not acceptable. The valve shall be manufactured with no metal, mechanical hinges or fasteners, which would be used to secure any component of the valve to a valve housing. The port area of the saddle shall contour into a circumferential sealing area that is concentric with the pipe which shall allow passage of flow in one direction while preventing reverse flow. The entire valve shall fit within the pipe inside diameter. The saddle area of the valve must be flat, not conical, and integral with the rubber body above centerline in order to not produce any areas or voids that can collect or trap debris. The valve must be easily installed in pipes with poor end condition without the need to modify or utilize the headwall or structure to seal and anchor the valve. Once installed, the Valve shall not protrude beyond the face of the structure or end of the pipe.
B. The Valve shall incorporate multiple concave grooves molded integrally into the flat saddle wall thickness extending longitudinally a minimum of 80%of the length of the saddle to reduce opening resistance and reduce headloss.
C. The Valve shall incorporate a custom shaped notch in the end of the bill to reduce cracking pressure. The notch shall be at the invert/bottom of the bill and symmetrical about the valve centerline. The longitudinal length of the notch shall be no greater than half the length of the bill.
D. The outside diameter of the upstream and downstream sections of the valve must be circumferentially in contact with the inside diameter of the pipe.
E. Slip-in style Valves will be furnished with a set of stainless steel expansion clamps. The clamps, which will secure the valve in place, shall be installed in the upstream or downstream cuff of the valve, depending on installation orientation, and shall expand outwards by means of a turnbuckle. Each band shall be pre-drilled allowing for the valve to be

pinned and secured into position in accordance with the manufacturer's installation instructions.
F. Manufacturer must have flow test data from an accredited hydraulics laboratory to confirm pressure drop and hydraulic data.
G. Company name, plant location, valve size patent number, and serial number shall be bonded to the check valve.
2.02 FUNCTION
A. When line pressure exceeds the backpressure, the line pressure forces the bill and saddle of the valve open, allowing flow to pass. When the backpressure exceeds the line pressure, or in the absence of any upstream or downstream pressure, the bill and saddle of the valve is forced closed, preventing backflow.
2.03 MANUFACTURER
A. All valves shall be manufactured in the U.S.A.
PART 3: EXECUTION
3.01 INSTALLATION
A. Valve shall be installed in accordance with manufacturer's written Installation and Operation Manual and approved submittals.
3.02 MANUFACTURER'S CUSTOMER SERVICE
A. Manufacturerâ€™s authorized representative shall be available for customer service during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.
B. If specified, the manufacturer shall also make customer service available directly from the factory in addition to authorized representatives for assistance during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.

2.3.11 Weir Gate

Each slide gate will be manufactured as detailed here and will be supplied tested as per requirements. To the maximum extent possible, the gate assembly comprising of frame, guides and slide will be supplied as a factory assembled unit and shipped to site ready to install on the wall thimble or wall. The slide gates will be manufactured from cast iron and will be flat or flange back type suitable for wall thimble or wall mounting and manufactured in accordance with AWWA C560. The slide gates will be designed for water tightness for both seating and un-seating differential head per the actual site requirement. The slide gates will have a seating and un-seating leakage rate of 1/2 the leakage rate allowed by AWWA C560. All slide gates will be shop tested to verify the leakage performance at operating head in the un-seating direction. Hydrostatic testing will be conducted at 1.5 times operating head, to demonstrate structural integrity. Opening load at unseating operating head will be measured to verify actuating mechanism sizing. The slide gates will be of rising stem type unless site geometry prohibits it. Operation will be by means of a manual hoist, electric actuator or hydraulic cylinder. The slide gate will be supplied complete with all accessories such as: wall thimble, gate assembly, gasket between wall thimble and gate assembly, studs and nuts for mounting on the thimble, stem, thrust nut, stem couplings, stem guides, pedestal, operating mechanism as required, gate opening indicating arrangement and as required anchor bolts and fasteners for stem guides and pedestal. The gate will utilize adjustable wedges. All wedge attachment will include a key and keyway or other positive means to prevent rotation

2.3.11.1 Frame and Guides

Frame and GuidesThe frame will be cast iron, one-piece construction with

rectangular opening. The gate frame will be sufficiently rigid to withstand the designated water head. The frame will be flat or flange back, conventional, or self-contained as shown on the Contract Drawings. The gate frame will be self-contained or non-self-contained. Non-self-contained frames will have sufficient length guides to contain no less than one-half the slide in the fully open position on upward opening slide gates or downward opening weir gates. Self-contained frames will extend sufficiently to attach a yoke for mounted the operating mechanism at the appropriate height. All operating loads for self-contained gates will be reacted within the frame with no significant loads imposed on the civil works.

2.3.11.2 Slide

The gate slide will be cast iron and will be ribbed to withstand the designated water head. The gate slide will be provided with an integral pocket for the thrust nut connecting the stem with the slide. The slide and thrust nut will be designed to safely withstand the stem design load as defined by this specification. For non-rising stem applications, the thrust nut will be located above the gate opening.

2.3.11.3 Seating/Sealing Faces

Seating/Sealing facing will be bronze or stainless steel. Bronze facing will be mechanically swaged into machined dovetailed grooves in the gate frame and slide. At the option of the manufacturer, stainless steel seat facings may be attached with taper screws which cannot be mechanically removed after fitting on facings. The taper screws will be of same material as that of the seat facings. Taper screws will be machined flush with the seat facing to provide an uninterrupted sealing surface. The contact pressure on bronze seat facings cannot exceed 900 psi under full operating head calculated based only the side seat facings. For stainless steel, the limit is 750 psi. The sealing surfaces will be machined to a 32 micro inch finish. The mating seating/sealing faces on the gate frame and slide will be precisely finished for proper contact. The mating surfaces will exclude a 0.004” feeler gauge at all points.

2.3.11.4 Wedging Devices

The slide gates will be provided with individually adjustable wedging devices to ensure proper contact of the frame and slide seat facings to achieve the required leakage performance. Slide gates used for seating head conditions only will be provided with side wedges. Slide gates wider than 24”, used for unseating heads will have side and top wedging devices. The bottom will have wedges or a flush bottom closing arrangement as required by the installation geometry. The wedging system includes wedge brackets on the frame. The wedge bracket will remain in a fixed position and the mating wedge on the slide will be adjustable or vice versa. A key and keyway arrangement will be provided on the base of wedge brackets to prevent any tendency to shift. Provision will be made to secure the adjustable brackets firmly in adjusted position. The adjustable wedges will be made of solid cast bronze, machined on all contact surfaces. The fixed wedging surface will be bronze faced.

2.3.11.5 Conventional or Flush Bottom Closing

Conventional closure slide gates will have corrosion resistant metal seat facings around the entire perimeter. Gates whose inverts are either flush with the concrete or have less than 10” of height difference will be

provided with a flush bottom, resilient seal. The resilient seal will be mounted on the frame to prevent it from being exposed to the flow. Gates with less than 20 feet of operating head may have the seal on the slide.

2.3.11.6 Operating Stem

The slide gates will be supplied with rising type operating stems unless non-rising stems are required by installation geometry. The stem will be supplied with ACME full or stub threading. The stem will be designed to allow for elevation deviations of up to 2”. The design of stem will be per the provision in AWWA C560. The L/r ratio will not exceed 200. For buckling, Euler’s formula will be used with an end condition of 2.0. For threaded sections, the radius of gyration will be based on the minor diameter. At the stem design load as follows, the yield strength of the material will not be exceeded. As a minimum for manual hoists, the stem design load is the load produced with a 100 pound effort on the crank or handwheel. For electric actuators, the stem design load is the greater of the load produced with a 100 pound handwheel effort and 1.25 times the load produced at a locked rotor condition. For hydraulic actuation, the stem design load will be 1.25 times the thrust produced at system relief pressure.

2.3.11.7 Stem Guides

Stem guides will be provided as required to meet the stem design criteria. Wall mounted stem guides will be adjustable in two directions, providing at least 0.50” of adjustment in both directions. Wall brackets will be cast iron or stainless steel. Wall mounted stem guides will have machine bored, split bushings to facilitate erection. Bushings will be bronze or UHMWPE. Stem guides mounting at the base of the pedestal do not require adjustment.

2.3.11.8 Manual Operating Mechanisms

Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the yoke of self-contained gates or on the pedestal of non-self-contained gates. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb. effort when the gate is in the closed position and experiencing the maximum operating head. An arrow with the word “OPEN” shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem. Handwheel operators shall be equipped with roller bearings above and below the operating nut. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist. The handwheel shall be removable and shall have a minimum diameter of 15 inches. Crank-operated gearboxes shall be fully enclosed and shall have cast aluminum or ductile iron housing. Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required. Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts. Gears shall be steel with machined cut teeth designed for smooth operation. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings. Positive mechanical seals shall be provided on the operating

nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist. The crank shall be cast aluminum or cast iron with a revolving nylon grip. The crank shall be removable. All gates having widths in excess of 72 inches and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation. Interconnecting shafting shall be constructed of aluminum or stainless steel. Flexible couplings shall be provided at each end of the interconnecting shaft. One crank shall be provided to mount on the pinion shaft of one of the gearboxes. An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the crank or handwheel, on a non- geared operator, is located over 48 in above the operating floor. Chain wheels are not acceptable. A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets. The extended operator system shall lower the centerline of the pinion shaft to 36 in above the operating floor. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60 in or less above the operating floor. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable. The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36 in above the operating floor. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb. effort on the crank or handwheel. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly. Operators shall be equipped with polycarbonate plastic stem covers. The top of the stem cover shall be closed and vented. Gate opening indication will be provided on the stem cover for all non-rising stem gates. A full height scale will be mounted on the side of the stem cover and an indicator nut mounted on the rising stem to show gate position. The scale graduation will be 1”. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting. When shown on the Contract Drawings, provide 2-inch square nut, mounted in a floor box, with a non-rising stem. The square nut shall be constructed of stainless steel. The floor box shall be constructed of stainless steel or cast iron and shall be set in the concrete floor above the gate as shown. Provide one aluminum or stainless-steel T-handle wrench for operation.

2.3.11.9 Anchor Bolts

Anchor bolts, nuts and washers will be provided by the gate manufacturer for mounting the gates and the appurtenances. The quantity and location determined by the gate manufacturer. All anchors will be epoxy type with epoxy provided by the contractor. Anchor bolts will have a minimum diameter of 1/2-inch.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

2.4.1 Hydrostatic Test on Watertight Joints

Perform a hydrostatic test on the watertight joint types as proposed. This test will be conducted at the plant or by an independent laboratory. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample

joint may be tested.

2.4.1.1 Concrete, Clay, PVC, PE, SRPE and PP Pipe

Provide joints in reinforced and nonreinforced concrete pipe meeting the performance requirements in ASTM C990M ASTM C990 or ASTM C443M ASTM C443. Provide joints in clay pipe meeting the test requirements in ASTM C425. Provide joints in PVC, PE, SRPE, and PP plastic pipe meeting the test requirements in ASTM D3212.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, BOX CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavate trenches, excavate for appurtenances and backfill for culverts and storm drains, in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

3.1.1 Trenching

Excavate trenches to the width indicated on the drawings or as specified herein. Trench width should permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Place sheeting and bracing, where required, within the trench width as specified, without any overexcavation.

3.1.2 Removal of Rock

Replace rock in either ledge or boulder formation with suitable materials to provide a compacted earth cushion. Provide a compacted earth cushion between unremoved rock and the pipe with a thickness of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Maintain the cushion under the bell as well as under the straight portion of the pipe where bell-and-spigot pipe is used. Provide a compacted earth cushion between unremoved rock and the box culvert of at least 8 inches in thickness for concrete box culverts. Excavate rock as specified and defined in Section 31 00 00 EARTHWORK .

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe or box culvert, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, remove such material to the depth required and replace with select granular material to the proper grade. Compact select granular material as specified in paragraph FINAL BACKFILL. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, perform such removal and replacement at no additional cost to the Government.

3.2 BEDDING AND INITIAL BACKFILL

Provide a firm bedding foundation of uniform density throughout the entire length of the pipe or box culvert.

3.2.1 Concrete Pipe

Use select granular material conforming to Section 31 00 00 EARTHWORK for haunch and bedding material. Compact haunch and outer bedding to at least 90 percent laboratory maximum density and place in layers not exceeding 6 inch loose thickness for compaction by hand-operated compactors and 200 mm 8 inches for other than hand-operated machines. Loosely place middle bedding and do not compact. After the pipe has been properly bedded, place haunch material, at a moisture content that will facilitate compaction, evenly along both sides of the pipe and thoroughly compact each layer with mechanical tampers or rammers to the springline of the pipe. Thoroughly compact the haunch material under the haunches of the pipe. For bell and spigot pipe, form a depression in bedding material for bells so entire barrel of pipe is uniformly supported. Minimize the length, depth, and width of bell depressions to that required for properly making the particular type of joint.

3.2.1.1 Trenches

After the pipe has been properly bedded and haunch material placed to the midpoint (springline) of the pipe, backfill and compact the remainder of the trench by spreading and rolling or compacting by mechanical rammers or tampers in layers not exceeding 6 inches. Test for density as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Leave untreated sheeting in place beneath structures or pavements.

3.2.1.2 Fill Sections

For pipe placed in fill sections, uniformly spread fill material longitudinally on both sides of the pipe in layers not exceeding 6 inches in compacted depth, and compact by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe must extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, place and thoroughly compact the remainder of the fill in layers not exceeding 8 inches.

3.2.2 Clay Pipe

Provide bedding for clay pipe as specified by ASTM C12.

3.2.3 Corrugated Steel and Aluminum Pipe

Provide bedding and structural backfill for corrugated steel and aluminum pipe and pipe arch in accordance with ASTM A798/A798M. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Structural backfill material consists of materials classified by ASTM D2487 as either GW, GM, GP-GM, GW-GM, GC, GP-GC or SW. Provide bedding for corrugated structural plate pipe meeting the requirements of ASTM A807/A807M.

3.2.4 Ductile Iron Pipe

Provide bedding for ductile iron pipe as shown on the drawings.

3.2.5 Plastic Pipe

Provide bedding for PVC, PE, SRPE and PP pipe meeting the requirements of ASTM D2321. Use Class IB or II material for PVC, PE, SRPE pipe bedding, haunching, and initial backfill. Use Class I, II, or III material for PP pipe bedding, haunching and initial backfill.

3.2.6 Precast Reinforced Box Culvert

Use granular material a minimum of 6 inches in depth for bedding precast concrete box culverts in trenches with soil foundation. Provide granular bedding in trenches with rock foundation that is 1/2 inch in depth per foot of depth of fill. The minimum depth of bedding will be 8 inch up to a maximum depth of 24 inches. Loosely place the granular bedding. Provide uniform support along the entire length of box culvert.

3.2.6.1 Trenches

After the box culvert has been properly bedded, place selected material from excavation or borrow, at a moisture content that will facilitate compaction, along both sides of box culvert in layers not exceeding 6 inches in compacted depth. Bring the backfill up evenly on both sides of box culvert for the full length box culvert. Thoroughly compact each layer with mechanical tampers or rammers. Continue this method of filling and compacting until the fill has reached an elevation equal to the top of the box culvert. Backfill and compact the remainder of the trench by spreading and rolling or by compacting with mechanical rammers or tampers in layers not exceeding 6 inches. Test density as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Leave untreated sheeting in place beneath structures or pavements.

3.2.6.2 Fill Sections

Use backfill material and placement and compaction procedures for box culvert placed in fill sections as specified below. Uniformly spread the fill material longitudinally on both sides of the box in layers not exceeding 6 inches in compacted depth. Compacted by rolling parallel with pipe or by using mechanical tamping or ramming. Prior to commencing normal filling operations, the width of the fill at a height of 12 inches above the top of the box must extend a distance of not less than twice the outside width of the box culvert on each side of the box or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the box, place and thoroughly compacte the remainder of the fill in layers not exceeding 6 inches.

3.3 PLACING PIPE AND BOX CULVERT

Submit printed copies of the pipe or box culvert manufacturer's recommended pipe or box culvert installation procedures prior to installation. Thoroughly examine each section of pipe or box culvert before being laid; do not use defective or damaged pipe. Protect plastic pipe, excluding SRPE pipe, from exposure to direct sunlight prior to

laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Lay pipelines to the grades and alignment indicated. Provide proper facilities for lowering sections of pipe into trenches. Place lifting lugs in vertically elongated corrugated steel or aluminum pipe in the same vertical plane as the major axis of the pipe. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work. Divert drainage or dewater trenches during construction as necessary. Deflection of installed flexible pipe must not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (percent)
Plastic (PVC, HDPE, SRPE, and PP)	5

3.3.1 Concrete, Clay, PVC, Ribbed PVC, Ductile Iron Pipe

Lay pipe proceeding upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Elliptical and Elliptical Reinforced Concrete Pipe

Place pipe so that the manufacturer's reference lines, designating the top of the pipe, are within 5 degrees of a vertical plane through the longitudinal axis of the pipe. Prevent damage to or misalignment of the pipe during backfilling operations.

3.3.3 PE, SRPE, and Dual Wall and Triple Wall PP Pipe

Lay on a bed shaped to line and grade and joint sections together in accordance with manufacturer's guidelines.

3.3.4 Corrugated Steel and Aluminum Pipe and Pipe Arch

Lay pipe with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Install part paved pipe so that the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Provide fully paved steel pipe or pipe arch with the sheet thickness of the pipe or pipe arch painted or otherwise indicated on a label applied on the inside of the pipe or pipe arch. Coat any unprotected metal in the joints with bituminous material as specified in AASHTO M 190 or AASHTO M 243. Protect interior coating against damage from insertion or removal of struts or tie wires. Use lifting lugs to facilitate moving pipe without damage to exterior or interior coatings. Handle pipe or pipe arch and coupling bands during transportation and installation with care to preclude damage to the coating, paving or lining. Repair damaged coatings, pavings and linings in accordance with the manufacturer's recommendations prior to placing backfill. Remove and

replace pipe on with coating, paving or lining that has been damaged to such an extent that satisfactory field repairs cannot be made. Accomplish vertical elongation, where indicated, in the factory. Provide suitable markings or properly placed lifting lugs to ensure placement of factory elongated pipe in a vertical plane.

3.3.5 Structural-Plate Steel

Install structural plate in accordance with ASTM A807/A807M. Assemble structural plate in accordance with instructions furnished by the manufacturer. Instructions must show the position of each plate and the order of assembly. Tighten bolts progressively and uniformly, starting at one end of the structure after all plates are in place. Repeat the operation to ensure that all bolts are tightened to meet the torque requirements of 200 foot-pounds plus or minus 50 foot-pounds. Check power wrenches used by the use of hand torque wrenches or long-handled socket or structural wrenches for amount of torque produced. Check and adjust power wrenches frequently as needed, according to type or condition, to ensure proper adjustment to supply the required torque.

3.3.6 Structural-Plate Aluminum

Assemble structural plate in accordance with instructions furnished by the manufacturer. Instructions must show the position of each plate and the order of assembly. Tighten bolts progressively and uniformly, starting at one end of the structure after all plates are in place. Repeat the operation to ensure that all bolts are torqued to a minimum of 100 foot-pounds on aluminum alloy bolts and a minimum of 150 foot-pounds on galvanized steel bolts. Check power wrenches used by the use of hand torque wrenches or long-handled socket or structural wrenches for the amount of torque produced. Check and adjust power wrenches as frequently as needed, according to type or condition, to ensure that they are in proper adjustment to supply the required torque.

3.3.7 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe must be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.3.8 Precast Reinforced Concrete Box Culvert

Proceed upgrade with laying of sections and point tongue ends of tongue-and-groove box culvert section in the direction of flow.

3.4 JOINTING

3.4.1 Concrete and Clay Pipe

3.4.1.1 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe and Box Culverts

Follow the recommendation of the particular manufacturer in regard to sealing compound special installation requirements. When lubricants, primers, or adhesives are used, only apply on surfaces that are dry and clean. Affix sealing compounds to the pipe or box culvert not more than 3 hours prior to installation of the pipe or box culvert. Protect sealing compounds from the sun, blowing dust, and other deleterious agents at all times. Inspect sealing compounds before installation of the pipe or box culvert, and remove and replace any loose or improperly affixed sealing

compound. Align the pipe or box culvert with the previously installed pipe or box culvert, and pull the joint together.

3.4.1.2 Flexible Watertight Joints

Use lubricants, cements, adhesives, and other special installation requirements for gaskets and jointing materials as recommended by the manufacturer. When lubricants, cements, or adhesives are used, only apply on surfaces that are clean and dry. Affix gaskets and jointing materials to the pipe not more than 24 hours prior to the installation of the pipe, and protect from the sun, blowing dust, and other deleterious agents at all times. Inspect gaskets and jointing materials before installing the pipe; remove and replace any loose or improperly affixed gaskets and jointing materials. Align the pipe with the previously installed pipe, and push the joint home. If the gasket becomes visibly dislocated when joining sections of pipe, remove the pipe and remake the joint.

3.4.2 Corrugated Steel and Aluminum Pipe

3.4.2.1 Field Joints

Provide transverse field joints designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. Provide joints meeting the general performance requirements described in ASTM A798/A798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. Keep the space between the pipe and connecting bands free from dirt and grit so that corrugations fit snugly. While being tightened, tap the connecting band with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. Fill the annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, with a bituminous material after jointing. Provide field joints for each type of corrugated metal pipe that maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. Provide bands of the type, size, and sheet thickness indicated. Provide angles or lugs and bolts of the size indicated. Provide bands and angles or lugs and bolts as specified in the applicable standards or specifications for the pipe.

3.4.2.2 Flexible Watertight, Gasketed Joints

Use lubricants or cements and other special installation requirements as recommended by the gasket manufacturer. Where sleeve type gaskets are used, place the gasket over one end of a section of pipe for half the width of the gasket. Then double over the other half over the end of the same pipe. When the adjoining section of pipe is in place, roll the doubled-over half of the gasket over the adjoining section. Correct any unevenness in overlap so that the gasket covers the end of pipe sections equally. Center connecting bands over adjoining sections of pipe, and place rods or bolts in position and tighten nuts. Band Tightening: Tighten the band evenly, keep even tension on the rods or bolts, and the gasket; properly seat the gasket in the corrugations. Keep watertight joints uncovered for a period of time designated by the Contracting Officer. Before covering joints, measure the tightness of the nuts with a torque wrench. If the nut has tended to loosen its grip on the bolts or

rods, retighten the nut with a torque wrench and keep uncovered until a tight, permanent joint is assured.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construct manholes of precast reinforced concrete. Construct inlets of precast reinforced concrete. Provide manholes and inlets complete with frames and covers or gratings; and with fixed galvanized steel ladders as indicated. The wall along the line where steel ladders are installed must be vertical for its entire length. Adequately anchor ladders to the wall by means of steel inserts spaced not more than 6 feet vertically, and install to provide at least 6 inches of space between the wall and the rungs. Make pipe connections to concrete manholes and inlets with flexible, watertight connectors.

3.6 FINAL BACKFILL

Backfill trenches with satisfactory material deposited in layers of a maximum of 8 inches loose thickness and compacted to 90 percent of maximum density for cohesive soils and 95 percent of maximum density for cohesionless soils in accordance with Section 31 00 00 EARTHWORK . Testing is the responsibility of the Contractor and will be performed at no additional cost to the Government. Unless otherwise specified, determine field in-place density of final backfill at a frequency of one test per 50 linear feet, or fraction thereof, of each lift of backfill. Submit test results in accordance with Section 31 00 00 EARTHWORK . Do not displace or damage pipe or box when compacting final backfill by rolling or operating heavy equipment parallel with the pipe or box. Movement of construction machinery over a culvert or storm drain at any stage of construction will be at the Contractor's risk. Repair or replace any damaged pipe. Protect concrete pipes with a minimum of 3 feet of cover prior to permitting heavy construction equipment to pass over them during construction. Provide the minimum cover for construction loads over corrugated steel pipes as specified in Section 26, Division II of AASHTO HB-17. Provide minimum cover for construction loads over plastic pipes as specified in ASTM D2321.

3.7 FIELD QUALITY CONTROL

3.7.1 Tests

Testing is the responsibility of the Contractor. Perform all testing and retesting at no additional cost to the Government.

3.7.1.1 Leakage Test

Test pipe lines for leakage prior to completing backfill by performing either an exfiltration test, low pressure air pipeline test or by individual pipe joint testing. Submit leakage test results to the Contracting Officer.

3.7.1.1.1 Exfiltration Test

Prior to exfiltration tests, backfill the trench up to at least the lower half of the pipe. If required, place sufficient additional backfill to prevent pipe movement during testing, leaving the joints uncovered to

permit inspection. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, measure infiltration using a suitable weir or other device acceptable to the Contracting Officer. Perform exfiltration test by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. Allow the filled line to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, reestablish the head. Measure the amount of water required to maintain this water level during a 2-hour test period. Leakage as measured by the exfiltration test must not exceed 250 gallons per inch in diameter per mile of pipeline per day and 0.2 gallons per inch in diameter per 100 feet of pipeline per hour. Correct visible leaks encountered regardless of leakage test results.

3.7.1.1.2 Low Pressure Air Pipeline Tests

Perform low pressure air testing for vitrified clay pipes in accordance with ASTM C828. Perform low pressure air testing for plastic pipe in accordance with ASTM F1417. Perform low pressure air testing procedures for other pipe materials using the pressures and testing times prescribed in ASTM C828, after consultation with the pipe manufacturer.

3.7.1.1.3 Individual Pipe Joint Testing

Testing of individual joints for leakage by low pressure air or water must conform to ASTM C1103M ASTM C1103.

3.7.1.2 Deflection Testing

Conduct deflection test no sooner than 30 days after completion of final backfill and compaction testing. Clean or flush all lines prior to testing. Perform a deflection test on entire length of installed flexible pipeline upon completion of work adjacent to and over the pipeline, including backfilling, placement of fill, grading, paving, placement of concrete, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads must not exceed the limits in paragraph PLACING PIPE AND BOX CULVERT above as percent of the average inside diameter of pipe. Use a laser profiler or mandrel to determine if allowable deflection has been exceeded.

3.7.1.2.1 Laser Profiler

Inspect pipe interior with laser profiling equipment. For initial post installation inspections for pipe diameters larger than 48 inches, perform a visual inspection of the pipe interior.

3.7.2 Inspection

3.7.2.1 Post-Installation Inspection

Visually inspect pipes with diameters larger than 48 inches. Inspect each segment of pipe for alignment, settlement, joint separations, soil migration through the joint, cracks, buckling, bulging and deflection. An engineer must evaluate all defects to determine if any remediation or repair is required.

3.7.2.1.1 Concrete Pipe

An engineer must evaluate all pipes with cracks with a width greater than 0.25 mm 0.01 inches, but less than 0.10 inches to determine if any remediation or repair is required.

3.7.2.1.2 Post-Installation Inspection Report

The deflection results and final post installation inspection report must include: a copy of all video taken, pipe location identification, equipment used for inspection, inspector name, deviation from design, grade, deviation from line, deflection and deformation of flexible pipe, inspector notes, condition of joints, condition of pipe wall (e.g. distress, cracking, wall damage dents, bulges, creases, tears, holes, etc.).

3.7.2.2 Low Impact Development Inspection

Inspect Low Impact Development (LID) features indicated on the design portion of the LID Verification Report. Certify LID features were constructed according to plans and specifications or by submitting as-built drawings in accordance with UFGS 01 78 00 Closeout Submittals. When as-built drawings show deviations to the LID features, document the deviations on the LID Verification Report.

3.7.3 Repair of Defects

3.7.3.1 Leakage Test

When leakage exceeds the maximum amount specified, correct source of excess leakage by replacing damaged pipe and gaskets and retest.

3.7.3.2 Deflection Testing

When deflection readings are in excess of the allowable deflection of average inside diamater of pipe are obtained, remove pipe which has excessive deflection and replace with new pipe. Retest 30 days after completing backfill, leakage testing and compaction testing.

3.7.3.3 Inspection

Replace pipe or repair defects indicated in the Post-Installation Inspection Report.

3.7.3.3.1 Concrete Pipe

Replace pipes having cracks with a width greater than 0.1 inches.

3.7.3.3.2 Flexible Pipe

Replace pipes having cracks or splits.

3.8 PROTECTION

Protect storm drainage piping and adjacent areas from superimposed and external loads during construction.

3.9 WARRANTY PERIOD

Pipe segments found to have defects during the warranty period must be replaced with new pipe and retested.

-- End of Section --