INDIANA-AMERICAN WATER

PIPELINE SPECIFICATIONS

NOVEMBER-2019

TECHNICAL SPECIFICATIONS- 2019

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SECTION 01000

SUMMARY OF WORK

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Contractor shall provide all labor, materials (except as herein noted), tools, equipment, services and means to construct the pipeline(s) and other Work as described in the Contract Documents (including these Specifications) and shown on the Drawings. The Work for which the Contractor is responsible includes, but is not limited to, the following:

1. Call for utility locations;
2. Acquisition of any additional temporary easements or other written authorizations necessary to perform the Work, including access and storage areas;
3. Pavement removal, including saw cutting, as required;
4. Construction and maintenance of bridges and other structures as required for traffic control;
5. Furnishing of flagmen, traffic warning and control as required;
6. Protection, temporary removal and replacement of signage and traffic control devices where affected by the Work;
7. Sheeting, bracing and support of trench and adjoining ground where necessary;
8. Furnish and install thrust blocking and pipe restraints as required;
9. Handling drainage and water removal;
10. Guarding the site and materials on site;
11. All necessary safety equipment, devices, and other precautions;
12. Furnishing materials not provided by the Owner to the site (see article 1.03)
13. Unloading, loading, hauling, distributing, laying and testing the pipe and appurtenances;
14. Protection, temporary support and/or rearranging of sewer lateral and other utility pipes, ducts, wires, cables and poles where necessary;
15. Excavation and backfilling of trenches and pits;
16. Restoration of paved and concrete surfaces including roadways, curbing, driveways, and sidewalks;
17. Removal and proper disposal of surplus excavated material and debris;
18. Installation of required pipe, fittings and appurtenances;

19. Performance of pressure and leakage tests and correction of any deficiencies;
20. Flush & clean pipeline;
21. Disinfecting of pipeline (and dechlorination of discharge);
22. Site cleaning;
23. Maintenance of street or other surfaces for the required period of time;
24. Ground restoration and planting;
25. Submit schedules, Shop Drawings and as-built records;
26. Erosion and sediment control.

B. Contractor shall refer to the Standard General Conditions of the Construction Contract for definitions of the Owner, Contractor, Engineer and other terminology that may be used in these Specifications.

C. Contractor shall refer to Section 01011 Special Provisions, for specific criteria, which are set by the Engineer or Owner's local Operations District and supplement or supersede other sections within these Specifications.

D. The above general outline of principal features does not in any way limit the responsibility of the Contractor to perform all Work and furnish the required materials, equipment, labor and means as shown or required by the Contract Documents.

E. Materials, equipment, labor, etc., obviously a part of the Work and necessary for the proper operation and installation of same, although not specifically indicated in the Contract Documents, shall be provided as if called for in detail without additional cost to the Owner.

F. Where the following acronyms are used on the Schedule of Prices or elsewhere in these Specifications, they shall be defined as follows:

1. OFCI = Owner Furnished Contractor Installed (materials or equipment to be furnished by the Owner but installed by the Contractor)
2. CFCI = Contractor Furnished Contractor Installed (materials or equipment to be furnished and installed by the Contractor)
3. Where neither acronym is indicated for a particular Bid Item, refer to this section, Section 01011 and Section 01075 for clarification.

1.02 WORK BY OWNER

A. Owner may perform certain items of Work related to this project which may include the following

1. Mark locations of existing water mains, services, and valves;
2. Other work, if any, as described below:

a. Operate all valves necessary to shut-off, flush and reactivate its existing pipelines;
b. Install Pipe taps;
c. Provide meter sets;
d. Install meters;
e. Perform flushing (use of valves and hydrants);
f. Collect bacteriological samples;
g. Monitor Contractor's dechlorination plan;
h. Perform all bacteriological testing of samples and provide confirmation of passing and results upon request.

B. See Special Provisions (Section 01011), Section 01075 and the Schedule of Prices for applicable list of tasks provided by Owner and additional clarification of materials furnished by Owner. In the case of conflicts regarding Owner-furnished materials, the Schedule of Prices shall govern (if Schedule of Prices is silent, Section 01011 shall govern, followed by Section 01075).

C. See Section 01011 for specific local requirements with regard to all other Specification sections.

1.03 MATERIALS FURNISHED BY OWNER

A. The following materials will be furnished by the Owner unless otherwise indicated in the Schedule of Prices, Section 01011 and/or Section 01075; and when so furnished, these materials shall be installed by the Contractor.

1. Ductile iron pipe and standard pipe gaskets for push-on joints
2. Restrained joint ductile iron pipe and compatible standard gaskets (16-inch and larger; also for smaller sizes when ductile iron pipe is identified on the Drawings for HDD applications)
3. Field-Lok gaskets (12-inch and smaller)
4. AWWA C900 PVC pipe (excluding Certa-Lok) and standard gaskets
5. Valves for buried service 4-inch diameter and greater with standard MJ ends and gaskets, including hydrant isolation valves (excluding metal-seated gate valves, tapping valves as noted below, and other horizontally-oriented gate valves)
6. Fire hydrant barrels (with Storz connections where required) and bottom shoes
7. Polyethylene encasement
8. Water meters.

B. Material to be furnished by Owner will typically be delivered to the job-site; however, certain materials may be delivered to the Owner's local Operations District property. Contractor is responsible for unloading all Owner-furnished material and transporting (both at job site and Owner's property) and shall reload and transport to the job site all items delivered to the Owner's property.

C. At Owner's discretion, Owner may furnish de-chlorination equipment (but not de-chlorination chemical) for the Contractor's temporary use on the Work under this Contract only.

D. All materials required to complete the Work, but not listed above, shall be furnished and installed by the Contractor. For example, unless otherwise noted in Section 01011, Section 01075, or the Schedule of Prices, the following materials will **not** be furnished by the Owner:

1. HDPE pipe
2. Certa-Lok™ PVC pipe
3. Ductile iron fittings and gaskets
4. Ductile iron anchor couplings
5. Fire hydrant laterals
6. Flushing hydrants
7. Valve boxes
8. Tapping sleeves, saddles, and tapping valves (except where standard MJ, vertically-oriented gate valves 12-inch diameter and smaller can be used)
9. Rods, bolts, lugs, gaskets
10. Retaining glands, couplings, and other external joint restraint devices for pipe, fittings, valves,
11. Service line piping (except where ductile iron pipe is required)
12. Corporation and curb stops
13. Identification tape
14. Tracer wire
15. Tape for polyethylene encasement
16. Pipe insulation materials
17. Air valves and blow-off assemblies
18. All other piping specialties and related components.

E. See Section 01075, Section 01011, and Schedule of Prices for applicable list of materials furnished by Owner

F. See Section 01011 for specific local requirements with regard to all other Specification sections.

1.04 LOCATIONS

A. All Work shall be performed on Owner's property, public rights of way, and/or public or private easements obtained by the Owner. Approximate right of way and easement limits are shown on the Drawings and/or described in the

Specifications. No work shall be performed by the Contractor outside of these limits.

B. It is the obligation and responsibility of the Contractor to determine the exact limitations of the rights of way and/or easements and any conditions limiting or affecting the use of the right of way by the Owner and/or the Contractor. All agreements respecting rights of way and the easements that are available to the Owner can be made available upon request. The Contractor agrees to indemnify and hold harmless the Owner against any claims made by any property owner, including any claim that the Contractor has failed to keep Contractor work, equipment, materials, or workmen within the limits authorized by the right of way and/or easement or any claim that the Contractor has failed to comply with any condition or requirement, or agreement respecting the right of way and/or easement.

C. Some of the locations shown or described in the Contract Documents, such as tie-ins, are approximate. All tie-ins shall be performed per the Contract Documents unless specifically directed by the Owner. It is the responsibility of the Contractor for pinpointing the exact locations.

D. Contours, topography and profiles of the ground as may be shown on the Drawings are believed to be reasonably correct, but are not guaranteed and are presented only as an approximation. It is the Contractor's responsibility to verify proposed pipeline elevations.

PART 2: PRODUCTS

2.01 GENERAL

Specifications for the materials and equipment to be provided by the Contractor are detailed in the respective Specification sections.

PART 3: EXECUTION

3.01 FIELD SURVEY WORK

Contractor shall lay out the Work in accordance with Article 4 Section 4.05 of the General Conditions. The Contractor shall utilize a Registered Land Surveyor to stake the existing right of way, proposed right of way and easements. Contractor shall stake the proposed alignment to insure compliance with the Contract Documents and Specifications. The Contract Documents shall include bench marks and control points for reference. Where necessary, Owner will furnish additional reference points as noted on the Drawings in paper or electronic format.

3.02 COORDINATION

A. Coordinate work; phase the construction operations; and provide and maintain any temporary connections necessary to prevent interference to operation of

Owner's facilities. Any construction work requiring the shutdown of facilities must be scheduled and performed only at such times as shall be authorized by the Owner. Such Work must be completed during the specific periods authorized by the Owner.

B. Refer to Section 15000 for further requirements regarding coordination of shutdowns and other interruptions to Owner's facilities.

3.03 REGULATORY REQUIREMENTS

When the Work is to be done in a third party's transportation or utility right of way, Contractor shall coordinate with the third party in accordance with Sections 01570, 02025, 02610 and 02620, and, where required by the third party, make necessary arrangements to have an inspector and/or traffic controllers/signalmen assigned to the Project by the third party.

Contractor shall comply with the third party's requirements and shall coordinate with the third party and its inspector / traffic controllers / signalmen as required throughout the duration of the Work. Work requiring inspection by the third party's inspector and/or traffic control/signaling by the third party shall only be performed when authorized by the third party. All costs in connection with third party inspections and traffic control/signaling mandated by third party transportation and utility authorities shall be paid by the Contractor.

END OF SECTION

SECTION 01010

DRAWING INDEX

PART 1: GENERAL

1.01 DRAWINGS

A. The following Drawings, dated [Date on Drawings], and prepared by Engineers company name [Engineering firm's name] ,accompany these Specifications and are a part thereof. Drawings are the property of the Owner and shall not be used for any purpose other than that intended by the Specifications.

Sheet No.	*Title, Description*
1	*TITLE*
2	*INDEX & DATA*
3-X	*WATER MAIN PLAN & PROFILE*
X	*WATER MAIN STANDARD DETAILS*

B. The following detail Drawings are provided and are to be incorporated in the Drawings:

Sheet No.	*Title, Description*
…	

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

Not Used.

END OF SECTION

SECTION 01011

SPECIAL PROVISIONS

PART 1: GENERAL

This section is intended call out requirements that are unique to individual Operations Districts of the Owner. The content of this section shall replace or supplement the requirements in other sections of the Specifications for Work within the individual Operations Districts as noted herein. **If any other article of this section suggests the use of any materials, means and methods but is excluded or modified in this Section 01011, this section shall have priority and shall supersede conflicting requirements in other sections.** If there are conflicts between the Drawings provided and these Specifications, contact Owner immediately for clarification.

FROM SECTION 15150 GATE VALVES

A. Valves located in the Terre Haute Operations District shall open right.

FROM SECTION 15155 BUTTERFLY VALVES

A. Valves located in the Terre Haute Operations District shall open right.

FROM SECTION 15180 FIRE HYDRANTS

When the Contractor is required to furnish fire hydrants, hydrants shall be furnished and equipped according to the below schedule. Touch-up paint color shall also conform to this schedule.

	Allowed Manufacturers			*Storz Outlet Required*	
District	*Kennedy*	*American Darling*	*Mueller*		**Color**
Crawfordsville	X	X	X	Yes	Safety Yellow - Company Red - Private
Johnson County			X	Yes	Safety Yellow - Company Red - Private
Kokomo	X		X	Yes	Safety Yellow - Company Red - Private
Mooresville			X	Yes	Safety Yellow - Company Red - Private
Muncie			X	Yes	Safety Yellow - Company Red - Private

District	Allowed Manufacturers			*Storz Outlet Required*	Color
	Kennedy	*American Darling*	*Mueller*		
Newburgh			X	Yes	Safety Yellow - Company Red - Private
Noblesville	X		X	Yes	Safety Yellow - Noblesville White with blue cap - Fishers Red - Private
Northwest	X		X	Yes	Safety Orange or Omaha Orange - Company Red - Private
Richmond			X	No	Safety Yellow - Company Red - Private
Seymour			X	No	Safety Yellow - Company Red - Private
Shelbyville			X	Yes	Safety Yellow - Company Red - Private
Sheridan	(1)	(1)	(1)	(1)	(1)
Somerset	No fire hydrants				
Southern-Clarksville, Jeffersonville, New Albany	X		X	Yes	Safety Yellow - Company Red - Private
Southern-Charlestown	(1)	(1)	(1)	(1)	(1)
Southern-Georgetown	(1)	(1)	(1)	(1)	(1)
Sullivan			X	Yes	Safety Yellow - Company Red - Private
Summitville			X	Yes	Safety Yellow - Company Red - Private
Terre Haute (incl. Farmersburg)			X	Yes	Safety Yellow - Company Red - Private
Wabash	X	X	X	Yes	Safety Yellow - Company Red - Private

District	Allowed Manufacturers			*Storz Outlet Required*	Color
	Kennedy	*American Darling*	*Mueller*		
Warsaw	X	X	X	Yes	Safety Yellow - Company Red - Private
West Lafayette	X		X	Yes	Safety Yellow - Company Red - Private
Winchester			X	No	Safety Yellow - Company Red - Private

(1) Confirm with local INAWC Operations

FROM SECTION 15190 Air Valves, Blow-off Assemblies and Sampling taps

A. Flushing Hydrants for Permanent Blow-off Assemblies

1. Johnson County- Above ground type.
2. All others- Confirm with local INAWC Operations

FROM SECTION 15200 SERVICE LINES

The Contractor shall supply all required meter pits, setters or yoke bars, valves, lids, service line, other listed products, and miscellaneous items required to install new residential service connections per the following schedule:

B. Crawfordsville

1. **Meter Pit:** 48” long.
2. **Meter Pit Ring/Cover and Lid:** Vestal 20” #RMRC-21L W/SN W/TR
3. **Yoke Bar or Setter:** A.Y. McDonald 14-2P
4. **Dual Meter sets:** A.Y. McDonald #08U3m 1 x ¾” x 7.5 u-branch
5. **Supports:** ¾” standpipes
6. **Inlet Angle Ball Valve:** A.Y. McDonald #4604BY ¾” x ¾” x 02
7. **Outlet Valve:** A.Y. McDonald #4779Y-22 ¾”x 02
8. **Service Line Material:** ¾” for individual services and 1” to supply dual meter settings; HDPE SDR-9 (200 psi) minimum.
9. **Corporation Stop:** Mueller #E-25009 1x1x1

C. Johnson County

1. **Meter Pit:** 48” long x 20” Diameter (single & dual)
2. **Meter Pit Ring/Cover and Lid:** Vestal 20” Model #RMC-20L W/SN W/TR (Single) and Model #RMC-20L W/SN W/2TR (Dual)
3. **Meter:** ¾” x 5/8” Furnished and installed by INAWC.
4. **Yoke Bar:** Mueller # H-5020P
5. **Branch Piece (Dual Set Only):** Mueller H-15363-254N
6. **Supports:** ¾” standpipes
7. **Inlet Ball Valve:** Mueller B-24278-250N (3/4”) Mueller B-24278-250N (1”)
8. **Outlet Ell:** Mueller #H-14207-250N (3/4”) and H-14207-250N (1”)
9. **Service Line Material:** ¾” for individual services and 1” to supply dual meter settings; HDPE SDR-9 (200 psi) minimum.
10. **Corporation Stop:** Mueller #H-15008N-250N (¾”) or #H-15008N-330N (1”)

D. Kokomo & Russiaville

1. **Meter Pit:** 48” x 20” Diameter (single) 24” (dual)
2. **Meter Pit Ring/Cover and Lid:** (Single) Vestal # 32-277 - RMRC-215-L W/SN W/RTR Ring & Lid or Ford # A53-REC463-T Ring & Lid. (Dual Set) Vestal # 32-046 - ER-2024 Ring with 32-501 - Monitor Ring & Lid W/SN W/2RTR or Ford # MC-24-REC463-TT Ring & Lid. (1” Set) Vestal # 32-046 - ER-2024 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR or Ford # MC-24-REC463-T Ring & Lid.
3. **Meter:** ¾” x 5/8” Furnished and installed by INAWC.
4. **Copper Setter:** (5/8”) A.Y. McDonald # 731-1--WXQQ33, Ford # VB81W-44-33-Q-NL, Mueller # B-2474N. (1”) A.Y. McDonald # 731-4--WXQQ44, Ford # VB84W-44-44-Q-NL, Mueller # B-2474N

2. **Yoke U-Branch Assembly (Dual Set Only):** A.Y. McDonald # 708UQQ or Mueller # H-15373N (1” x ¾” x 7.5”).

3. **Supports:** ½” Black Iron Pipe as vertical standpipe (Earth), ¾” Sch-80 PVC as horizontal cross bar (Rock).

4. **Service Line Material:** ¾” for individual services and 1” to supply dual meter settings; PE CTS SDR-9 (200 psi) minimum. Pipe stiffener inserts shall be plastic.

5. **Corporation Stop:** (3/4”) A.Y. McDonald # 74701T, Ford # F1000-3-Q-NL, Mueller # H-15008. (1”) A.Y. McDonald # 74701T, Ford # F1000-4-Q-NL, Mueller # H-15008N.

6. **Manufactured Meter Pit Setter:**

a. **1.5" Meter:** Pit: Ford# PMBB-688-36HB-48-SB4-G-NL (13" laylength, 18" lid to meter) Lid: Ford# MC-36-REC463-T Ring & Lid or Vestal # 32-049 - ER-2036 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR

b. **2" Meter:** Pit: Ford# PMBB-788-36HB-48-SB4-G-NL (17" laylength, 18" lid to meter) Lid: Ford# MC-36-REC463-T Ring & Lid or Vestal # 32-049 - ER-2036 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR

E. Mooresville

1. **Meter Pit:** 48" long x 20" Diameter (single) 24" (dual & 1" meters).
2. **Meter Pit Ring/Cover and Lid:** confirm with Local Operations.
3. **Meter:** confirm with Local Operations Furnished and installed by INAWC.
4. **Yoke Bar:** Mueller # H-5020P
5. **Supports:** ¾" standpipes
6. **Branch Piece (Dual Set Only):** Mueller H-15363-245N
7. **Inlet Ball Valve:** Mueller B-24278-250N (3/4" & 1")
8. **Outlet Ell:** Mueller #H-14207-250N (3/4" & 1")
9. **Service Line Material:** 1" diameter to supply single and dual meter settings; PE CTS SDR-9 (200 psi) minimum.
10. **Corporation Stop:** Mueller # H-15008-250N (¾") or H-15008-330N (1")

F. Muncie

1. **Meter Pit:** 48" long x 20" Diameter (single) 24" (dual).
2. **Meter Pit Ring/Cover and Lid:** (Single) Vestal # 32-277 - RMRC-215-L W/SN W/RTR Ring & Lid or Ford # A53-REC463-T Ring & Lid. (Dual Set) Vestal # 32-046 - ER-2024 Ring with 32-501 - Monitor Ring & Lid W/SN W/2RTR or Ford # MC-24-REC463-TT Ring & Lid. (1" Set) Vestal # 32-046 - ER-2024 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR or Ford # MC-24-REC463-T Ring & Lid.
3. **Meter:** 5/8" x 5/8" Furnished and installed by INAWC.
4. **Copper Setter:** A.Y. McDonald # 31-1-WXQQ33
5. **Yoke U-Branch Assembly (Dual Set Only):** A.Y. McDonald # 708UQQ or Mueller # H-15373N (1" x ¾" x 7.5").
6. **Supports:** ½" Black Iron Pipe as vertical standpipe (Earth), ¾" Sch-80 PVC as horizontal cross bar (Rock).
7. **Inlet Angle Ball Valve:** Mueller # B24273-200
7. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE CTS SDR-9 (200 psi) minimum. Pipe stiffener inserts shall be plastic.

8. **Corporation Stop:** Mueller ¾" # H-15008N

G. Newburgh

1. **Meter Pit:** 24" diameter (single and dual meters) x 24" long
2. **Meter Pit Ring/Cover and Lid:** Vestal #RMC-20L W/SN W/2TR
3. **Meter Pit Adapter Ring:** Vestal ER-2024
4. **Meter:** Confirm with local operations" Furnished and installed by INAWC.
5. **¾" Setter:** A.Y. McDonald # MD 760H212 WX 3D 33x15
6. **1" Setter:** A.Y. McDonald #MD 760H415 WX 3D 44x15
7. **Supports:** standpipes
8. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE CTS DR-9 (200 psi) minimum.
9. **Corporation Stop:** A.Y. McDonald #74701-22
10. **Tapping Saddles:** A.Y. McDonald SS Strap Saddle - 3835 (preferred—see also Section 15170)

H. Noblesville

1. **Meter Pit:** *Corrugated HDPE,* 48" long *20"* Diameter*. (Single), 24" (Dual or 1" Set).*
2. **Meter Pit Ring/Cover and Lid:** (*Single) Vestal # 32-277 - RMRC-215-L W/SN W/RTR Ring & Lid or Ford # A53-REC463-T Ring & Lid. (Dual Set) Vestal # 32-046 - ER-2024 Ring with 32-501 - Monitor Ring & Lid W/SN W/2RTR or Ford # MC-24-REC463-TT Ring & Lid. (1" Set) Vestal # 32-046 - ER-2024 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR or Ford # MC-24-REC463-T Ring & Lid.*
3. **Meter** 5/8" x 5/8" Furnished and installed by INAWC.
4. **Yoke Bar:** Mueller # H5010-P; A.Y. McDonald 14-1P, 14-2P, 14-3P, or 14-4P; or Ford Y501
5. **Supports:** ¾" standpipes
6. **Inlet Angle Ball Valve:** Mueller #H-14278-250, A.Y. McDonald 4604BY, or Ford AV91-313WNL
7. **Outlet Ell:** Mueller #H-14207-250
8. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE CTS SDR-9 (200 psi) minimum.
9. **Corporation Stop:** Mueller #H-15008N-250 (¾") or #H-15008N-330 (1"); A.Y. McDonald #74701-22 or Ford F1000-3-NL (¾") or F1000-1-NL (1")
10. **Manufactured Meter Pit Setter:**
    a. **1.5" Meter:** Pit: Ford# PMBB-688-36HB-48-SB4-G-NL (13" laylength, 18" lid to meter) Đid: Ford# MC-36-REC463-T Ring & Lid or Vestal # 32-049 - ER-2036 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR.

b. **2" Meter:** Pit: Ford# PMBB-788-30HB-48-SB4-G-NLFord# MC-30-REC463-T Ring & Lid or Vestal # 32-048 - ER-2030 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR

I. Northwest

1. **Meter Pit:** 48" long x 20" Diameter (single) 24" Diameter (dual meter & 1" services)
2. **Meter Pit Ring/Cover:** Vestal # 32-454 RMRCL W/SN W/TR (frost proof)
3. **Meter Pit Lid:** Vestal 32-776 w/ Electronic Meter Read Modules
4. **Meter Pit Frost Pan:** Vestal 32-777
5. **Meter:** ¾" x 5/8" Furnished and installed by INAWC.
6. **Yoke Bar:** A.Y. McDonald 14-2P or Ford Y502 (no prongs);
7. **Supports:** Standard support: (2) #6 rebar horizontal. Alternate support: ½" diameter vertical schedule 40 pipe.
8. **Outlet Angle Ball Valve:** (3/4") A.Y. McDonald 74602YQ, (1") A.Y. McDonald 74602Y-22; (3/4") Ford AV94-323W-Q-NL, (1") Ford AV94-324W-Q-NL.
9. **Inlet Ell:** (3/4") A.Y. McDonald 74779Y-22; (1") A.Y. McDonald 74779Y-22; (3/4") Ford L94-23-Q-NL
10. **Service Line Material:** HDPE SDR-9 (200 psi) minimum. Pipe stiffener inserts shall be stainless steel.
11. **Corporation Stop:** Mueller ¾" # H-15008N-3/4; A.Y. McDonald 74701BQ; Ford ¾" # F1000-3-Q-NL
12. **Curb Stop:** (3/4") Ford Ball Valve Curb Stop B44-333-Q-NL; Curb Box Ford 5604; Riser Rod: A.Y. McDonald # 5560

J. Richmond

1. **Meter Pit:** 48" long x 20" Diameter (single) 24" (dual)
2. **Meter Pit Ring/Cover and Lid:** (Single) Vestal # 32-277 - RMRC-215-L W/SN W/RTR Ring & Lid or Ford # A53-REC463-T Ring & Lid. (Dual Set) Vestal # 32-046 - ER-2024 Ring with 32-501 - Monitor Ring & Lid W/SN W/2RTR or Ford # MC-24-REC463-TT Ring & Lid. (1" Set) Vestal # 32-046 - ER-2024 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR or Ford # MC-24-REC463-T Ring & Lid.
3. **Meter:** ¾" x 5/8" Furnished and installed by INAWC.
4. **Meter Setter:** (5/8"x3/4") A.Y. McDonald # 731-2--WXQQ33, Ford # VB82W-44-33-Q-NL, Mueller # B-2474N. (1") A.Y. McDonald # 731-4--WXQQ44, Ford # VB84W-44-44-Q-NL, Mueller # B-2474N.
5. **Yoke U-Branch Assembly (Dual Set Only):** A.Y. McDonald # 708UQQ or Mueller # H-15373N (1" x ¾" x 7.5").
6. **Meter Idler:** A.Y. McDonald 740MJ07

7. **Support:** ½" Black Iron Pipe as vertical standpipe (Earth), ¾" Sch-80 PVC as horizontal cross bar (Rock).

8. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE DR-9 (200 psi) minimum. Pipe stiffener inserts shall be plastic.

9. **Corporation Stop:** (3/4") A.Y. McDonald # 74701T, Ford # F1000-3-Q-NL, Mueller # H-15008. (1") A.Y. McDonald # 74701T, Ford # F1000-4-Q-NL, Mueller # H-15008N.

K. Seymour

1. **Meter Pit:** 30" long.
2. **Meter Pit Ring/Cover and Lid:** Vestal 20" ring Model #RMRC-215L R&C W/SN W/TR (Single) and Model #RMRC-215L R&C W/SN W/2TR (Dual)
3. **Meter:** Confirm with local operations. Furnished and installed by INAWC.
4. **Meter Setter:** A.Y. McDonald 3/4" X 5/8"
5. **Support:** standpipes
6. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE CTSDR-9 (200 psi) minimum.
7. **Corporation Stop:** A.Y. McDonald # 4701BT

L. Shelbyville

1. **Meter Pit:** 36" long x 20" Diameter (single) 24" (dual)
2. **Meter Pit Ring/Cover and Lid:** Vestal 20" ring Model #RMRC-215L R&C W/SN W/TR (Single) and Model #RMRC-215L R&C W/SN W/2TR (Dual)
3. **Meter:** ¾" x 5/8" Furnished and installed by INAWC.
4. **Yoke Bar:** Mueller #H-5020P
5. **Supports:** ¾" standpipes
6. **Branch Piece (Dual Set Only):** Mueller H-15363-254N
7. **Inlet Ball Valve:** Mueller B-24278-250N
8. **Outlet Elbow:** Mueller #H-14207-250N
9. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE DR-9 (200 psi) minimum.
10. **Corporation Stop:** Mueller #H-15008N-250 (3/4") or H-15008N-330N (1")

M. Sheridan

1. **Meter Pit:** 36" long
2. **Meter Pit Ring/Cover and Lid:** Vestal #RMRC-215L R & C W/SN W/TR; A.Y. McDonald 74M53AT or Ford C53-T

3. **Meter** 5/8” x 5/8” Furnished and installed by INAWC.
4. **Yoke Bar:** Mueller # H5010-P; A.Y. McDonald 14-1P, 14-2P, 14-3P, or 14-4P; or Ford Y501
5. **Supports:** ¾” standpipes
6. **Inlet Angle Ball Valve:** Mueller #H-14278-250, A.Y. McDonald 4604BY, or Ford AV91-313WNL
7. **Outlet Ell:** Mueller #H-14207-250
8. **Service Line Material:** ¾” for individual services and 1” to supply dual meter settings; PE CTS SDR-9 (200 psi) minimum.
9. **Corporation Stop:** Mueller #H-15008N-250 (¾”) or #H-15008N-330 (1”); A.Y. McDonald #74701-22 or Ford F1000-3-NL (¾“) or F1000-1-NL (1”)

N. Somerset

1. **Meter Pit:** 36” long, 20” Diameter (single- 5/8” meter); 24” (dual meters, and 1” meters)
2. **Meter Pit Ring/Cover and Lid:** Ford Meter Box W3-T (20” X 11” X 4”) or Vestal #RMRC-20L W/SN W/TR
3. **Meter:** 5/8” x 5/8” Furnished and installed by INAWC.
4. **Yoke Bar or Setter:** Ford Meter Box 501P (5/8”) or A.Y. McDonald #14-1P
5. **Supports:** ¾” standpipes
6. **Branch Piece (Dual Set Only):** Mueller 1” X ¾” H-15363N-333
7. **Inlet Angle Ball Valve:** Ford Meter Box AV94313 ¾ PJ CTS X 5/8 or A.Y. McDonald # 4642BY-22 ¾” CTS X 5/8
8. **Outlet fitting:** ¾” X 5/8” yoke outlet – CTS X meter LLB or A.Y McDonald yoke 90# 4779Y-22
9. **Service Line Material:** ¾” for individual services and 1” to supply dual meter settings; PE CTS DR-9 (200 psi) minimum.
10. **Corporation Stop:** Ford Meter Box F1000-3 (3/4”) or F1000-4 (1”); or Mueller B-25008N (¾”) (CC X CTS)

O. Southern Indiana (Clarksville, Jeffersonville, New Albany)

1. **Meter Pit:** 24” long x 20” diameter (single) 24” (dual); 30” diameter. (1” meter).
2. **Meter Pit Ring/Cover and Lid:** Vestal 20” ring Model # 32-424 #RMRC-215L R&C W/SN W/TR (Single) and Model # 32-462 #RMRC-215L R&C W/SN W/2TR (Dual); Cover Model # 32-058.
3. **Meter:** 5/8” x 5/8” Furnished and installed by INAWC.
4. **Yoke Bar:** A.Y. McDonald 5/8” #14-1P; Ford Y501P
5. **Supports:** ¾” vertical standpipes
6. **Inlet Angle Ball Valve:** A.Y. McDonald # 4642BY-22; Ford AV94313WNL

7. **Outlet Ell:** A.Y. McDonald # 4779Y-22 ¾"x 01; Ford L9413NL
8. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE DR-9 (200 psi) minimum.
9. **Corporation Stop:** Mueller ¾" # H-15008N; Ford (3/4") F1000-3; (1") F1000-4
10. **Permanent Blow-off Assembly:** Kupferle TF500 only.
11. **Minimum Depth of cover for watermains shall be 42-inches.**

P. Southern Indiana (Georgetown & Charlestown)

1. **Meter Pit:** 24" long x 20" diameter (single) 24" diameter (dual); 30" diameter. (1" meter).
2. **Meter Pit Ring/Cover and Lid:** Vestal 20" ring Model # 32-424 #RMRC-215L R&C W/SN W/TR (Single) and Model # 32-462 #RMRC-215L R&C W/SN W/2TR (Dual); Cover Model # 32-058.
3. **Meter:** 3/4" x 5/8" Furnished and installed by INAWC.
4. **Yoke Bar:** A.Y. McDonald 5/8" #14-2P; Ford Y502P
5. **Supports:** ¾" vertical standpipes
6. **Inlet Angle Ball Valve:** A.Y. McDonald # 4642BY-22; Ford AV94313WNL
7. **Outlet Ell:** A.Y. McDonald # 4779Y-22 ¾"x 01; Ford L9413NL
8. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE DR-9 (200 psi) minimum.
9. **Corporation Stop:** Mueller ¾" # H-15008N; Ford (3/4") F1000-3; (1") F1000-4
10. **Permanent Blow-off Assembly:** Confirm with Local Operations.
11. **Minimum Depth of cover for watermains shall be 42-inches.**

Q. Sullivan

1. **Meter Pit:** 48" long, 20" Diameter (single) 24" Diameter (dual)
2. **Meter Pit Ring/Cover and Lid:** Sigma MB-63DF-LBTH (rim) and MB632CF-LB (lid)
3. **Meter:** 5/8" x 5/8" Furnished and installed by INAWC.
4. **Yoke Bar or Setter:** Ford Meter Box Y501P (3/4") or Y504P (1")
5. **Supports:** ¾" standpipes
6. **Inlet Angle Ball Valve:** Ford AV96-313-W-NL (3/4") or AV96-444-W-NL (1")
7. **Outlet Elbow:** Ford L96-13(3/4") or L96-44 (1")
8. **Service Line Material:** ¾" for short-side individual services, 1" for long-side services and to supply dual meter settings; HDPE SDR-11 (200 psi) minimum **IPS (NOT CTS)**

9. **Corporation Stop:** Confirm with local Operations District

R. Summitville

1. **Meter Pit:** 36" long, 20" Diameter (single- 5/8" meter); 24" Diameter (dual meters, and 1" meters)
2. **Meter Pit Ring/Cover and Lid:** Ford Meter Box W3-T (20" X 11" X 4") or Vestal #RMRC-20L W/SN W/TR
3. **Meter:** 5/8" x 5/8" Furnished and installed by INAWC.
4. **Yoke Bar or Setter:** Ford Meter Box 501P (5/8") or A.Y. McDonald #14-1P
5. **Supports:** ¾" standpipes
6. **Branch Piece (Dual Set Only):** Mueller 1" X ¾" H-15363N-333
7. **Inlet Angle Ball Valve:** Ford Meter Box AV94313 ¾ PJ CTS X 5/8 or A.Y. McDonald # 4642BY-22 ¾" CTS X 5/8
8. **Outlet Fitting:** ¾" X 5/8" yoke outlet – CTS X meter LLB or A.Y McDonald yoke 90# 4779Y-22
9. **Service Line Material:** ¾" for individual services and 1" to supply dual meter settings; PE CTS DR-9 (200 psi) minimum.
10. **Corporation Stop:** Ford Meter Box F1000-3 (3/4") or F1000-4 (1"); or Mueller B-25008N (¾") (CC X CTS)

S. Terre Haute (including Farmersburg)

1. **Meter Pit:** 48" long. xx" Diameter (single) xx" Diameter (dual)
2. **Meter Pit Ring/Cover and Lid:** Sigma MB-63DF-LBTH (rim) and MB632CF-LB (lid)
3. **Meter:** 5/8" x 5/8"" Furnished and installed by INAWC
4. **Yoke Bar:** Ford Meter Box Y501-P (3/4") or Y504-P (1")
5. **Supports:** ¾" standpipes
6. **Inlet Angle Ball Valve:** Ford AV96-313-W-NL (3/4") or AV96-444-W-NL (1")
7. **Outlet Elbow:** Ford L96-13(3/4") or L96-44 (1")
8. **Service Line Material:** ¾" diameter individual services, 1" diameter dual meter settings; HDPE SDR-11 (200 psi) minimum **IPS (NOT CTS)**
9. **Corporation Stop:** (3/4") Ford # F1001-3, (1") Ford # F1000-4.

T. Wabash

1. **Meter Pit:** 36" long, 20" Diameter (single- 5/8" meter); 24" Diameter (dual meters, and 1" meters)
2. **Meter Pit Ring/Cover and Lid:** Ford Meter Box W3-T (20" X 11" X 4")
3. **Meter:** 5/8" Furnished and installed by INAWC.
4. **Yoke Bar or Setter:** Ford Meter Box 501P (5/8") or A.Y. McDonald #14-1P
5. **Supports:** ¾" standpipe

6. **Branch Piece (Dual Set Only):** Mueller 1" X ¾" H-15363N-333
7. **Inlet Angle Ball Valve:** Ford Meter Box AV94313 ¾ PJ CTS X 5/8 or A.Y. McDonald # 4642BY-22 ¾" CTS X 5/8
8. **Outlet Fitting:** ¾" X 5/8" yoke outlet – CTS X meter LLB or A.Y McDonald yoke 90# 4779Y-22
9. **Service Line Material:** ¾" and 1": PE CTS SDR-9 (200 psi) minimum

   2" diameter: PE CTS or IPS SDR-9.
10. **Corporation Stop:** Ford Meter Box F1000-3 (3/4") or F1000-4 (1"); or Mueller B-25008N (¾") (CC X CTS)
11. **Manufactured Meter Pit Setter:**
    a. **1.5" Meter:** Pit: Ford# PMBB-688-36HB-48-SB4-G- Lid: Ford# MC-36-REC463-T Ring & Lid or Vestal # 32-049 - ER-2036 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR
    b. **2" Meter:** Pit: Ford# PMBB-788-36HB-48-SB4-G-NL Lid: Ford# MC-36-REC463-T Ring & Lid or Vestal # 32-049 - ER-2036 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR

U. Warsaw

1. **Meter Pit:** 36" long, 20" Diameter (single- 5/8" meter); 24" Diameter (dual meters, and 1" meters)
2. **Meter Pit Ring/Cover and Lid:** Ford A3-C-REC463-T
3. **Meter:** 5/8" Furnished and installed by INAWC.
4. **Yoke Bar:** A.Y. McDonald #14-1P (5/8")
5. **Supports:** ¾" (#6) horizontal rebar
6. **Branch Piece (Dual Set Only):** Mueller 1" X ¾" H-15363N-333
7. **Inlet Angle Ball Valve:** A.Y. McDonald # 4642BY-22 ¾" CTS X 5/8
8. **Outlet Fitting:** ¾" X 5/8" yoke outlet CTX X meter LLB, A.Y. McDonald yoke 90 # 4779Y-22
9. **Service Line Material:** PE CTS SDR-9 (200 psi) minimum. 1" diameter to supply single and dual meter settings; 2" diameter: PE CTS or IPS SDR-9. Pipe stiffener inserts shall be stainless steel.
10. **Corporation Stop:** Mueller B-25008N (¾") (CC X CTS)
11. **Insulator Ring:** 24"
12. **Manufactured Meter Pit Setter:**
    a. **1.5" Meter:** Pit: Ford# PMBB-688-36HB-48-SB4-G-NL Lid: Ford# MC-36-REC463-T Ring & Lid or Vestal # 32-049 - ER-2036 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR
    b. **2" Meter:** Pit: Ford# PMBB-788-36HB-48-SB4-G-NL Lid: Ford# MC-36-REC463-T Ring & Lid or Vestal # 32-049 - ER-2036 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR

V. West Lafayette

1. **Meter Pit:** 48” long 20” Diameter (single) 24” Diameter (dual)
2. **Meter Pit Ring/Cover and Lid:** Vestal 20” RMRC-21L W/SN W/TR
3. **Meter:** ¾” x 5/8” Furnished and installed by INAWC.
4. **Yoke Bar:** A.Y. McDonald #14-2P
5. **Supports:** ¾” standpipes
6. **Branch Piece (Dual Set Only):** A.Y. McDonald #08U3m 1x ¾”x 7.5 u-branch.
7. **Inlet Angle Ball Valve:** A.Y. McDonald #4604BY ¾” x ¾” x 02
8. **Outlet Valve:** A.Y. McDonald #4779Y-22 ¾” x 02
9. **Service Line Material:** ¾” for individual services and 1” to supply dual meter settings; PE CTS DR-9 (200 psi) minimum. Pipe stiffener inserts shall be plastic.
10. **Corporation Stop:** Confirm with local Operations District
11. **Curb Ball Valve:** Mueller #E-25009 1x1x1

W. Winchester

1. **Meter Pit:** 48” long. x 20” Diameter (single) 24” Diameter (dual)

2. **Meter Pit Ring/Cover and Lid:** (Single) Vestal # 32-277 - RMRC-215-L W/SN W/RTR Ring & Lid or Ford # A53-REC463-T Ring & Lid. (Dual Set) Vestal # 32-046 - ER-2024 Ring with 32-501 - Monitor Ring & Lid W/SN W/2RTR or Ford # MC-24-REC463-TT Ring & Lid. (1” Set) Vestal # 32-046 - ER-2024 Ring with 32-478 - Monitor Ring & Lid W/SN W/RTR or Ford # MC-24-REC463-T Ring & Lid.

3. **Meter:** 5/8” x 5/8” Furnished and installed by INAWC.
4. **Meter Setter:** A.Y. McDonald 732-107WX2233 (¾”) or 732-410WX2244 (1”).
5. **Meter Idler:** A.Y. McDonald 740MJ05
6. **Supports:** ¾” horizontal cross bar
7. **Service Line Material:** ¾” for individual services and 1” to supply dual meter settings; PE CTS SDR-9 (200 psi) minimum.
8. **Corporation Stop:** Mueller P-15008N (¾”) or P-15108N (1”)

END OF SECTION

SECTION 01075

BASIS OF PAYMENT

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Work to be performed under this Contract shall be paid for in accordance with the Schedule of Prices of the bid. The cost of labor, equipment, materials, tools, and services called for in the Specifications, shown on the Drawings, or necessary for a complete and satisfactory installation, but which are not specifically mentioned in this section shall be included in the appropriate bid item by the Contractor at no additional expense to the Owner**.**

B. Refer to Section 01000 for further information regarding materials to be furnished by the Owner.

C. Where reference is made herein to other section(s) of the Specifications, it shall not be interpreted to exclude sections that are not listed. For each bid item, Contractor shall fully comply with all applicable sections of the Specifications, whether or not individually listed herein.

D. The cost for connections shall be included in the corresponding bid items below. Such cost shall include all required coordination and any overtime, premium time, or other related costs associated with making connections outside of normal working hours when required by the Owner and/or Engineer as specified in this section and Section 15000.

E. Nothing included within this section shall supersede the technical and other requirements of other sections of the Specifications.

1.02 BID (PAYMENT) ITEMS

A. The prices shown in the Schedule of Prices of the Bid include all costs to construct the pipeline(s) under this Contract. Final payment will be made on the in place measurement of length(s) of pipeline(s) installed.

1. General Items
   a. Payment will be made at the Contract Unit Price per lump sum for the General Items Line Charge. The cost of mobilization and any other initial expense required for the start of Work will be included in the item, including but not limited to bonds, pre/post-construction videos and photos, surveying and staking, transporting/handling of Owner-furnished materials, clearing and grubbing (Section 02105), erosion and sedimentation control (Section 02540), and traffic regulation (Section 01570). This item shall include all Record Documents and other closeout items not listed elsewhere herein. The lump sum price bid for Trench Mobilization Line Charge and Closeout is limited to a maximum of 5% of the Total Bid Price.

The lump sum price bid for Handling of Owner Furnished Material is limited to a maximum of 3% of the Total Bid Price. The Work shall consist of the assembling and setting up for the project, including but not limited to the Contractor's general plant, including Contractor's general offices, shops, plants, storage areas, temporary signs, sanitary and any other facilities, as required by Section 01500, Section 01700 and other standard and special requirements of the Contract, as well as by local or State Law and regulation.

b. Initial Payment: Forty percent (40%) of the price bid for General Items Line Charge will be payable to the Contractor whenever the Contractor shall have completed five percent (5%) of the Work of the Contract. For the purposes of this item, five percent (5%) of the Work shall be considered completed based upon the total of payments earned, exclusive of the amount bid for this item and stored materials, as shown on the monthly billing of the approximate quantities of work done.

c. Final Payment: The final sixty (60%) of the price bid for General Items Line Charge will be payable to the Contractor whenever the Contractor completes the following:
   i. Completed all of the Work
   ii. Cleaned up and made final restoration
   iii. Delivered all required documents enumerated in the Specifications including, but not limited to the following:
      1) Required warranties and guarantees
      2) Special bonds
      3) Equipment and material certifications from manufacturer(s)
      4) Certificates from regulating agencies and/or authorities, where applicable
      5) Approved Record Documents
      6) Waiver of Liens
      7) Post-construction video and photos.

2. <u>Pipeline Installation: Excavation, Laying, Jointing, and Backfilling of Pipe</u>
   a. Payment will be made at the Contract Unit Price per linear foot for the size class and installation method (open cut, horizontal directional drill, or pipe bursting) of pipe installed, complete in place, including but not limited to excavation, Foundation Material, bedding, Common Fill embedment, laying, jointing, polyethylene encasement, tracer wire, identification tape, filter fabric (where required), saw cutting of pavement, dewatering, potholing and potholing restoration, Common Fill for backfill, trench dams/plugs (where required), adapters, temporary fittings, anchor collars, solid sleeves, marker posts, etc., all as required by the Owner and necessary to make a complete and satisfactory installation. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures necessary for the construction of the pipeline(s). The minimum width and depth of the pipe trench shall be in accordance with the requirements of Section 02210. All costs to complete the pipeline installation are included in the unit price per linear foot of pipeline, regardless of whether the Contractor uses sloped slides or shoring and sheeting when excavating the pipe trench. Any additional soil borings and other work necessary to design or perform directionally drilled installations are also included in this bid Item. All other items of work not listed in the

Schedule of Prices will be paid for inclusive in this bid item, including, but not limited to, the work required for disinfection of the pipeline.

b. Fitting installation: Payment will be made at the Contract Unit Price for each new fitting, complete in place including blocking or other pipe restraint. Unit price shall include all labor, materials (except where materials are furnished by the Owner), excavation and backfilling, tools, and all incidental work required to install each fitting complete as shown on the Drawings, as specified and necessary to make a complete and satisfactory installation.

3. Casing Installation
   a. Payment will be made at the Contract Unit Price per linear foot of casing installed by any of the methods described in and according to Section 02220 including but not limited to open cut, horizontal directional drilling and jack and bore. Location to be shown on the Drawings or as directed by the Owner. The Contract Unit Price shall include all casing pipe, end seals, casing spacers, insulators as required by Section 02220 or as necessary for a complete and satisfactory installation. In addition, the Contract Unit Price shall include all excavation (soil or rock) de-watering, jacking, ramming, drilling or boring (rock or soil), backfilling, installation of end caps, sheeting, bracing, shoring, temporary construction, safety measures, etc., all as necessary excluding restoration for a complete and satisfactory installation. Restoration will be paid by the respective Restoration Pay on a square yard basis as indicated on the Drawings. Installation of the water main in the casing will be made at the Contract Unit Price per linear foot of pipe installed. The casing Contract Unit Price will also include all measures required to protect roadways, railroad tracks and embankments from settlement or damage of any type.
4. Tapping Sleeve & Valve
   a. Payment will be made at the Contract Unit Price per each for the size of tapping sleeve and valve to be installed, complete in place, as required by the Owner.
   b. Contract Unit price shall include all labor, materials (except where materials are furnished by the Owner), excavating and backfilling, tools, and all incidental work required to install the tapping sleeve and valve complete as shown on the Drawings, excluding surface restoration. The Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures necessary for the installation of the tapping sleeve and valve. Contractor shall furnish Owner with the removed tapping “coupon”.
   c. Restoration will be paid by the respective Restoration bid item(s) separately on a square yard basis. Contractor will be paid for restoration of an area no larger than 6 feet by 6 feet (4 square yards) for all tapping sleeves without prior authorization from Owner.
5. Gate Valve and Butterfly Valve Installation
   a. Payment will be made at the Contract Unit Price for each new valve (excluding hydrant valve in item 16) in accordance with Section 15150 or 15155, complete in place, including valve box and extension stem (when

required) per Section 15130. Ball valves for small diameter water mains will also be included in this item in accordance with Section 15200. Unit price shall include all labor, materials (except where materials are furnished by the Owner), excavation backfilling and restoration, tools, and all incidental work required to install each valve complete as shown on the Drawings, as specified and necessary to make a complete and satisfactory installation.

6. Valve Replacement
   a. Payment will be made at the Contract Unit Price for each replacement valve (excluding hydrant valve in item 16) in accordance with Section 15185 and Section 15150 or 15155, complete in place, including new valve box and extension stem (when required) per Section 15130. Unit price shall include all labor, materials (except where materials are furnished by the Owner), excavation, backfilling and restoration, tools, and all incidental work required to install each valve complete as shown on the Drawings, as specified and necessary to make a complete and satisfactory installation, including removal of old pipe and/or valve to accommodate replacement valve.

7. Fire Hydrant Installation
   a. Complete in place: Payment will be made at the Contract Unit Price for each fire hydrant installation in accordance with Section 15180. The unit price shall include all costs to install any materials furnished by Owner as well as Contractor-furnished material. The Contract Unit Price will include excavation, backfill, furnishing of material (except where furnished by Owner), and installation of fire hydrant, watch valve, valve box, piping, reaction blocking, crushed stone, and all restoration etc., all as required by the Specifications, Owner's Standard Detail Drawings or as necessary to make a complete and satisfactory installation.

8. Air Valve
   a. Payment will be made at the Contract Unit Price for each air release valve assembly installed, complete in place. Unit price shall include all labor; materials (except where materials are furnished by the Owner); excavation, backfilling and restoration; tools; furnishing and installing manhole frames and covers; ladders; painting; furnishing, installing and testing of all piping, valves, air valves, fittings, vent piping, small piping and piping appurtenances; and all incidental work required to construct each structure complete as shown on the Drawings, as specified and necessary to make a complete and satisfactory installation in accordance with Section 15190.

9. Permanent Blow Off Assembly
   a. Payment will be made for each blow-off assembly at the Contract Unit Price for Blow-off Assembly, complete in place in accordance with Section 15190. Unit price shall include all labor, materials (except where materials are furnished by the Owner), excavation, backfilling and restoration, tools, and all incidental work required to construct each blow off assembly complete as shown on the Drawings, as specified and necessary to make a complete and satisfactory installation.

10. Shut Down and Tie-In
    a. Payment will be made at the Contract Unit Price per each for the size of existing mains shut down and tie-in to be installed, complete in place, as required by the Owner.
    b. Contractor shall perform tie-in (unless otherwise indicated on the Drawings). Contract unit price shall include all labor, materials (except where materials are furnished by Owner), excavation and backfilling, tools, and all incidental work required to install the shut down and tie-in complete as shown on the Drawings, excluding surface restoration. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures necessary for the installation of the shut down and tie-in(s). The Owner will operate all valves necessary to shut off and reactivate its pipelines.
    c. Restoration will be paid by the respective Restoration bid item(s) separately on a square yard basis. Contractor will be paid restoration of an area no larger than 6 feet by 6 feet (4 square yards) for each shut down and tie-in without prior authorization from Owner.

11. Shut Down, Cut and Cap
    a. Payment will be made at the Contract Unit Price per each for the size of shut down, cut and cap and line stop to be installed, complete in place, as required by the Owner.
    b. Contractor shall perform cut and cap unless otherwise indicated on the Drawings. Contract unit price shall include all labor, materials (except where materials are furnished by Owner), excavation and backfilling, tools, and all incidental work required to install the shutdown, cut and cap complete as shown on the Drawings excluding surface restoration. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures necessary for the installation of the shutdown, cut and cap(s). The Owner will operate all valves necessary to shut off and reactivate its pipelines.
    c. Contractor shall perform line stop (except as noted in Section 01011 or the Drawings). The Contractor unit price shall include all labor, materials (expect where materials are furnished by Owner), excavation and backfilling, tools, and all incidental work required to install the line stop complete as shown on the Drawings excluding surface restoration. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures necessary for the installation of the line stop.
    d. Restoration will be paid by the respective Restoration bid item(s) separately on a square yard basis. Contractor will be paid restoration of an area no larger than 6 feet by 6 feet (4 square yards) for each shut down and cut and cap location and for each line stop location without prior authorization from Owner.

12. Rock Excavation
    a. Payment will be made at the Contract Unit Price per vertical foot of depth per linear foot of trench. No payment will be made for excavation made outside the limits described in Section 02210. Unit Price includes removal, hauling, bedding and embedment material, and proper disposal of all material. Rock is defined as per Section 02210.

13. Select Fill
    a. Payment will be made at the Contract Unit Price per linear foot of specified type of select fill for embedment and final backfill. This bid item also includes the removal, hauling and proper disposal of all excavated material. No payment will be made for select fill needed outside the maximum normal trench width as described in Section 02210. If for any reason the trench width exceeds the maximum trench width defined in Section 02210, the Contractor shall provide the additional select fill for embedment and final backfill at no cost to the Owner as described in Section 02210.

14. Flowable Fill
    a. Payment will be made at the Contract Unit Price per linear foot of flowable fill in place where required. This bid item also includes the removal, hauling and proper disposal of all excavated material. No payment will be made for flowable fill needed outside the maximum normal trench width as described in Section 02210. If for any reason the trench width exceeds the defined maximum trench width, the Contractor shall provide the additional flowable fill for backfilling at no cost to the Owner as described in Section 02210.

15. Extra Trench Depth
    a. When directed by the Engineer/Owner or otherwise required to install the pipe deeper than the depth shown on the Drawings or specified, and as approved in advance by the Resident Project Representative, payment will be made at the Contract Unit Price per additional vertical foot of depth below the designed trench depth per linear foot of trench. Trench depth to be in accordance with the requirements of Section 02210. Quantities will be determined by Resident Project Representative.

16. Exploratory Excavation
    a. Payment will be made at the Contract Unit Price per cubic yard of material excavated as authorized or directed by the Owner for exploratory excavations not otherwise required by the Drawings or Specifications. Payment will only be made when the excavation and the location have been approved by the Owner as additional Work, and inclusion of this bid item does not relieve the Contractor of its obligation to perform potholing and other exploratory excavations as required by other sections of the Specifications at no additional cost to the Owner. The unit price will include all materials, equipment and labor necessary for the excavation and backfilling and/or proper disposal of the excavated material. Specific restoration materials will be paid for under the appropriate bid item (e.g., concrete work, paving, etc.).

17. Dewatering
    a. No additional payment shall be made for dewatering in accordance with Section 02020, including any necessary traffic warning systems or any work necessary to restore the site to its original condition, including any damaged facilities.

18. Concrete Sidewalks & Drives and Gravel Drives
    a. Payment for concrete sidewalk and driveway restoration associated with pipe line installation will be made at the Contract Unit Price per linear foot of sidewalk or driveway installed or as required by state, municipal, or other

local authorities. The unit price shall include stone bedding, concrete, and finishing, including restoration of surrounding surfaces, complete in place conforming to the requirements of Section 03310 and/or any state, municipal, or other local requirements that may apply.

b. Payment for concrete sidewalk and driveway restoration associated with tapping sleeves and valves, tie-ins, cut and caps, access pits (for pipe bursting, horizontal directional drilling, and jack and bore) will be made at the Contract Unit Price per square yard of sidewalk or driveway installed, width to be as shown on drawing or as required by the state, municipal, or other local authorities. The unit price shall include stone bedding, concrete, and finishing, complete in place conforming to the requirements of Section 03310 and/or any state, municipal, or other local requirements that may apply.

c. Handicap Ramps will be made at the contract unit price for each handicap ramp installed. The unit price shall include stone bedding, concrete, and finishing, complete in place conforming to the requirements of Section 03310 and/or any state, municipal, or other local requirements that may apply.

d. Payment for gravel driveway restoration associated with pipe line installation will be made at the Contract Unit Price per linear foot of driveway installed or as required by the state, municipal, or other local authorities. The unit price shall include stone bedding and finishing, complete in place conforming to the requirements of Section 02620 and any state, municipal, or other local requirements that may apply.

e. No separate payment will be made for any concrete thrust and reaction blocking. All concrete blocking for pipeline installation is to be included in bid item Pipeline Excavation, Laying, Jointing and Backfilling of Pipe.

19. Curb Replacement

a. Payment will be made at the Contract Unit Price per linear foot for the type of curbing installed. The unit price shall include excavation, stone bedding, concrete and finishing, backfilling, complete in place and conforming to the requirements of Section 03310 and/or any state, municipal, or other local requirements that may apply.

20. Temporary Asphaltic Paving

a. Payment for temporary asphaltic pavement associated with pipeline installation will be made at the Contract Unit Price per linear foot of temporary paved trench, where required or directed by the Owner. The contract price shall include the furnishing and installation of temporary bituminous material in accordance with Section 02610, Part 3.01, or as otherwise required by Federal, State or Local Authorities. The Owner may choose to include cost of temporary asphalt in pipe installation cost if so noted in Section 01011.

b. Payment for temporary asphaltic pavement restoration associated with tapping sleeves and valves, tie-ins, cut and caps, access pits (for pipe bursting, horizontal directional drilling, and jack and bore) will be made at the Contract Unit Price per square yard of area permanently paved as required. The contract price will include the furnishing and installation of permanent pavement material in accordance with Section 02610 or as otherwise required by Federal, State or Local Authorities. The bid item includes wearing course and line painting. The Owner may choose to

include cost of temporary asphalt in pipe installation cost if so noted in Section 01011.

21. Permanent Pavement Restoration
    a. Payment for permanent pavement restoration associated with pipeline installation will be made at the Contract Unit Price per linear foot of trench permanently paved as required. The contract price will include the furnishing and installation of permanent pavement material in accordance with Section 02610 or as otherwise required by Federal, State or Local Authorities. This bid item includes wearing course and line painting.
    b. Payment for permanent pavement restoration associated with tapping sleeves and valves, tie-ins, cut and caps, access pits (for pipe bursting, horizontal directional drilling, and jack and bore) will be made at the Contract Unit Price per square yard of area permanently paved as required. The contract price will include the furnishing and installation of permanent pavement material in accordance with Section 02610 or as otherwise required by Federal, State or Local Authorities. The Bid item includes wearing course and line painting.

22. Pavement Overlay – Outside of normal trench width
    a. Overlay Only: Payment will be made at the Contract Unit Price per square yard of pavement overlay. The contract price will include preparing the existing surface (as required) and the furnishing and installation of a minimum of 1 ½" paving material (unless a greater depth is required or specified). Materials and installation will be in accordance with Section 02610 or as otherwise required by Federal, State or Local Authorities. Restoration over pipeline trench line is not included in this bid item.
    b. Mobilization for Milling: Payment will be made at the Contract Unit Price lump sum Mobilization for milling. The contract price will include bringing equipment to the work site in preparation to perform milling operations and maintaining such equipment on-site on a standby basis as needed to support the Work.
    c. Milling and Overlay: Payment will be made at the Contract Unit Price per square yard of overlay. The contract price will include preparing, milling grinding of the existing surface and the furnishing and installation of a minimum of 1 ½" paving material (unless a greater depth is required or specified). Materials and installation will be in accordance with Section 02610 or as otherwise required by Federal, State or Local Authorities. Restoration over pipeline trench line is not included in this bid item.

23. Topsoil and Seed
    a. Payment for topsoil and seed associated with pipeline installation will be made at the Contract Unit Price per linear foot topsoil and seed (as measured along the pipe centerline), complete in place, all in accordance with the requirements of Section 02820. Unit price shall include all labor, materials, raking and grading, tools, and all incidental work required to install topsoil, seed, and straw matting (see Section 02820) as shown on the Drawings and as specified.
    b. Payment for topsoil and seed associated with exploratory excavations, tapping sleeves and valves, tie-ins, cut and caps, access pits (for pipe bursting, horizontal directional drilling, and jack and bore) will be made at the Contract Unit Price per square yard of topsoil and seed, complete in

place, all in accordance with the requirements of Section 02820. Unit price shall include all labor, materials, raking and grading, tools, and all incidental work required to install topsoil, seed, and straw matting (see Section 02820) as shown on the Drawings and as specified. The allowable width shall be defined as the nominal trench width plus fifteen feet where top soil, seed and straw matter are required. Trench width shall be as described in Section 02210.

24. Sod – New and Replace
    a. Payment for sod associated with pipeline installation will be made at the Contract Unit Price per linear foot of sod (as measured along the pipe centerline), complete in place, all in accordance with the requirements of Section 02820. Unit price shall include all labor, materials, raking and grading, tools, and all incidental work required to install sod as shown on the Drawings, as specified and necessary to make a complete and satisfactory installation.
    b. Payment for sod associated with exploratory excavations, tapping sleeves and valves, tie-ins, cut and caps, access pits (for pipe bursting, horizontal directional drilling, and jack and bore) will be made at the Contract Unit Price per square yard of sod, complete in place, all in accordance with the requirements of Section 02820. Unit price shall include all labor, materials, raking and grading, tools, and all incidental work required to install sod as shown on the Drawings, as specified and necessary to make a complete and satisfactory installation. The square yards allowed shall be defined as the nominal trench width plus fifteen feet, times the appropriate length of the trench where top soil and sod are required. Trench width shall be as described in Section 02210.

25. Transfer Existing Small Diameter Services (¾" – 1"), install New Small Diameter Services (¾" – 1"), and Meter Pit Installations
    a. Payment will be made at the Contract Unit Price for the installation of each of the following:
        i. Service Transfers New and Renewal: Service transfers include installation of corporation, and connection of existing service line shall be either union or length of pipe and union.
        ii. Short Side Service Line, New or Renewal: Short side service lines, new or renewal, include complete installation of service line from corporation to curb stop or meter pit and connection or re-connection of customers' line on outlet side of curb stop or customer's side of meter pit. This includes each service whose length is less than half (½) the improved road width.
        iii. Long Side Service Line, New or Renewal: Long side service lines, new or renewal, include complete installation of service line from corporation to curb stop or meter pit and connection or re-connection of customers' line on outlet side of curb stop or customer's side of meter pit. This includes each service whose length equals or exceeds half (½) of the improved road width.
    b. All of the above include complete installation in place including permanent restoration. Meter pits and/or Curb Stops will normally be installed in the tree space or at the property line. All installations shall be in accordance with Section 15200. Payment will be made under only one bid item per service.

c. Meter Pit Replacement in Landscaping: Includes complete installation of meter pit, service brass (requirements to be provided by each local operation), and specified meter pit lid. Also includes labor required to install pit and reconnection to customer service line and all restoration within a landscaped area.
d. Meter Pit Replacement in Concrete: Includes complete installation of meter pit, service brass (requirements to be provided by each local operation), and specified meter pit lid. Also includes labor required to install pit and reconnection to customer service line and all restoration within a concrete sidewalk or driveway.

26. Transfer Existing Large Diameter Services (2" and larger), install New Large Diameter Services (2" and larger), and Meter Chamber Installations
    a. Payment will be made at the Contract Unit Price for the installation of each of the following:
        i. Service Transfers New and Renewal: Service transfers include installation of corporation, and connection of existing service line shall be either union or length of pipe and union.
        ii. Short Side Service Line, New or Renewal: Short side service lines, new or renewal, include complete installation of service line from corporation to curb stop and connection or re-connection of customers' line on outlet side of curb stop. This includes each service whose length is less than half (½) of the improved road width.
        iii. Long Side Service Line, New or Renewal: Long side service liens, new or renewal, include complete installation of service line from corporation to curb stop and connection or re-connection of customers' line on outlet side of curb stop. This includes each service whose length equals or exceeds half (½) of the improved road width.
    b. All of the above include complete installation in place including permanent restoration. Curb stops will normally be installed in the tree space or at the property line. All installations shall be in accordance with Section 15200 and/or 15125 unless otherwise shown on the Drawings or directed by the Engineer. Payment will be made under only one bid item per service.

27. Service Retirement
    a. The unit price specified to be paid for the performance of this item shall be per each complete water service abandoned and removed and shall include all material, labor, and equipment to retire each service in accordance with Section 15185. Performance of this item shall include but is not limited to excavation, hauling, backfill, removal of old valve box, street / curb / driveway / sidewalk restoration, site restoration, and all other items necessary for a complete retirement of each service as specified and required by the Owner.
    b. Meter Pit Retirement in Landscaping: The unit price specified to be paid for the performance of this item shall include all material, labor, and equipment to retire each meter pit located within a landscaped area. Performance of this item shall include but is not limited to excavation, hauling, backfill, remove meter pit, site restoration, and all other items necessary for a complete retirement.
    c. Meter Pit Retirement in Concrete: The unit price specified to be paid for the performance of this item shall include all material, labor, and equipment to retire each meter pit located within a concrete sidewalk or concrete

driveway. Performance of this item shall include but is not limited to excavation, hauling, remove meter pit lid, site restoration and all other items necessary for a complete retirement.

28. Fire Hydrant Retirement
    a. Payment will be made at the Contract Unit Price for each existing fire hydrant retirement, which includes watch valve retirement and watch valve box removal. The unit price shall include all labor, materials, excavation backfilling and restoration, tools, hauling, removal, restoration, and all incidental work required to disconnect the existing fire hydrant.

29. Valve Retirement
    a. In Asphalt: The unit price specified to be paid for the performance of this item per each valve abandoned and valve box removal shall include all material, labor, and equipment to retire each valve located within an asphalt area in accordance with Section 15185. Performance of this item shall include but is not limited to excavation, hauling, remove valve box, backfill, road restoration, and all other items necessary for a complete retirement of each valve.
    b. In Concrete: The unit price specified to be paid for the performance of this item per each valve abandoned and valve box removal shall include all material, labor, and equipment to retire each valve located within a concrete area in accordance with Section 15185. Performance of this item shall include but is not limited to excavation, hauling, remove valve box, backfill, and all other items necessary for a complete retirement of each valve
    c. In Landscaping: The unit price specified to be paid for the performance of this item per each valve abandoned and valve box removal shall include all material, labor, and equipment to retire each valve located within a landscaped area in accordance with Section 15185. Performance of this item shall include but is not limited to excavation, hauling, remove valve box, and all other items necessary for a complete retirement of each valve

B. Where the following acronyms are used on the Schedule of Prices or elsewhere in these Specifications, they shall be defined as follows:

    1. OFCI = Owner Furnished Contractor Installed (materials or equipment to be furnished by the Owner but installed by the Contractor)
    2. CFCI = Contractor Furnished Contractor Installed (materials or equipment to be furnished and installed by the Contractor)

C. Where neither acronym is indicated for a particular bid item, refer to this section, Section 01000 and Section 01011 for clarification.

PART 2: PRODUCTS

Not Used

PART 3: EXECUTION

Not Used

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Contractor shall prepare and submit detailed Progress Schedule, Cash Flow Schedule, Schedule of Values, Pre-Construction Video(s) and photos, Shop Drawings to the Engineer for approval in accordance with Article 2 Sections 2.05 and 2.07 of the General Conditions. Work shall not commence until these submittals have been approved by the Engineer except as otherwise authorized in writing by the Owner or Engineer.

B. Schedule of Values shall be in accordance with Standard General Conditions of the Construction Contract.

C. Contractor shall update schedules and submit Contractor's Daily Reports, progress payment requests, and other required information throughout the Work as required herein or elsewhere in the Contract Documents.

D. As-built drawings and related information shall be maintained and submitted as required herein and in Section 01700.

1.02 CONSTRUCTION PROGRESS SCHEDULE

A. A Progress Schedule shall be submitted by the Contractor in a Gantt chart / bar graph format and shall include, as a minimum, a graphic representation of all significant activities and events involved in the construction of the project. The graphic representation and statement must clearly depict and describe the sequence of activities planned by the Contractor, their interdependence and the times estimated to perform each activity**.** Develop the Progress Schedule as necessary to properly control and manage the project.

1.03 CASH FLOW SCHEDULE

A. In addition to the Progress Schedule required above, submit to the Engineer, for approval, a Cash Flow Schedule. The Cash Flow Schedule shall show the amounts of money by months, which will be required to reimburse the Contractor for Work performed during each month of the Contract Time. The sum of all the monthly cash requirements shall equal the total price of the Contract. The monthly cash requirements shall be proportioned with the aid of the Progress Schedule.

B. The approved Cash Flow Schedule will be used by the Owner to program funds for progress payments to the Contractor. Monthly payments will be made to the Contractor in accordance with the Contract Agreement, but at no time will the aggregate amount of payments exceed the accumulated amount of payments for the same period of the Cash Flow Schedule.

1.04 FINALIZING SCHEDULES

A. Contractor shall present and be prepared to discuss at the preconstruction meeting the schedules submitted in accordance with this section. Unless additional information is required to be submitted by the Contractor, the Engineer will, within 15 working days of the preconstruction conference (or within 15 working days of receipt of the schedules or additional required information, whichever is later), provide comments to the Contractor. Contractor shall then resubmit the affected schedules addressing the Engineer's comments.

B. Approval of the final schedules by the Engineer or Owner is advisory only and shall not relieve the Contractor of responsibility for accomplishing the Work within the Contract Times. Omissions and errors in the approved schedule shall not excuse performance less than that required by the Contract. Approval by the Engineer or Owner in no way makes the Engineer or Owner an insurer of the success of those schedules or liable for time or cost overruns flowing from shortcomings in such schedules.

1.05 UPDATING SCHEDULES

A. Contractor shall submit to the Engineer and Owner monthly updates of the schedules required per this section.

B. The Cash Flow Schedule shall be updated to reflect actual progress to date and any other changes.

1.06 ADJUSTMENT OF PROGRESS SCHEDULE AND CONTRACT TIMES

A. Shop Drawings which are not approved on the first submittal or within the scheduled time shall be immediately rescheduled, as well as any work which fails to pass specified tests or has been rejected. When impacted, other scheduled activities shall be rescheduled accordingly.

B. If the Contractor desires to make changes in the method of operating that affect the approved Progress Schedule, notify the Engineer and Owner in writing stating what changes are proposed and the reason(s) for the changes. If the Engineer or Owner approves these changes, revise and submit for approval, without additional cost to the Owner, all of the affected portions of the schedule.

C. The Contract Times will be adjusted only for causes specified in the General Conditions. In the event the Contractor requests an adjustment of the Contract Times, furnish such justification and supporting evidence as the Engineer may deem necessary for a determination as to whether the Contractor is entitled to an adjustment of Contract Times under the provisions of the General Conditions. The Engineer will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing. If the Engineer finds that the Contractor is entitled to any adjustment of the Contract Times, the Engineer's determination as to the total number of days adjustment shall be based upon the currently-approved Progress Schedule and on all data relevant to the adjustment. The Contractor acknowledges and agrees that actual delays in activities which,

according to the Progress Schedule, do not affect the Contract completion date shown by the critical path in the schedule will not be the basis for an adjustment of Contract Times.

D. From time to time it may be necessary for the Progress Schedule and/or Contract Times to be adjusted by the Owner to reflect the effects of job conditions, weather, technical difficulties, strikes, unavoidable delays on the part of the Owner, and other unforeseeable conditions that may indicate schedule and/or Contract Times adjustments. Under such conditions, the Engineer shall direct the Contractor to reschedule the Work and/or Contract Time to reflect the changed conditions. Revise the Progress Schedule accordingly. No additional compensation shall be made to the Contractor for such changes except as provided in the General Conditions. Unless otherwise directed, take all possible actions to minimize any extension to the Contract Times and any additional cost to the Owner.

1.07 REQUIREMENTS FOR CONFORMING TO SCHEDULE

A. If, in the opinion of the Engineer, the Contractor falls behind the Progress Schedule, Contractor shall take such steps as will be necessary to improve progress and ensure Work is accomplished within the Contract Times. Engineer may require Contractor to increase the number of shifts and/or overtime operations, days of work, and/or the amount of construction planned (daily or weekly), and to submit for approval such supplementary schedule or schedules as the Engineer deems necessary to demonstrate the manner in which the agreed rate of progress will be regained—all without additional cost to the Owner. An updated Cash Flow Schedule will be required in this occurrence and will be provided with the supplementary schedules referenced above.

1.08 MONTHLY VALUE OF WORK (VOW)

A. Contractor shall submit monthly VOW to Owner's project manager with approval from Resident Project Representative no later than the date requested by the Owner's staff. Contractor shall project totals for any days remaining in month.

B. Monthly VOW shall include any stored material, if applicable, and any lump sum line items for that month.

C. Monthly VOW shall also include any related restoration for the work performed that month.

D. Owner reserves the right to require VOW to be submitted weekly if the above requirements have not been followed for existing or previous month(s).

1.09 SHOP DRAWINGS

A. Prior to mobilizing to the Work site or otherwise beginning Work, Contractor shall promptly submit to the Engineer for review and approval Shop Drawings with manufacturers' literature and product data, certifications, details, and other required information for all equipment and materials to be provided or furnished by

the Contractor, as well as other required submittals as required by the Contract Documents and/or required by the Engineer. Shop Drawings shall be provided in compliance with all requirements indicated on the Drawings and in the following sections of the Specifications:

1. Section 01570 Traffic Regulation
2. Section 01600 Products
3. Section 01700 Project Closeout
4. Section 02020 Dewatering
5. Section 02210 Trenching, Backfilling and Compacting
6. Section 02220 Casing Installation
7. Section 02350 Pipe Bursting of Water Mains
8. Section 02458 Horizontal Directional Drilling (HDD)
9. Section 02540 Erosion and Sedimentation Control
10. Section 02558 Identification/Location Guide
11. Section 02610 Roadway Paving and Surfacing
12. Section 02820 Lawn Restoration and Landscaping
13. Section 03305 Cast-In-Place Concrete for Pipe Work
14. Section 03310 Cast-In-Place Concrete for Paving, Driveways, Sidewalks, Curbs and Paved Ditches
15. Section 03450 Precast Concrete Structures
16. Section 15000 Piping – General Provisions
17. Section 15020 Disinfecting Pipelines
18. Section 15025 Flushing and Cleaning Pipelines
19. Section 15030 Pressure and Leakage Tests
20. Section 15105 Ductile Iron Pipe and Fittings
21. Section 15120 Polyvinyl Chloride (PVC) Pipe
22. Section 15125 High Density Polyethylene (HDPE) Pipe
23. Section 15130 Piping Specialties
24. Section 15150 Gate Valves
25. Section 15155 Butterfly Valves
26. Section 15180 Fire Hydrants
27. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps
28. Section 15200 Service Lines

B. Contractor shall submit all Shop Drawings electronically in portable document format (.pdf) or other format acceptable to the Engineer.

C. If requested by the Owner or Engineer, Contractor shall also provide one (1) hard copy, which shall be stapled or 3-ring bound. Submittals smaller than 8-1/2 by 11 inches shall be secured to paper 8-1/2 by 11 inches. Submittals larger than 8-1/2 by 11 inches shall be neatly folded to fit within a 9 by 11-1/2 inch folder.

1.10 PRE-CONSTRUCTION & POST CONSTRUCTION VIDEO/ELECTRONIC PHOTOS

A. Prior to mobilization at the site, provide to the Engineer on DVD a video recording of all planned construction areas, material storage areas, areas adjacent to these areas, including but not limited to streets, driveways, sidewalks, curbs, ditches, fencing, railing, visible utilities, retaining structures and adjacent building structures. The purpose of the video is to document existing conditions and to provide a fair measure of required restoration. The video shall incorporate all surrounding areas that could be impacted by construction activities. Care shall be taken to record all existing conditions which exhibit deterioration, imperfections, structural failures or situations that would be considered substandard.

B. Where necessary to adequately document pre-construction conditions and/or where required by Engineer, electronic photographs of specific locations shall be provided to supplement the electronic video.

C. Following Final Completion upon authorization by the Engineer or Owner, Contractor shall provide to the Engineer on DVD a video recording of all areas impacted by the Work, including storage areas, and all adjacent areas, showing the same details as required for pre-construction videos. The purpose of this video is to document conditions upon completion of the Work in order to establish if subsequent claims are related to the Work or circumstances unrelated to the Work.

D. The videos shall be high quality, color and in an approved electronic format. Temporary lighting shall be provided as necessary to properly video areas where natural lighting is insufficient (indoors, shadows, etc.). The videos shall include audio soundtrack to provide the following information:

   1. Detailed description of location being viewed referenced to Contract Drawings (i.e., well location, building designation, pipeline route, etc.);
   2. Direction (N, S, E, W, looking up, looking down, etc.) of camera view;
   3. Date, time, temperature, and environmental conditions during recording.
   4. Any areas not visible by video/photo methods shall be described in detail.

E. Unless otherwise approved by Engineer, videos shall not be performed during inclement weather or when the ground is covered partially or totally with snow, ice, leaves, etc.

F. Contractor shall submit one copy of the original documents to the Engineer accompanied by a detailed log of the contents of each DVD. The log shall include location descriptions with corresponding file name to facilitate the quick location of information contained on the DVDs. The DVDs will be maintained by the Engineer during construction and may be viewed at any time by Contractor upon request.

Upon final acceptance, the DVDs will become the permanent property of the Owner.

G. Approval of the pre-/post-construction videos/photos by the Engineer and/or Owner is advisory only and shall not relieve the Contractor of responsibility for complying with the requirements of this section. Failure of the Contractor to adequately document pre-construction conditions shall not result in any additional costs to the Owner. Approval by the Engineer in no way makes the Owner or Engineer liable for additional costs resulting from shortcomings in such documentation. In the event that the pre-construction videos and photos fail to adequately document pre-existing conditions, the Contractor shall be responsible for restoring all affected areas to the satisfaction of the property owner or agency with jurisdiction at no additional cost to the Owner.

H. In the event of claims by property owners regarding damages or loss potentially related to the Work, whether received during or after construction, the videos shall be used to verify the property owner's claims.

1. If the videos and photos clearly show the area in question and substantiate the property owner's claim, the Contractor will be responsible for satisfactorily resolving the claim (including payment of any damages) and restoring conditions to the pre-Work conditions within the terms of the Contract Documents.

2. If the videos and/or photos clearly show the area in question and fail to justify the claim, the claim will be denied by the Owner.

3. If the area in question is not included in the pre-construction video or insufficient detail is shown to evaluate the property owner's claim, the Owner and Contractor will review the claim in light of other available documentation.

4. If the pre-construction video and/or photos clearly show the area in question but the post-construction video and photos do not show the area in question or fail to establish the condition upon completion of the Work, the Contractor will be responsible for satisfactorily resolving the claim (including payment of any damages) and restoring conditions to the pre-Work conditions within the terms of the Contract Documents.

5. If the Owner feels that the area in question should have been shown in the pre-construction video, the Contractor will be responsible for satisfactorily resolving the property owner's claim (including payment of any damages) and restoring conditions to the pre-Work conditions within the terms of the Contract Documents.

1.11 PROGRESS PAYMENTS

A. The detailed arrangement for submittal of progress payments shall be discussed at the preconstruction meeting. In general, progress payments shall be submitted monthly in a format acceptable to the Engineer. The progress payment request shall be based on the unit prices and should provide the percentage of completion, total dollar value completed, dollar value completed prior to the current payment,

and the amount requested for this progress payment for each line item contained in the schedule of values. Progress payment requests for material and/or equipment suitably stored but not yet incorporated into the Work shall be accompanied by a copy of the appropriate manufacturer's invoice, shipping order, bill of lading, etc.; and the progress payment amount shall be the direct cost to the Contractor, or Subcontractor, for such material and/or equipment. Payment will not be made to the Contractor if, upon inspection by the Engineer, it is determined that the material and/or equipment does not conform to the requirements of the Contract Documents including proper storage, receipt of approved Shop Drawings, receipt of any special guarantees, Bonds, insurance coverage, any evidence of damage or imperfections, etc.

B. Contractor shall submit pay application for previous month to Resident Project Representative for review and approval prior to submittal to Owner.

C. Contractor shall send an electronic copy of the approved pay application to the Owner's project manager and Resident Project Representative by the 5th day of the month.

D. Pay application should include the following items:

1. Contractor Invoice Cover Sheet
2. Project Summary Sheet signed by the Contractor, the Resident Project Representative on the project and the INAWC Project Manager.
3. VOW spreadsheet with all final quantities for the month

1.12 CONTRACTOR'S DAILY REPORTS

A. The Contractor shall complete daily reports containing at least the following information:

1. A description of daily work activities performed, including but not limited to:
   a. size and quantity of main installed,
   b. size and quantity of fittings, valves, and hydrants installed,
   c. quantity of granular fill installed,
   d. description and quantity of other equipment and materials installed,
2. Description and quantity of underground obstructions encountered;
3. A description of daily material or equipment deliveries;
4. The temperature and weather conditions;
5. The names and number of hours worked by each trade (General Contractor);
6. The number of craftsmen and hours worked by each Subcontractor;
7. The number of hours worked by each type of equipment;
8. Downtime due to equipment failure;
9. Detailed description of issues that may cause the Contractor to incur delays, including quantity and types of issues.

B. The daily reports shall be available upon request from Owner.

C. Information provided on the daily report shall not constitute notice of delay or any other notice required by the Contract Documents. Notice shall be as required therein.

1.13 PROJECT RECORD DOCUMENTS (BY CONTRACTOR)

A. The Contractor shall complete and maintain on-site one set of the following Record Documents, which shall record all actual revisions to the Work concurrent with construction progress and shall be available upon request (during working hours or on the next business day) by the Owner, Engineer or Resident Project Representative.

1. Drawings;
2. Specifications;
3. Addenda;
4. Change orders and other modifications to the Contract;
5. Approved Shop Drawings and other submittals;
6. Field sketches.

B. The Record Documents shall be updated daily (red-line markups). The Owner reserves the right to stop Work at Contractor's expense until red-line markups are up to date. Red-line markups shall contain but are not limited to the following information.

C. Store Record Documents separate from documents used for construction.

D. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. manufacturer's name and product model and number,
2. product substitutions or alternates utilized,
3. changes made by addenda and modifications.

E. Record Drawings, Documents and Shop Drawings: Legibly mark each item to record actual construction including:

1. Original Drawings with Red-Line markings including measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements as stated in Section 01300 Submittals.
2. Field changes of dimension and detail
3. Pipe restrained joint lengths
4. Actual fitting and valve locations with horizontal dimensions measured from permanent structures.

5. Depths that exceed the minimum cover
6. Details not on original Drawings.
7. Pre and Post Construction videos
8. Electronic photographs
9. Others as required in other sections of the Specifications.

F. Submit documents to Engineer with final Application for Payment.

G. The Owner will issue a notice of Final Completion to the Contractor when the Work is in-service and up-to-date Record Documents have been provided by the Contractor.

1.14 GPS DATA COLLECTION BY RESIDENT PROJECT REPRESENTATIVE

A. Resident Project Representative shall collect GPS points, prepare record cards, and hand-drawings of field changes. GPS points shall be collected at all locations identified below on a daily basis:

1. water mains
2. depths varying 6-inches greater than minimum/maximum cover shown on the Drawings,
3. valves,
4. hydrants,
5. fittings,
6. corporation stops,
7. meter pits,
8. service lines

B. In addition to coordinates, each point shall include the attributes required on the digital collection method (using standard terminology submitted to and approved by the Owner) at a minimum:

1. fittings
2. valves
3. hydrants
4. main
5. others as required by the Owner

C. Resident Project Representative may choose to use equipment provided and configured by the Owner or may purchase equipment of equal or better specification to be configured in conjunction with the Owner for purposes of GPS data collection. All data from such collection will be processed and stored by the Owner.

D. Contractor shall assist and coordinate with Resident Project Representative in the collection of GPS points. Contractor shall provide safe access as needed and

adequate supplemental information for Resident Project Representative to document this information.

E. In the event RPR is unable to be on site, Contractor shall provide provisions such as vertical riser pipe to allow collection of the GPS data for any areas requiring backfill prior to collection of the GPS data. Unless otherwise directed by the Resident Project Representative, vertical riser pipes must be installed at each fitting and at every 50' to allow measure down to the pipe as well as collection of the GPS point. Riser pipes must be removed, backfilled and the surface restored following their removal.

1.15 RED-LINE DRAWINGS AND OTHER RECORD DOCUMENTATION BY RESIDENT PROJECT REPRESENTATIVE

A. Resident Project Representative shall maintain a separate set of red-line drawings updated each day that they are on-site and cross-checked to the Contractor's red-line markups. Elevation views—show vertical changes that are greater than 6" from the design elevation as well as any fittings used for vertical offsets. Red-line drawings to show the new main and the main that was retired. Do not include the proposed design location.

B. Resident Project Representative shall prepare sketches showing actual field installation at all intersections and tie-ins. The sketches shall indicate configuration, dimensions and elevations of all new mains and all existing utilities in the area.

C. Asset Record Cards are required to be completed by Resident Project Representative.

D. Resident Project Representative shall transfer red line drawings and other record documents to the Owner at the same time. This information will then be transferred to the final record drawings.

E. Resident Project Representative shall observe:

a. Tapping Sleeve & Valve installation

b. Shutdown and Tie-in

c. Shutdown and Cut/Cap

d. Pipe installation - First Day and first fitting

e. Valve installation – first installation

f. Crossing of large storm, sanitary, gas

g. Offsets under/over other utilities

h. Casing installation - open cut, HDD or Jack and Bore

i. Road crossings that require short term closure or partial closures

j. Service & Meter Pit Installation - First Day

k. Railroad crossing - throughout the duration

l. HDD installation - pullback of pipe

m. Pressure testing of pipe

n. Chlorination & De-Chlorination of pipe

o. Customer notifications as required by District

p. Final Walk thru

1.16 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01600 Products

E. Section 01700 Project Closeout

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

Not Used.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this Section consists of providing all labor, materials, tools, equipment, and services required to maintain existing facilities, provide temporary facilities, and perform related work as indicated on the Drawings and as specified within this section and related sections of the Specifications.

1.02 WATER SUPPLY

A. All use of existing water systems during construction by the Contractor shall be with the approval and direction of the Owner. The Contractor shall be responsible for all temporary piping, temporary meter provisions, temporary backflow preventer provisions and other water utility requirements for supplying water during construction. The Contractor shall use the existing water system only at locations, times and conditions as set forth by the Owner.

B. Temporary water supply, including temporary services, fire hydrants, and valves shall be provided as specified in Section 15000 where existing water services and/or fire hydrants would otherwise be out of service for more than eight (8) hours due to pipe bursting or other construction activities associated with the Work.

C. When and where available, Owner shall supply water for filling, testing, flushing, and disinfecting the new pipeline(s) and appurtenances. The water usage will be tracked by Owner, and there will be no cost to the Contractor for water supplied up to ten (10) times the volume of the new pipeline(s). If additional water is needed for filling, testing, flushing, and disinfecting, due to poor workmanship or defects in material or equipment furnished by the Contractor, Owner shall furnish the additional water (if and when available) and reserves the right to charge the Contractor for the additional water usage at prevailing rates.

D. The Contractor shall contact the Owner's local Operations District office forty eight (48) hours prior to filling and flushing to obtain a meter with backflow device. Contractor shall furnish and install all necessary temporary piping and valves in connection with such water supply. Only Owner shall operate valves on the existing water system. When the new pipeline is already connected to the existing water main and is to be filled directly from the existing main through a main line valve (whether new or existing), only Owner shall operate this valve.

E. If water is not readily available at the site or the Owner cannot provide the volume of flow required by the Contractor, Contractor shall supply water as needed from an off-site location at no additional cost to the Owner.

F. Contractor shall supply all water needed for lawn restoration and any other purposes not identified above. All water used from the Owner's water system by the Contractor for such purposes shall be metered through an Owner-approved metering assembly installed by the Contractor. Contractor shall furnish and install all necessary temporary piping, valves, and required backflow prevention devices in connection with such water supply.

G. The Owner reserves the right to impose limitations upon the Contractor's use of water as the Owner, in its sole discretion, determines may be necessary to assure it of its continued ability to meet the demands of its customers and the volumes and pressures required for fire protection. Any water required by the Contractor in excess of the quantities the Owner provides to the Contractor must be purchased from Owner by the Contractor at Contractor's expense.

1.03 TEMPORARY HEAT

A. Contractor shall provide approved type heating apparatus with the necessary fuel in order to protect and/or dry out the Work. Do not leave stored fuel unsecured. The stored materials and finished Work shall be protected at all times from damage by the weather elements. If required by weather factors to meet the coatings manufacturer's specifications, forced curing of the paint will be required.

1.04 ELECTRICAL SUPPLY

A. Contractor shall pay all fees, obtain necessary permits, have meter installed for power and light, and pay all monthly charges as may be required for completing the Work.

1.05 TEMPORARY LIGHTING

A. Contractor shall provide and maintain lighting for construction operations and lighting to exterior staging and storage areas after dark as necessary for security purposes.

1.06 BARRIERS

A. Contractor shall provide barriers to prevent unauthorized entry to construction areas. Barriers shall be sufficient to protect people, existing facilities, and adjacent properties from damage or injury. Provide protection for plant life designated to remain. Replace damaged plant life in kind at no additional cost to Owner.

1.07 FENCING

A. Refer to Part 1.06 Barriers of this Section for temporary barrier requirements.

1.08 PARKING

A. Contractor shall arrange for temporary parking to accommodate construction personnel, Resident Project Representative, and other persons requiring access to the work site.

B. Continual parking in grass areas in the right of way by the Contractor shall not be allowed.

1.09 PROGRESS CLEANING

A. Contractor shall maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition. Remove debris and rubbish from closed or remote spaces prior to enclosing the space. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust. Remove waste materials, debris, and rubbish from site weekly and dispose off-site.

1.10 SANITARY FACILITIES

A. Contractor shall provide suitable temporary facilities and enclosures for the use of workers and site visitors and shall maintain same in a sanitary condition.

B. The Contractor is advised that the Owner is in the business of providing potable water, and the Contractor's sanitary arrangements shall not endanger the Owner's facilities.

1.11 FIELD OFFICES

A. Furnishing a field office is not required unless otherwise indicated under Section 01011 or 01075.

1.12 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01010 Drawing Index

C. Section 01011 Special Provisions

D. Section 01075 Basis of Payment

E. Section 01570 Traffic Regulation

F. Section 01700 Project Closeout

G. Section 02025 Existing Utilities and Structures

H. Section 15000 Piping – General Provisions

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

Not Used.

END OF SECTION

SECTION 01570

TRAFFIC REGULATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this Section consists of providing all labor, materials, tools, equipment, and services required to maintain and regulate traffic as necessary to perform the Work, maintain traffic flow and protect the general public as indicated on the Drawings and as specified within this Section and related sections of the Specifications.

B. Contractor shall furnish and install all traffic barricades, markers, signs, controls and provide flaggers, traffic police and other facilities required by the Federal, State and local government authorities and the Engineer to protect general public and maintain the existing roads, streets and highways.

1.02 GENERAL REQUIREMENTS

A. Traffic control methods and materials shall conform to the latest editions of applicable State DOT Standard Specifications for Road and Bridge Construction and USDOT Manual on Uniform Traffic Control Devices for Streets and Highways.

B. Competent traffic personnel suitably attired for safety shall be employed at every location where the Contractor's equipment is working immediately adjacent to, or is entering, leaving or crossing, active traffic lanes. The traffic personnel shall be employed continuously for the full time such conditions exist.

C. Special attention shall be given to the protection of pedestrians and, in particular, children going to and coming from school. Ingress and egress shall be maintained for all properties abutting the pipeline.

1.03 COORDINATION OF WORK

A. Prior to the start of construction, assign one individual at a supervisory level who will be responsible to coordinate and oversee maintenance and protection of traffic. See General Conditions article 6.

B. Notify the State and local police, ambulance services and fire departments of daily traffic diversions.

C. Be fully responsible to complete all obligations of the Contract regardless of any restrictions which may be imposed by Federal, State or local authorities.

1.04 MAINTAINING TRAFFIC

A. Traffic Diversion: Whenever it is necessary to divert traffic from its normal channel into another channel, such diversion shall be clearly marked by cones, drums, barricades or temporary guardrail. If the markers are left in place at night, suitable lights shall be provided and maintained.

B. One Way Traffic: Whenever one way traffic is established, at least two (2) flaggers shall be provided and adhere to all requirements of the local police and street regulator having jurisdiction.

C. Street Closing: When permitted by Federal, State or local authorities having jurisdiction, the Contractor may close streets to through traffic for minimum periods of time. Notify and secure the permission of the local police and fire departments and such other public authorities. Contractor shall comply with all laws, ordinances and regulations regarding notification to the occupants of premises bordering the affected streets. Give all occupants reasonable notice with respect to the closing of any street, in whole or in part, even when not required by any law, ordinance, or regulation. Schedule work such that the time the street is closed is kept to a minimum and make suitable provisions for access by local residents, school buses, and mail delivery vehicles, unless otherwise authorized by the Engineer. Provide access for police, fire, ambulance and emergency vehicles at all times. Fire hydrants and other public utility valves shall be kept accessible at all times.

1.05 TRAFFIC SIGNALS AND CONTROLS

A. The installation and operation of all traffic signals and traffic control devices shall conform to the requirements of Federal, State and local government highway departments. The replacement of pavement markings disturbed during construction or the installation of temporary markings is the sole responsibility of the Contractor.

B. To protect persons from injury and to avoid property damage, adequate barricades including flasher and reflectorized construction signs and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic and pedestrians to use the construction area.

C. When permitted to close a street or road to traffic, furnish, erect, maintain and remove barricades, suitable and sufficient red lights, and other lights or reflecting material at the limits of the project, where side streets intersect, and at other points of public access to the project. Furnish, erect and maintain advance warning signs and barricades on side street at the first street intersection beyond the one closed by construction indicating “Street Closed, One Block Ahead”. Furnish, erect, maintain and remove detour marking signs on temporary routes.

1.06 TRENCH AND STORED MATERIALS MARKINGS

A. Before completion of each day’s work, in traveled areas, the pipe trench shall be completely backfilled and tamped, and the necessary temporary paving installed.

Compacted aggregate or compacted granular backfill shall be used in sidewalk and walkway areas according to local building requirements. Compacted aggregate shall be used in driveway areas. These areas are not to be left open, impassable or unsafe through the night. In the event that the pipe trench cannot be completely backfilled and tamped, temporary bridges and crossings shall be used to accommodate through traffic and the general public. The job site will be left in a neat and satisfactory condition at the end of each day. The requirements of this Section are in addition to any requirements of Federal, State or local laws, rules, regulations or ordinances or any requirements found elsewhere in the Contract Documents.

B. At night, any material or equipment stored between the street and sidewalk or within 5 feet behind any raised curbs, whether on or outside the paved street, shall be clearly outlined with light or other dependable warning devices that are approved by the Engineer. Equipment and material stored on the street shall be marked at all times. In addition, provide any other lights, barricades, etc., that may be needed for the protection of pedestrian traffic.

1.07 OTHER REQUIREMENTS

A. Trucks and/or trailers used as protective vehicles to protect workers or work equipment from errant vehicles on roadways with posted speed limits of 50 MPH or greater shall be equipped with Truck-Mounted Attenuators conforming to the National Cooperative Highway Research Program (NCHRP) Report 350 “Recommended Procedures for the Safety Performance Evaluation of Highway Features”.

B. The protective truck must be positioned a sufficient distance in front of the workers or equipment being protected to allow for appropriate vehicle roll-ahead, but not so far that errant vehicles will travel around the vehicle and strike the workers/equipment. Attenuators should be in the full down-and-locked position.

C. For stationary operations, the truck’s parking brake should be set and, when possible, the front wheels turned away from the work site. Turning the front wheels should be based on specific conditions at the site such that the after-impact trajectory is into a safe area.

D. If the regulation of traffic and controls are not being provided in accordance with this Section 01570, and the public is inconvenienced or its safety is being endangered, in the judgment of the Engineer or Owner, the Owner may take such steps as it deems advisable to provide such services; and all costs in providing such services will be deducted from any payment which may be due or may thereafter become due the Contractor.

1.08 SUBMITTALS

The Contractor shall prepare and submit a Maintenance of Traffic Plan to the Engineer and local traffic law enforcement agency for review. The Maintenance of Traffic Plan shall show the location of all barricades, signs, devices and alternate routes for local traffic and pedestrian safety. Erection of the appropriate safety and warning devices in

accordance with the USDOT “Manual of Uniform Traffic Control Devices” (MUTCD) shall be completed prior to beginning work and maintained until all construction is completed and the site restored.

1.09 PERMITS

A. Owner will obtain the Indiana DOT Right of Way Permit where required for Work shown on the Drawings. Contractor shall apply and pay for all other permits and pay all other inspection fees required by federal, state, local and private transportation authorities having jurisdiction over the Work area.

B. Contractor is responsible for complying with all requirements of such permits (including those obtained by the Owner), attending Board of Public Works meetings upon request, paying for all required inspections and/or traffic control by third-parties (e.g. off-duty police), at no additional cost to the Owner. Contractor’s Construction Schedule shall allow sufficient time for all permitting processes.

1.10 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01010 Traffic Regulation

C. Section 01011 Special Provisions

D. Section 01075 Basis of Payment

E. Section 01300 Submittals

F. Section 02610 Roadway Paving and Surfacing

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

Not Used.

END OF SECTION

SECTION 01600

PRODUCTS

PART 1: GENERAL

1.01 PROTECTION OF MATERIAL AND EQUIPMENT

A. Provide for the safe storage of all material furnished or purchased until it has been incorporated in the completed project and accepted by the Engineer. Bear the risk of loss and/or damage to the materials and Work until the Work is finally accepted by the Engineer. If space is available, the Contractor may store material and equipment at the Owner's local property. All storage shall be approved by the Owner's local Operations Superintendent prior to any items being placed on Owner's property.

All electrical and mechanical equipment shall be stored in a warm, dry shelter with proper ventilation. Under no circumstances shall motors, electrical control equipment or any other electrical or mechanical equipment be stored under polyethylene plastic covers or tarpaulins. When space is available inside existing structures at the Owner's local property, the Contractor will be allowed to store equipment inside the structures subject to the stipulations in the preceding paragraph. Contractor may store equipment at a secure off-site facility subject to inspection by the Engineer. Owner may stipulate additional requirements and require additional documentation before making payment for materials stored at any location other than the Project site or an Owner's facility.

B. The interior of all pipe, fittings, and accessories shall be kept free from dirt, foreign matter and standing water at all times.

C. After valves and hydrants have been inspected, properly store them prior to use. In order to prevent entry of foreign material that could cause damage to the seating surfaces, the valves and hydrants shall be stored in a fully closed position unless recommended otherwise by the manufacturer. Resilient seated valves shall be stored in accordance with the manufacturer's recommendations. This may include storage with protective covers for rubber seats and in marginally open condition. Valves and hydrants shall be stored indoors unless otherwise approved by the Engineer.

D. If valves must be stored outdoors, protect the operating mechanism, such as gears, motor, actuators and cylinders, from weather elements. Valve ports and flanges must be protected from the weather and foreign materials. If valves are subject to extreme (freezing or excessively hot) temperatures, all water must be removed from the valve interior and the valve closed tightly before storage, unless specifically recommended otherwise by the manufacturer. Valves shall be stored on pallets with the discs in a vertical position to prevent rainwater from accumulating on top of the disc, seeping into the valve body cavity, freezing, and cracking the casting.

1.02 SERVICING EQUIPMENT

A. Check all equipment upon acceptance to determine if oil reservoirs are full and areas to be greased are properly packed with grease. Provide the proper grease or oil for use in lubricating the required areas of the equipment. Any service to equipment while in storage, or installed pending acceptance, is the responsibility of the Contractor and shall be performed per manufacturer's requirements, industry standards or as stated specifically in the Specifications.

1.03 RESPONSIBILITY FOR MATERIAL AND EQUIPMENT

A. Under no circumstances shall equipment, pipe, valves, fittings, or appurtenances be dropped or dumped from any trucks or equipment. When received from the Carrier and at time of unloading, inspect all pipe and accessories for loss or damage. No shipment of material shall be accepted by the Contractor unless loss or damage (if present) has been described on the Bill of Lading by the Carrier's agent. Any discrepancies between the Bill of Lading and the physical material shall be noted on the Bill of Lading. All demurrage charges on carloads or truckloads of pipe or other material shall be paid by the Contractor. Owner Furnished Contractor Installed materials shall require Contractor to sign the carriers delivery packing slips and return the original copy to the Owner or Owners representative within 3 business days.

B. After acceptance of material and/or equipment by Contractor at point of delivery, the Contractor assumes full responsibility for safe and secure storage, handling, servicing and installation of such material and/or equipment in accordance with manufacturer's recommendations, industry standards or specific requirements of the Contract Documents. Once in his possession, assume full responsibility for, and protect all material from theft and damage. Any lost or stolen materials shall be replaced at the Contractor's expense.

C. Re-inspect all material for defects, correct size, and quantity in the field prior to installation. Immediately report all material found to be defective, improperly sized, or deficient in quantity to the Owner.

D. The Contractor is responsible for all material furnished by the Contractor and Contractor's suppliers. All such material that is defective in manufacture or has been damaged in transit or has been damaged after delivery shall be replaced by the Contractor at his expense.

E. Owner Furnished, Contractor Installed materials: Certain material and equipment will be furnished by the Owner as noted in the Contract Documents. The Contractor's responsibility for material and/or equipment furnished by the Owner shall begin upon the Contractor's acceptance of such material and/or equipment at the point of delivery. All material and equipment shall be examined and items found to be defective in manufacture and/or otherwise damaged shall be rejected by the Contractor at the time and place of delivery. The Owner will thereupon repair or replace the damaged items. Thereafter, any material and/or equipment found to be defective prior to project acceptance by the Engineer shall be repaired or replaced by Contractor at no additional cost to Owner unless

Contractor submits proof that such defect was latent and could not have been detected by Contractor when performing their duties and responsibilities under these Contract Documents.

F. Owner Furnished, Contractor Installed materials: Contractor's and Owner's responsibilities for providing guarantees or warranty and manufacturer's representatives for service, inspection, certification of installation, installation, field training, start-up, etc. for material and/or equipment furnished by Owner shall be as follows unless otherwise specified: Owner will provide the warranty and Contractor shall coordinate with the Owner and assist in coordinating with manufacturer's representatives for all necessary field service, start-up service, installation certifications, installation, field training of Owner's personnel, etc. for Owner-furnished material and/or equipment as required for acceptance of such material and/or equipment in the completed project. Contractor shall cooperate in the discovery of defective Owner Furnished Contractor Installed (OFCI) materials. When requested by Owner, Contractor shall provide labor, equipment, and tools (but not materials) to assist with correcting or replacing Owner-furnished materials. Contractor shall be reimbursed by the Owner or material supplier for labor and materials incurred as a result of the defective material item.

1.04 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer’s literature and product data, installation instructions, Operating and Maintenance Manuals, certifications, and other required submittals in accordance with Section 01300 for products furnished where submittals are required under the corresponding section of the Specifications.

1.05 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

PART 2: PRODUCTS

2.01 GENERAL

A. Unless otherwise specifically provided for in these Specifications, all equipment and materials incorporated in the work shall be new, in current production and in accordance with the Specifications and Drawings.

B. Product manufacturers, models, and part numbers identified in these Specifications are the only approved products that will be accepted for the Work. No substitutions, “or equal,” or other manufacturers/products not specifically listed in these Specifications may be furnished or installed by the Contractor without prior written approval from the Owner. Any proposed substitutions, “or equal,” or other manufacturers/products proposed to be incorporated into the Work shall be submitted by the Contractor for review and approval by Indiana American Water Company Engineering, Greenwood, Indiana.

2.02 COORDINATION OF DIMENSIONS

Verify and make necessary corrections to construction dimensions so that all specified and/or alternative equipment, which is approved by the Engineer, can be installed and will function within the intent of the Drawings and Specifications. Promptly notify the Engineer of all necessary corrections required.

2.03 SAFETY AND HEALTH REQUIREMENTS

A. All materials, equipment, fixtures and devices furnished shall comply with applicable Laws and Regulations.

B. All material and equipment furnished and installed under this Contract shall be equipped with suitable and approved safety guards and devices required for the safety of the public and operating personnel. Such guards and safety devices shall be in accord with the latest requirements of safety codes approved by the American National Standards Institute as well as the safety requirements of applicable Laws and Regulations. Where said safety codes of the ANSI are incompatible with applicable Laws and Regulations, said Laws and Regulations shall prevail.

PART 3: EXECUTION

3.01 INSTALLATION

A. Material and equipment shall be installed in accordance with the appropriate sections of these Specifications.

3.02 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. Arrange for a qualified service representative from each company manufacturing or supplying certain equipment as required by the individual Specifications sections to perform the duties herein described.

B. After installation of the applicable equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test, and adjust the equipment. The

inspection shall include, but shall not be limited to, the following points as applicable:

1. soundness (without cracked or otherwise damaged parts);
2. completeness in all details, as specified;
3. correctness of setting, alignment, and relative arrangement of various parts;
4. adequacy and correctness of packing, sealing and lubricants.

C. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.

END OF SECTION

SECTION 01700

PROJECT CLOSEOUT

PART 1: GENERAL

1.01 TESTING OF FACILITIES

All work shall be tested under operating conditions and pressures; and any leaks or malfunctions shall be repaired to the satisfaction of the Engineer at no additional expense to the Owner.

1.02 CLOSEOUT PROCEDURES

Submit written notification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection. Provide submittals to Engineer that are required by governing or other authorities. Submit Application for final payment identifying total adjusted Contract sum, previous payments, and sum remaining due. Contractor shall submit original Maintenance Bond and Waiver of Liens for all subcontractors.

1.03 PROGRESS CLEANING AND FINAL CLEANING

A. Periodically, or as directed during the progress of the Work, remove and properly dispose of the resultant dirt and debris and keep the premises reasonably clear. Upon completion of the Work, remove all temporary construction facilities and unused materials provided for the Work and put the premises in a neat and clean condition and do all cleaning required by the Specifications. Trash and combustible materials shall not be allowed to accumulate in construction locations.

B. Execute final cleaning prior to final inspection. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances. Clean equipment and fixtures to a sanitary condition. Clean debris. Clean site; sweep paved areas, rake clean landscape surfaces. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.04 PROJECT RECORD DOCUMENTS

A. Maintain project record documents in accordance with Section 01300.

B. Submit documents to Engineer with final Application for Payment.

C. The Owner will issue a notice of Substantial Completion to the Contractor when the Work is in-service and up-to-date Record Documents have been provided by the Contractor.

1.05 SURPLUS MATERIALS

A. The Contractor shall return surplus Owner-furnished material to the Owner's local Operations District's property or other location(s) specified by the Engineer within fourteen (14) days of the notice of Substantial Completion is issued.

B. Refer to Section 15185 for requirements regarding removal of abandoned hydrants, valve boxes, air valves, meter installations, and curb stops.

C. Unless otherwise directed by the Engineer, the Contractor shall return the following components from abandoned facilities that were removed as part of the Work to the Owner's local Operations District's property or other location(s) specified by the Engineer within fourteen (14) days after the notice of Substantial Completion is issued. If directed by the Engineer, the Contractor shall dispose of these abandoned materials at no additional cost.

1. Fire hydrants
2. Valve boxes and lids (only if in good condition)
3. Automatic air valves
4. Meter pits, covers, and lids
5. Meter setting components, including meter setters, yoke bars, branches, ball valves, and other components as directed by the Engineer.

1.06 GUARANTEES AND WARRANTIES

A. The Contractor expressly warrants that all workmanship and materials performed or furnished under this Contract will conform to the Specifications, Drawings and other applicable descriptions furnished or adopted by the Contractor and with all applicable laws, provisions and requirements of the Contract Documents. Remedy any defects due to faulty materials or workmanship which are discovered within a period of one (1) year from the date of acceptance of the Work in this project and pay for any damage or associated loss resulting from faulty materials or workmanship, including value of any water lost since the acceptance date due to faulty materials or workmanship. Quantity of water lost shall be as estimated by the Engineer and/or Owner based on best available information, calculations, modeling, and professional judgement. The Owner shall give notice of observed defects with reasonable promptness. The Contractor warranty hereunder is in addition to, and not in limitation of, any obligations found elsewhere in the Contract Documents, any special guarantees provided by the Contractor or Contractor suppliers, and any obligations imposed by law.

B. In addition to the above requirements, assign material and equipment guarantees and warranties from all manufacturers and suppliers to the Owner and deliver copies of such guarantees and warranties and the necessary assignments to the Owner in order to assure the Owner of the full benefit of such guarantees and warranties.

1.07 RESTORATION

A. Restore and/or replace paving, guardrails, curbing, sidewalks, gutters, shrubbery, fences, signs, mailboxes, sod and all other disturbed surfaces, structures, utilities, and any other items required by the Drawings and/or Specifications to a condition equal to or better than that before the Work began and to the satisfaction of the Resident Project Representative and Owner.

1.08 MAINTENANCE OF SURFACES

Following the written Substantial Completion acceptance issued by Engineer, maintain the surfaces of all areas disturbed by the Work, including paved and unpaved areas, adjacent curbs and gutters, sidewalks, fencing, and sod for a period of one (1) year thereafter or longer as required by state, county or local authorities unless otherwise stipulated in writing by the Engineer. Supply all material, equipment, tools, labor and services required for the maintenance of the restored surfaces and structures; and perform the Work in a manner satisfactory to the Engineer. Contractor shall repair or replace (at the Engineer's discretion) any pavement, sidewalks, curbs, fencing, signs, utilities, structures, landscaping, and other items that are damaged due to trench settlement or other residual effects of the Work.

1.09 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 02610 Roadway Paving and Surfacing

F. Section 02820 Lawn Restoration and Landscaping

G. Section 15185 Abandonment of Mains and Hydrants

PART 2: PRODUCTS

Not Used.

PART 3: EXECUTION

Not Used.

END OF SECTION

SECTION 02020

DEWATERING

PART 1: GENERAL

1.01 SCOPE OF WORK

The work under this Section consists of providing all labor, materials, tools, equipment, and services required to dewater pipeline excavations as indicated on the Drawings and as specified within this Section as necessary for proper construction of the pipeline(s) under dry conditions.

A. If ground water, surface water, and/or other sources of water are encountered that impact the Work and cannot be adequately drained, Contractor shall furnish and operate pumping equipment of sufficient capacity to dewater the excavation and adequately control hydrostatic pressures. Dewater the excavation so that the laying and joining of the pipe is made in a dry environment so as to prevent water from entering the pipe during construction.

B. No additional payment will be made for any dewatering operation, overtime, equipment rental or any other expense incurred due to the occurrence of ground water, surface water or water from possible leakage from existing buildings, structures or piping in the vicinity of the Contractor's operations. If Contractor believes excessive wet conditions exist beyond what could have been anticipated, he shall immediately notify Engineer and propose appropriate dewatering measures. Engineer shall determine whether Contractor is entitled to additional compensation.

C. Discharge shall be in strict accordance with state and/or local requirements. Contractor's dewatering pump discharge shall include an approved filtration device. Convey all water removed from the excavation to a natural drainage channel or storm sewer without causing any property damage as approved by the local governing body.

D. Dispose of silt and debris from dewatering operations that accumulates during construction in strict accordance with state and/or local requirements. Any such materials removed from Right of Way owned by the State of Indiana must be disposed of in an INDOT certified dump site.

1.02 SUBMITTALS

Contractor shall submit the following submittals for Work under this section in accordance with Section 01300:

A. Name of dewatering subcontractor, if applicable.

B. Shop Drawings indicating the following:

1. Plans showing the methods and location of dewatering and discharge including a sufficient number of detailed sections to clearly illustrate the scope of work.
2. Relationship of the dewatering system, observation wells, and discharge line to existing buildings, other structures, utilities, streets, and new construction.
3. Utility locations.
4. Drawings shall bear the seal and signature of the qualified Registered Professional Engineer in charge of preparing the drawings.
5. List of materials and equipment to be used.
6. A sample of all well record forms to be maintained during construction.

C. Detailed description of the sequence of dewatering operations.

D. Evidence of written approval from the local storm water governance authority.

E. Emergency observation plans to be put into operation during failure of the dewatering system.

F. Monthly Dewatering System Monitoring Reports containing the following data on approved forms:

1. For observation wells, daily piezometric levels shall be identified by date, time, well number and system (subsystem if multiple pumps are used) pumping rate. Piezometric levels shall be noted in feet of drawdown and groundwater elevation.
2. For dewatering wells, suspended material test results shall be identified by date, time, well number, well pumping rate (if monitored) and system (subsystem if multiple pumps are used) pumping rate.
3. Installation records for new wells.

G. Schedule and records of all maintenance tests for primary and standby dewatering systems including the following:

1. Maintenance tests and water quality tests for suspended matter at the discharge point including date, time of day, elapsed times of tests procedures, components tested, suspended particles, resultant observations and well readings.
2. Daily discharge rates.
3. Installation and removal of wells.
4. General observations of the system such as equipment running times, and failures.

H. Dewatering well removal records.

I. Observation well removal records.

1.03 QUALITY ASSURANCE

A. Contractor shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the Work described herein.

B. Dewatering shall prevent the loss of fines, seepage, boils, quick conditions or softening of the foundation strata while maintaining stability of the sides and bottom of the excavation, and providing dry conditions for construction operations.

1.04 PERMITS

A. Contractor shall obtain and pay for any permits required for dewatering and disposal.

1.05 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01500 Temporary Facilities

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 02540 Erosion and Sedimentation Control

H. Section 15000 Piping – General Provisions

PART 2: PRODUCTS

2.01 MATERIALS

A. Materials, especially the well screen, shall be carefully chosen to be compatible with the environment to prevent erosion, deterioration, and clogging.

PART 3: EXECUTION

3.01 DESIGN

A. The dewatering system shall be capable of relieving all hydrostatic pressure against the height of the excavation walls and of lowering the hydrostatic level to a minimum of six inches (6”) below the bottom of the required excavation in the work areas.

B. Provide, operate and maintain all ditches, berms, site grading, sumps and pumping facilities to divert, collect and remove all surface water from work areas. All collected water shall be discharged into the outfall pipe.

C. Carry the dewatering system discharge through pipes out of the area of the excavation into the outfall junction manhole shown on the Drawings (if applicable) or as otherwise approved by the Engineer. If required as a condition of the applicable permit or by applicable law, ordinance or code, provide meters to measure the discharge flow.

D. Provide observation wells to determine compliance with dewatering requirements as indicated on the Contract Drawings, Shop Drawings, permits, or as otherwise directed by the Engineer.

3.02 INSTALLATION

A. Install the dewatering system from the existing ground surface or from the bottom of an excavation which is located above the natural ground water level.

B. Observation wells shall consist of a standpipe or riser of minimum 1.0-inch inside diameter and a minimum three (3) foot long well-point screen or slotted PVC section at the bottom.

3.03 DEWATERING PROCEDURE

A. Place the dewatering system into operation and lower the water level prior to excavation.

B. Operate the dewatering system continuously twenty-four (24) hours per day, seven (7) days per week until waterlines and structures have been satisfactorily constructed in the dewatering area. Contractor shall be responsible for observation and maintenance of the dewatering operation to ensure satisfactory performance. When required by federal, state or local authorities with jurisdiction, Contractor shall provide continuous, 24-hour per day, 7-day per week on-site monitoring by a competent person.

END OF SECTION

SECTION 02025

EXISTING UTILITIES AND STRUCTURES

PART 1: GENERAL

1.01 SCOPE OF WORK

The Work under this section consists of providing all labor, materials, tools, equipment, and services required to verify, coordinate, survey, accommodate, protect, repair and restore existing utilities and structures as specified within this section and related sections of the Specifications.

A. It is the responsibility of the Contractor to verify all existing structures and utilities. Prior to submitting a bid for the proposed Work, Bidders shall visit and familiarize themselves with the entire project area, including all discernible existing structures and utilities. As needed for the purpose of accurately preparing their bids for the proposed Work, Bidders shall take appropriate measures to determine the presence, location, size, and character of such structures and utilities.

B. Certain information regarding the reputed presence, size, character, and location of existing underground facilities such as pipes, drains, storm sewer, sanitary sewers, sanitary sewer laterals, electrical lines, telephone lines, cable TV lines, gas lines, and water lines has been shown on the Contract Drawings and/or provided in the Contract Documents. This information is provided by the Engineer and Owner to the best of its knowledge in accordance with conditions described in the General Conditions and for information purposes only.

C. Prior to commencement of the Work, the Contractor shall, at his own expense, take such surveys as may be necessary to establish the existing conditions, including the actual presence, location, size, and character of all existing structures and utilities (including individual utility services and private utilities) in proximity to the Work as necessary for the purpose of performing construction activities associated with the proposed Work.

1.02 NOTIFICATION OF UTILITIES

A. Notify the applicable State Agency with jurisdiction over underground facilities and/or all utility companies that construction work under this Contract will pass through areas containing their underground facilities. Notify these parties a minimum of 72 hours in advance, as required by the organization with jurisdiction, to support the construction work. All excavation in the vicinity of existing underground utilities shall be performed in accordance with applicable regulations.

1.03 BRIDGE CROSSINGS

A. Notify the applicable State Agency and Transportation Organization with jurisdiction over bridge facilities and/or all utility companies that construction work under this Contract will pass at or near the bridge structure. Notify these parties a minimum of 72 hours in advance, or as required by the organization with jurisdiction to support the construction work. All construction in the vicinity of existing bridge structures shall be performed in accordance with applicable regulations.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01500 Temporary Facilities

E. Section 01600 Products

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 15000 Piping – General Provisions

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the Engineer shall determine which requirements shall prevail.

A. Statewide Alternative Technical Standards: Water Main Separation Distances From Existing Sanitary and Storm Sewers as approved by Indiana Department of Environmental Management

PART 2: PRODUCTS

2.01 MATERIALS

A. Furnish all materials for temporary support, adequate protection, and maintenance of all underground and surface utility structures, pipes, conduits, wires/cables, supports, drains, and other obstructions encountered in the progress of the Work.

PART 3: EXECUTION

3.01 OBSTRUCTIONS BY OTHER UTILITY STRUCTURES

A. Support, relocate, remove, or reconstruct existing utility structures that obstruct installation of the proposed utility such as conduits, cables, ducts, pipes, branch connections to main sewers, or drains. The obstruction shall be permanently supported, relocated, removed or reconstructed where they obstruct the grade or alignment of the pipe. Contractor must do so in cooperation with the owners of such utility structures. Before proceeding, the Contractor must reach an agreement with the Engineer on the method to work around the obstruction.

B. No deviation shall be made from the required line, grade, or depth without the consent of the Engineer.

3.02 REPAIRS

A. Repair or replace any damage to existing structures, utilities, work, materials, or equipment damaged by Contractor's operations.

B. Repair all damage to streets, roads, curbs sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, trees, shrubs or other public or private property caused by transporting equipment, materials or personnel to or from the work site. Make satisfactory and acceptable arrangements with the persons or agencies having jurisdiction over the damaged property concerning repair or replacement

C. Brace and support existing pipes or conduits crossing the trench, or otherwise exposed to prevent trench settlement from disrupting the line or grade of the pipe or conduit. The Contractor shall submit an acceptable method of bracing and supporting such pipes or conduits, which must be approved by the Engineer before proceeding with the Work. All repairs and replacement of damaged structures and utilities shall be coordinated with and meet the approval of the applicable utility and local governance authority. Contractor shall repair or replace all utility services broken or damaged at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Use temporary arrangements, as approved by the Engineer, until any damaged items can be permanently repaired. Contractor shall maintain all items damaged or destroyed by construction and subsequently repaired until project acceptance.

3.03 SEPARATION OF WATER MAINS AND SANITARY SEWERS

A. General

Consider the following factors when determining adequate separation:

1. Separation requirements shall comply with the current Indiana Administrative Code governance.
2. Materials and type of joints and restraints for water and sanitary sewer pipes,

3. Soil conditions & backfill materials,
4. Service and branch connections into the water main and sanitary sewer line,
5. Compensating variations in horizontal and vertical separations,
6. Space for repair and alterations of water and sanitary sewer pipes,
7. Off-setting of pipes around manholes.

B. Parallel Installation

Install water mains a minimum of 10 feet horizontally from any existing or proposed sanitary sewer. Measure the distance from edge to edge.

C. Crossings

Whenever water mains must cross sanitary sewer laterals or sanitary sewers, lay the water main at such an elevation that the water main is 18 inches above or below as measured from outside of water main to outside of the sanitary sewer pipe. Contractor shall install the water main so that a pipe joint does not exist at the point of intersection. Maintain this vertical separation for the portion of the water main located within 10 feet horizontally of any sanitary sewer it crosses. The 10 feet is measured as a perpendicular distance from sanitary sewer line to the water line. Where water mains must cross under a sanitary sewer, additional protection shall be provided by:

1. Adequate structural support for the sanitary sewer to prevent excessive deflection of the joints and the settling on and breaking of the water line, and
2. Centering the section of water pipe at the point of the crossing so that the joints shall be equidistant and as far as possible from the sanitary sewer line.

3.04 SEPARATION OF WATER MAINS AND STORM SEWERS

Where water mains and storm sewers are proposed to be installed parallel, lay water mains at least 10 feet horizontally from the existing or proposed storm sewer (measured from edge to edge). Where storm sewers and water mains must cross, place water mains at least 18 inches vertically from the storm sewer as measured from edge to edge of pipes.

3.05 EXCEPTIONS

A. The Owner has obtained approval from Indiana Department of Environmental Management of “Statewide Alternative Technical Standards: Water Main Separation Distances From Existing Sanitary and Storm Sewers”. The Drawings are designed to incorporate these alternative technical standards. Where the Drawings clearly show deviation from the above specified horizontal and vertical separation requirements, the Drawings are to take precedence.

B. In other cases where it is impossible or not practical to maintain the specified horizontal and vertical separation as stipulated above, Contractor shall notify Engineer and shall not proceed with the installation. Upon request, Contractor

shall assist the Engineer in coordination with Indiana Department of Environmental Management to obtain a separation exception at no additional cost to the Owner. The Contractor shall install the water main as directed by the Engineer in writing based on either the approved Statewide Alternative Technical Standards or an approved separation exception.

C. The Engineer may allow other deviations on a case by case basis.

END OF SECTION

SECTION 02105

CLEARING AND GRUBBING

PART 1: GENERAL

The work under this section consists of providing all labor, materials, tools, equipment, and services required to clear and grub the Work area as indicated on the Drawings and as specified within this section and related sections of the Specifications. This Work includes all related disposal as required.

1.01 SCOPE OF WORK

A. As necessary to perform the work, Contractor shall clear the construction area within the Contract Limit Lines, including removal of grass, brush, shrubs, trees, loose debris and other encumbrances. Trees marked to remain shall not be cleared or otherwise disturbed. Comply with State and local code requirements when disposing of trees, shrubs and all other materials removed under this section.

B. Protect existing trees, shrubs and bushes located outside the clearing limits from damage for the life of this Contract. Relocating trees and shrubs, so indicated on the Drawings, to designated areas.

C. All injury to trees, shrubs, and other plants caused by site preparation or other construction activities associated with the Work shall be repaired immediately. Work shall be done by qualified personnel in accordance with standard horticultural practice and as approved by the Engineer.

D. Only where designated on the Drawings, Contractor shall remove topsoil to its full depth (not less than 4-inches) and stockpile on site where shown on the Drawings or directed by the Resident Project Representative for use in restoration of the area. Install silt fence around topsoil stockpiles and preserve all topsoil for use during final restoration in accordance with Section 02820.

E. Remove from the site and dispose of all debris resulting from work under this Section. Contractor shall bear all expenses to obtain a suitable disposal area including transport to the disposal area, disposal fees and handling at the disposal area.

1.02 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 02210 Trenching, Backfilling and Compacting

E. Section 02230 Stream Crossing

F. Section 02540 Erosion and Sedimentation Control

G. Section 02820 Lawn Restoration and Landscaping

H. Section 15000 Piping – General Provisions

PART 2: PRODUCTS

Not Used

PART 3: EXECUTION

3.01 CLEARING AND GRUBBING

Clear and grub only the minimum area necessary to complete the Work.

A. Clear and grub the work site within easement and/or clearing limit lines shown on the Drawings or as shown elsewhere in the Contract Documents, but only to the extent necessary to perform the Work and/or as directed in writing by the Engineer or Owner. Remove those items that are designated for removal and/or obstruct construction. This includes, but is not limited to; trees, downed timber, shrubs, bushes, vines, roots, stumps, undergrowth, rubbish, paving materials, debris, and all other objectionable materials. Site objects outside clearing limits shall not be removed. Only those portions of the construction area which are absolutely necessary and essential for construction shall be cleared. Minimize the length of time of ground disturbance as much as practical, especially within environmentally sensitive areas. Ground shall not be cleared and grubbed until immediately prior to construction.

B. Notify the Engineer of locations where additional trees and shrubs will interfere with installation of facilities. Do not remove additional trees or shrubs without written permission of Engineer or Owner.

C. Conduct operations to minimize disturbance of trees and shrubs. Trim trees and roots in accordance with the best horticultural practices, including sealing cuts to preserve the tree.

D. Excavation resulting from the removal of trees, roots, structures, and the like shall be filled with suitable material, as approved by the Engineer.

3.02 CLEARING (IMPROVED AREA)

A. Remove site improvement objects such as signs, lawn ornaments, etc. which interfere with construction. Removed site improvement objects shall be stored in a manner protecting objects for reinstallation after construction is complete. Relocate mailboxes as necessary. Provide temporary traffic control signs as required. When permanent signs must be removed for construction, either move

signs to an approved temporary location or remove signs and provide temporary signs. Temporary signs shall be worded to match permanent signs, except as necessary to be compatible with construction operations. Reinstall permanent signs and mailboxes as soon as work is completed in the area unless otherwise directed by the Engineer.

B. Remove pavement, curb and sidewalk by saw-cutting, milling or removal by trench machine in accordance with governing agency requirements and as specified in these Contract Documents. Cut the full depth of the pavement with straight and continuous lines and squared edges. Contractor shall minimize horizontal offsets in the pavement removal and replacement. Saw cuts may be eliminated where paving abuts curb or roadway expansion joints or construction joints, and pavement can be removed without damaging or disturbing curbs or remaining pavement. Remove sidewalks in full squares only. Saw cut sidewalks if no true joint exists.

3.03 DISPOSAL

A. Burning of logs, stumps, roots, cuttings and other material on the site shall not be permitted.

B. All materials obtained as a result of the clearing and grubbing operations shall be disposed of in accordance with the requirements of the applicable governing agencies. Any such materials removed from Right of Way owned by the State of Indiana must be disposed of in an INDOT certified dump site.

C. Chipping of brush materials will be permitted. Contractor shall bear all costs to dispose of the resultant chips at an approved location.

END OF SECTION

SECTION 02210

TRENCHING, BACKFILLING AND COMPACTING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to accomplish all trenching, trench support, bedding, embedment, backfilling, compacting, and related work for all piping and appurtenances to be installed as indicated on the Drawings and as specified within this section and related sections. Contractor shall provide all required foundation, bedding, embedment, and backfill materials and other related materials required to perform the Work specified in this section.

1.02 GENERAL REQUIREMENTS

A. This section provides common, general requirements related to trenching, bedding, embedment, and backfilling of water pipelines and appurtenances. This section does not purport to cover all conditions or every possible situation that might be encountered.

B. If any underground condition or situation is encountered that is not addressed within this section, another section, or on the Drawings, Contractor shall immediately stop work and notify Engineer and Owner of the condition and/or situation discovered. Contractor shall not proceed with work in such cases until so directed by the Engineer and subject to the Engineer's requirements.

C. Federal, State, and/or local governmental or quasi-governmental bodies may have jurisdiction over the site of the Work, particularly within road rights-of-way. Contractor shall be responsible for identifying, understanding, and complying with all requirements of each authority with jurisdiction in the work area, regardless of whether or not such requirements are stipulated on the Drawings or in the Specifications and despite any conflicting requirements herein. In the case of conflicting requirements, Contractor shall coordinate with Owner and Engineer to resolve such conflicts before proceeding with the Work.

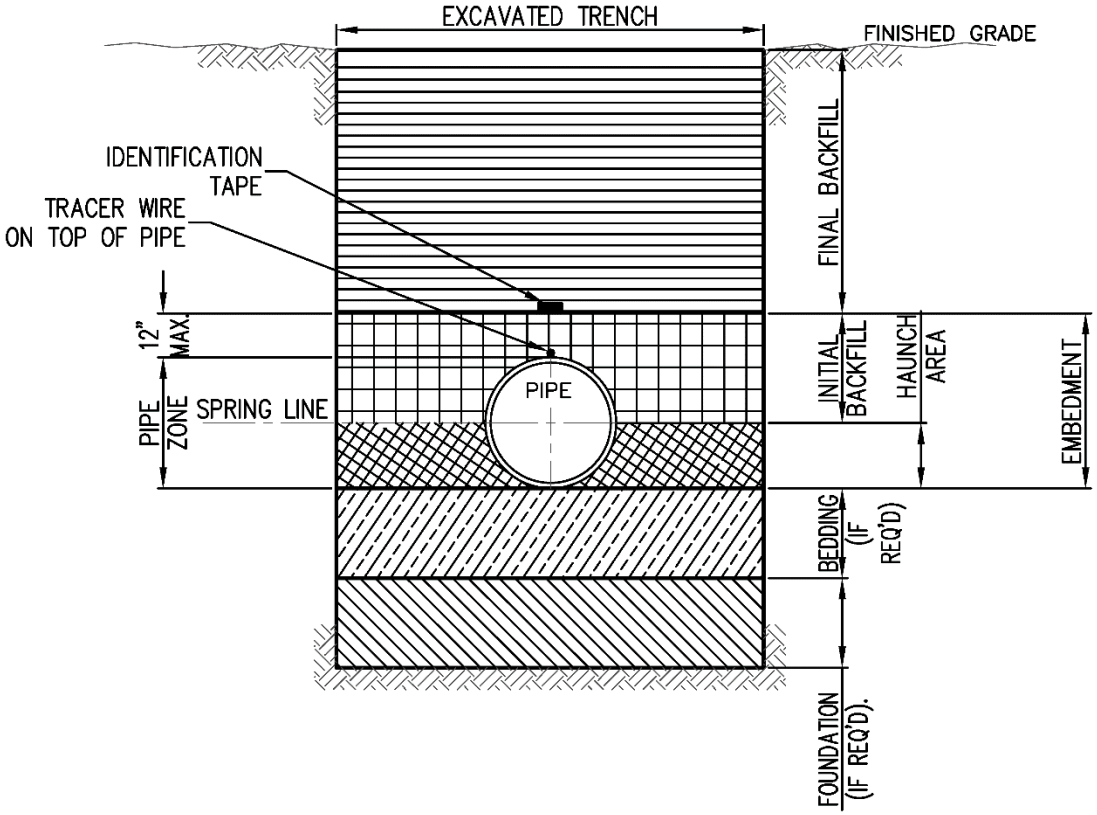
D. Contours, topography and profiles of the ground shown on the Drawings are believed to be reasonable approximations and are not guaranteed.

E. The Contractor is responsible for verifying the backfill requirements to be used prior to submitting bids. Contractor accepts the construction site with the conditions that existed at the time of bidding.

F. Reference Special Conditions and Drawings for additional information and requirements.

1.03 DEFINITIONS

Unless otherwise defined herein, terminology shall be per ASTM F1668 or ASTM F412 (for terms not defined in ASTM F1668). Embedment material shall include both the fill material used in the haunch area and the initial backfill—but not the bedding. As applicable, other references shall be consulted for terminology not defined in the above references. The following detail represents the usage of terms within this Section.



1.04 SUBMITTALS

A. Prior to beginning work, Contractor shall submit all submittals required by this section and in accordance with Section 01300.

B. Contractor shall submit samples of all bedding, embedment, and backfill materials to an approved testing agency for analysis, as required by the Engineer. Test all such materials, whether obtained from the trench excavation or from an off-site source, as directed by the Engineer, including at least classification and gradation tests. Submit the testing agency's test results and report to the Engineer for approval.

1. B-Borrow Sand testing results shall be submitted prior to installation for:

1. Visual classification according to Unified Soil Classification System (ASTM D2488)

2. Lab tests, including grain size (sieve analysis), natural moisture, and Atterburg limits.

2. The report must state that the materials meet the requirements of these Specifications and any applicable specifications of Federal, State and local authorities (applicable specifications shall be individually listed).

C. All bedding, embedment, and backfill materials, including Common Fill and Select Fill shall be approved by the Engineer and the governing authority prior to placing the materials in the pipe trench.

D. For any spoils or debris removed from the right of way under the jurisdiction of the State of Indiana, furnish the Engineer with satisfactory evidence that they were disposed of in an approved INDOT-certified disposal site.

E. Submit the mix design for flowable fill to the Engineer for approval. A trial batch demonstration may be required. The mix design shall include a list of all ingredients, the source of all materials, the gradation of all aggregates, the names of all admixtures and dosage rates, and the batch rates. Document and justify minor mix design changes, after the trial batch verification, prior to implementation. This does not include adjustments to compensate for routine moisture fluctuations. Resubmit the mix design for approval of changes in the source of materials, the addition or deletion of admixtures, or changes in cementitious materials.

1.05 PERMITS

A. The Contractor shall obtain and pay for any permits required for the Work specified in this section unless otherwise indicated in Section 01000, 01011, or 01075.

1.06 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01500 Temporary Facilities

F. Section 01570 Traffic Regulation

G. Section 01600 Products

H. Section 01700 Project Closeout

I. Section 02020 Dewatering

J. Section 02025 Existing Utilities and Structures

K. Section 02105 Clearing and Grubbing

L. Section 02230 Stream Crossing

M. Section 02540 Erosion and Sedimentation Control

N. Section 02558 Identification/Location Guide

O. Section 02610 Roadway Paving and Surfacing

P. Section 02620 Gravel Roads and Driveways

Q. Section 02820 Lawn Restoration and Landscaping

R. Section 03305 Cast-in-Place Concrete for Pipe Work

S. Section 03310 Cast-in-Place Concrete for Paving, Driveways, Sidewalks, Curbs, and Paved Ditches

T. Section 15000 Piping – General Provisions

1.07 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

B. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping

C. ASTM F412 – Standard Terminology Relating to Plastic Piping Systems

D. ASTM F1668 – Standard Guide for Construction Procedures for Buried Plastic Pipe

E. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

F. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

G. AWWA Manual M23 - PVC Pipe - Design and Installation.

H. AWWA Manual M55 – PE Pipe Design and Installation

I. Indiana Department of Transportation Standard Specifications (INDOT)

PART 2: PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All pipe bedding and embedment materials (including haunch area fill and initial backfill) shall be stable, sufficiently workable to be readily distributed and placed under the sides of the pipe to provide satisfactory haunching, and readily compactable to achieve required soil densities.

B. All final backfill materials shall be stable, sufficiently workable to be readily distributed and placed in the trench without forming voids, and readily compactible to achieve required soil densities.

2.02 COMMON FILL

A. Common Fill shall be earth materials entirely free of vegetation; refuse; garbage; lumber; construction debris; and soft or organic materials. Large rocks, stones, frozen clods, and other debris greater than 1½ inch (measured in the longest dimension) shall be removed and disposed of off-site or in a location approved by the Engineer prior to placement in the trench. Maximum aggregate (stone or rock) size in Common Fill material used in contact with pipe shall be further limited based on the pipe size as specified in Paragraph 2.04.

B. Common Fill material shall conform to ASTM D2487 using the “Unified Soil Classification System” and shall be one of the following:

1. Class II soil type designation. Class II soil types include GW, GP, SW, and SP (or any soil beginning with one of these symbols) and are described as clean, coarse grained, non-cohesive, well graded soils containing up to 12% fines
2. Class III soil type designation. Class III soil types include GM, GC, SM, and SC (or any soil beginning with one of these symbols) described as clean coarse grained natural soil and ML and CL (or any soil beginning with one of these symbols) described as sandy or gravelly fine grained natural soil material with >=30% retained on a No. 200 sieve.

C. Common fill material may be obtained from the trench excavation provided it has been approved by the Engineer, who may, at his discretion, require testing in accordance with the requirements of Paragraph 1.04 above.

D. Contractor shall furnish the necessary approved common fill materials from an off-site source whenever approved material obtained from the trench excavation is insufficient to complete the backfill.

2.03 SELECT FILL

The following selected granular and aggregate materials shall be used as specified for Select Fill materials:

A. ¾ inch Clean Granular Fill Material shall meet the sieve analysis requirements of AASHTO as follows:

1. 1" sieve passing 100%
2. ½" sieve passing 0-5% and
3. No. 4 sieve passing 0-1%.

B. ¾ inch Minus or Modified Granular Fill Material contains additional fine material and may be used as indicated herein for specific pipe materials or as directed by the Engineer. Material shall meet the sieve analysis requirements of AASHTO as follows:

1. 1" sieve passing 100%,
2. ¾" sieve passing 80-90%,
3. No. 4 sieve passing 25-50%,
4. No. 10 sieve passing 0-20%, and
5. No. 200 sieve passing 0-5%.

C. 1" Coarse Aggregates (i.e. 100% passing 1½" sieve):

1. #53 crushed limestone coarse aggregate as specified in INDOT Section 904.03.
2. #5 or #43 coarse aggregate as specified in INDOT Section 904.03.

D. ¾" Coarse Aggregates (i.e. 100% passing 1" sieve):

1. #73 crushed limestone coarse aggregate as specified in INDOT Section 904.03.
2. #8 coarse aggregate as specified in INDOT Section 904.03.

E. 3/8" and ½" Coarse Aggregates (i.e. 100% passing ¾" sieve):

1. #9 coarse aggregate as specified in INDOT Section 904.03.
2. #11 or #12 coarse aggregate as specified in INDOT Section 904.03.

F. Maximum aggregate size in Select Fill materials used in contact with pipe shall be limited based on the pipe size as specified in Paragraph 2.04.

G. B-Borrow Sand as defined in INDOT Section 211.02 and as follows:

1. No. 4 sieve passing 100% and
2. No. 200 sieve passing 0-10%.

3. INDOT No. 23 and No. 24 Fine Aggregates as specified in INDOT Section 904.02h.
4. INDOT No. 4 Structure Backfill as specified in INDOT Section 904.05, with demonstrated particle gradation within the limits stated in Table 2. Only material that is classified as Unified Soil Classification System soil types SW, SW-SM, or SW-SC may be used as B-Borrow Sand. Poorly-graded sands, including soils classified as SP shall not be used.
5. Table 2- Gradation Requirements for B-Borrow Sand

Table 2 - Gradation Requirements for B-Borrow Sand

Sieve	Minimum %	Maximum %
3/8"	100	100
#4	95	100
#8	80	100
#16	50	80
#30	25	60
#50	7	30
#100	1	10
#200	0	3

2.04 MAXIMUM AGGREGATE SIZE IN CONTACT WITH PIPE

A. Unless otherwise specified below or directed by the Engineer, the maximum aggregate size in Common and Select Fill materials used in contact with pipe shall be limited based on the pipe size (nominal diameter) as follows:

1. For pipes up to 4-inch diameter, the maximum stone or rock size is limited to ½-inch (i.e. 100% passing ½" sieve).
2. For pipes, 6-inch to 8-inch diameter, the maximum stone or rock size is limited to ¾-inch (i.e. 100% passing 1" sieve).
3. For pipes 10-inch to 16-inch diameter, the maximum stone or rock size is limited to 1-inch (i.e. 100% passing 1½" ieve).
4. For pipes larger than 16-inch diameter, the maximum stone or rock size is limited to 1½-inch (i.e. 100% passing 1½" sieve).

2.05 FILTER FABRIC

A. Filter fabric shall be non-woven, synthetic fiber material with sieve design to prevent fine soil particles from migrating through the material. The filter fabric shall have a minimum thickness of 15 mils, tensile strength of 130 lbs., elongation at break of 64%, and trapezoidal tear strength of 70 lbs.

2.06 FLOWABLE FILL

A. Flowable fill (controlled low strength material) shall be a uniform mixture of sand, Type II Portland cement, fly ash, admixtures and water. The mix design shall produce a flowable material with little or no bleed water, which produces a minimum compressive strength of 50 psi and maximum compressive strength of 100 psi at 56 days. The cured material shall be excavatable and have a maximum dry weight of 100 pounds per cubic foot. Slump of mix at the point of application shall be 7-inches to 10-inches.

B. Admixtures specifically designed for flowable fill shall be used to improve flowability, reduce unit weight, control strength development, reduce settlement and reduce bleed water. Admixtures shall be Rheocell-Rheofill by Master Builders, Inc.; Darafill by Grade Construction Products. Cement and all other materials shall be as specified in Section 03305.

C. Fine Aggregate (Sand) shall consist of natural or manufactured siliceous sand, clean and free from deleterious substances, and graded within the following limits:

Sieve Size	Percent Passing by Weight
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100*	2 to 10

*For manufactured sand, the percent passing the No. 100 Sieve may be increased to 20%.

D. Materials are to be measured by weight and/or volumetric methods. The flowable fill may be mixed in a central concrete mixer, a ready mix truck, or by other acceptable methods. The flowable fill shall be transported to the point of placement in a revolving drum mixer or in an agitator unit.

E. The Contractor may be required to provide test data from a laboratory inspected by the Cement and Concrete Reference Laboratory and approved by the governing authority that shows the proposed mix design is in accordance with the requirements listed above.

F. Consistency shall be tested by placing a three inch (3”) diameter by six inch (6”) high open ended cylinder on a smooth, nonporous, level surface and filling it to the top with the flowable fill. Pull the cylinder straight up within 5 seconds of filling and measure the spread of the fill. The minimum diameter of the spread shall be eight inches (8”).

2.07 FOUNDATION MATERIAL

A. Where required, foundation material shall be No. 2 stone or Revetment, Class 1 Riprap, or Uniform Riprap, per INDOT 904.04, or other material appropriate for the conditions, as approved by the Engineer.

2.08 TRENCH DAMS/PLUGS

Trench dams or plugs shall be one of the following:

A. Compacted earthen trench dams or plugs shall consist of compacted, cohesive, impervious soils meeting ASTM D2487 classification GC, SC, CL, or ML, and compacted to 95 percent of maximum density at or near the optimum moisture content (ASTM D698). Compacted trench dams shall be 3 ft. thick (along the pipe).

B. Engineered trench dams shall consist of two parallel fabricated anti-seep collars spaced at least one foot (1') apart (spacing between anti-seep collars shall not be less than the pipe nominal diameter) filled with a well-mixed, engineered core material that consists of rounded stone and dry bentonite clay powder (approximately 80% stone by weight and 20% bentonite by weight). Core material shall be poured in a dry state and shall "flow" around and under the pipe, conforming to the pipe shape and filling voids and inconsistencies in the surrounding soils. Once exposed to water (by natural processes), the hydrated core material shall expand and form a water-tight seal while remaining somewhat flexible. Engineered trench dams shall be by AquaBlok.

C. Trench dams or plugs shall extend the full depth of the bedding and embedment (and at least 12 inches above top of pipe) and the full width of the trench from wall to wall.

PART 3: EXECUTION

3.01 CONSTRUCTION EQUIPMENT

A. All excavation, backfilling, and materials handling equipment shall have rubber tires when mains are located in or adjacent to pavements unless otherwise approved by the Engineer and authorities with jurisdiction. Track equipment will generally be permitted only when there is no danger of damaging pavement or when all pavement will be replaced under the Contract promptly following pipeline installation.

B. It is the Contractor's responsibility, to repair, at their expense, any damages due to the use of any equipment to complete the Work.

3.02 NOISE, DUST AND ODOR CONTROL

A. Conduct all construction activities so as to avoid all unnecessary noise, dust and odors.

B. Contractor shall take all necessary measures to control dust from his operations and to prevent spillage of excavated materials onto public roads.

C. Appropriate measures acceptable to the Owner and applicable federal, state, and local authorities shall be taken to prevent blowing dust. Contractor shall sprinkle water at locations and in such quantities and at such frequencies as may be required by the Owner to control dust and prevent it from becoming a nuisance to the surrounding area.

D. Contractor shall remove all spillage of excavated materials, debris, and dust from public roads by methods approved by the Owner.

E. Contractor shall operate and maintain equipment with the proper mufflers, baffles, panels, and other sound-attenuating devices in place and in good operating condition so as to control noise levels in the work area.

F. Contractor shall take any other reasonable measures required by the Owner to control noise and prevent it from becoming a nuisance to the surrounding area.

3.03 PROTECTION OF TREES

A. Clearing and grubbing shall comply with the requirements of Section 02105.

B. Take special care to avoid damage to trees and their root system. Open trenching shall not be used near established trees in areas marked on the Drawings and designated “Tree Protection”. In a “Tree Protection” open-cut excavation shall be provided by hand exposing and excavation around existing tree roots, and/or tunneling or boring.

C. In other areas where established trees are to remain with roots in the path of the trench line, as indicated on the Drawings or otherwise required, the Contractor shall install pipe through tree roots by acceptable means approved by the Engineer. In these areas, methods to be used may include careful cutting (not ripping or tearing) of larger tree roots if authorized by the Engineer.

D. In all cases, operate equipment within the drip line in a manner that will not injure trees, trunks, branches, or their roots. Extra care shall be taken when employing booms, storing materials, and handling excavated materials.

E. Contractor is solely responsible for tree replacement damaged as a result of the Work and all construction activities.

3.04 TRENCH SUPPORT

A. Support open cut excavation for mains where trenching may cause danger to life, unnecessary damage to street pavement, trees, structures, poles, utilities, or other private or public property. Support the sides of the excavation by adequate and suitable sheeting, shoring, bracing or other approved means in accordance with all applicable Federal, State, County, Municipal, and OSHA rules and regulations during the progress of the Work.

B. Maintain the trench support materials and equipment in place until backfilling operations have progressed to the point where the supports may be withdrawn without endangering life or property per General Conditions Article 6 on safety issues.

C. Contractor is solely responsible for trench support and safety of the work area and all construction activities. Refer to requirements of Section 15000.

3.05 TRENCH EXCAVATION AND BOTTOM PREPARATION

A. General Earth Excavation:

1. General excavation shall consist of the satisfactory removal and disposal of all material taken from within the limits of the Work contracted, meaning the material lying between the original ground line and the finished ground line as shown on the Drawings regardless of whether the original ground line is exposed to air or is covered by water. Excavation below existing ground line to enable any required construction or removals is included. It is distinctly understood that any reference to earth, rock, silt, debris or other materials on the Drawings or in the Specifications is solely for information and shall not be taken as an indication of classification of excavation or the quantity of earth, rock, silt, debris or other material encountered.
2. Excavate to the lines and grades indicated on the Drawings or established in the field by the Engineer. Backfill and compact over-excavated areas with approved fill material. All labor and materials associated with over-excavation shall be furnished at the Contractor's expense.
3. Keep all excavations free from water. Maintain groundwater a minimum of 6 inches below excavations in accordance with Section 02020. Remove soil which is disturbed by pressure or flow of groundwater and replace with free draining material.
4. Remove pavement over excavations made in paved roadways by saw cutting, milling, or removal by a trench machine. Cut the full depth of the pavement with straight lines and squared edges. Pavement cuts are to be continuous lines, minimizing horizontal offsets as shown on the Drawings and approved by the Engineer. Saw cuts may be eliminated where paving abuts curb or roadway expansion joints or construction joints, and pavement can be removed without damaging or disturbing curbs or remaining pavement. Remove sidewalks in full squares only. Saw cut sidewalks straight and perpendicular if no joint exists.
5. The Contractor shall be required to remove and dispose off-site all excess excavated materials, spoils and debris, and excavated materials unsuitable for backfilling. If spoils and debris are removed from the right of way under the jurisdiction of the State of Indiana, they must be disposed of in an approved INDOT certified dump site.

B. Rock Excavation:

1. If the Contract includes a unit price for rock excavation, the unit price shall include the removal, hauling, stockpiling and/or proper disposal of the rock per Section 01075 Basis of Payment. Rock is defined as:
   a. Boulders or loose rock having a volume of one cubic yard or more;
   b. Material which cannot be loosened or broken down by ripping with a hydraulic ripper or other Engineer-approved devices and equipment designed to remove rock; or
   c. Material that requires systematic blasting, backhoe ramming, barring, or wedging for removal.
2. Notify the Engineer promptly upon encountering rock. No payment will be made for rock removed without Engineer's approval.
3. Strip rock for measurements as directed by the Engineer. No payment will be made for rock excavated or loosened before measurement. Only rock actually removed will be paid for. Payment width shall be a maximum of pipe barrel plus 24 inches (12 inches each side of pipe). Unless otherwise shown on the Drawings, the payment depth shall be 6 inches below bottom of pipe, unless additional depth has been removed at the direction of Engineer. The Engineer's determination as to whether the material meets the definition of rock and Engineer's measurement of the volume of rock removal for which the Contractor is entitled to payment will be final and conclusive.

C. Trench Width:

Widths of trenches shall be held to a minimum to accommodate the pipe and appurtenances and permit proper installation and joint assembly. The trench width shall be measured at the top of the pipe barrel and shall conform to the following limits:

<u>Earth:</u>

Minimum:	Outside diameter of the pipe barrel plus 8 inches (i.e. 4 inches each side).
Maximum:	Nominal pipe diameter plus 24 inches (i.e. 12 inches each side).

<u>Rock:</u>

Minimum:	Outside diameter of the pipe barrel plus 24 inches (i.e. 12 inches each side).
Maximum:	Nominal pipe diameter plus 30 inches. (Contractor will only be compensated for the minimum described above.)

D. Excessive Trench Width:

Provide additional backfill, embedment, and bedding material, as specified above and as approved by the Engineer, to fill any trench excavation that exceeds the maximum trench width defined in Paragraph 3.05.E.

E. Trench Depth and Bottom Preparation:

1. Provide prescribed minimum cover from the top of the pipe barrel to the top of the finished grade, unless otherwise authorized by the Engineer, or as shown on the Drawings.
2. Earth: Excavate to the depth required, so as to provide a uniform and continuous bearing and support for the pipe barrel on solid and undisturbed ground at every point between joints. It will be permissible to disturb the finished trench bottom over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle, provided such disturbed areas are filled with the embedment material. Provide bell holes at each bell joint. Prepare the finished trench bottom accurately using hand tools. When required for the pipe material, excavate to sufficient depth to allow for the required bedding; and prepare a pipe bed using bedding material as specified for the pipe material.
3. Rock: Excavate trenches in rock or boulders 6-inches below the pipe barrel unless otherwise directed by the Engineer. Remove all loose material from the trench bottom. Prepare a pipe bed using bedding material as specified for the pipe material.
4. For both earth and rock excavation, a bedding shall be constructed if the trench bottom contains alternating hard and soft areas or rock particles larger than permitted in the embedment material. In such cases, Contractor shall excavate to sufficient depth to allow for the required bedding as specified for the pipe material and prepare a pipe bed using bedding material as specified for the pipe material. Contractor shall perform continuous evaluation of the trench bottom in areas with changing conditions.
5. Unsuitable Bottom: Notify the Engineer whenever fluid or unstable trench subgrade (i.e. unsuitable material incapable of supporting the pipe without settlement, differential settlement, or soil displacement) is found. Remove the material over the area and to the depth determined by the Engineer. Provide compacted foundation and/or bedding material as directed to restore the trench bottom to the required grade in these areas. Where foundation material is used, prepare a pipe bed on top of the foundation using bedding material as specified for the pipe material.

F. Open Trench Length:

The length or size of excavation shall be controlled by the pipe laying length and the particular surrounding conditions, but shall always be confined to that which can be safely maintained and does not unreasonably restrict access. The length of open trench required for installation of fused HDPE pipe shall be in accordance with AWWA Manual M55. The Owner and Engineer reserve the right to limit the length or size of the excavation. If the excavation becomes a hazard, or if it excessively restricts traffic or other access at any point, Owner or Engineer may require special construction procedures, such as limiting the length of the open trench or prohibiting placing excavated material in the street. Contractor shall take precautions to prevent hazard or injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles accessible to the public, shall be well lighted.

3.06 GENERAL TRENCH BEDDING, EMBEDMENT, AND BACKFILL REQUIREMENTS

A. **General Requirements:**

1. Wherever specific materials are stated on the Drawings for bedding, embedment, and/or backfill, those requirements supersede the material requirements indicated in this section, unless such requirements conflict with backfill requirements of governing authorities.
2. Mechanical equipment may be used to place the bedding, embedment, and backfill materials. Place the materials in such a manner that the materials do not free fall, but rather flow onto the previously placed material. Crushed aggregate and other materials with angular stones larger than ¾-inch (measured in largest dimension) shall not be dumped directly onto the pipe (regardless of pipe material).
3. When trench walls are supported by trench boxes or other temporary devices (e.g. sheeting, bracing, shoring, etc.), do not compact bedding or embedment materials against the walls of the trench supports and then move the supports, which would compromise the structural integrity of the pipe. Follow appropriate procedures to ensure that compaction within the pipe bedding and embedment zones is performed for the full width between the trench walls and subsequently undisturbed.
4. Do not compact embedment or backfill with mechanical equipment such as wheeled vehicles until cover depth over the pipe exceeds requirements to prevent damage to the pipe, as recommended by the most stringent applicable standard or manufacturer's recommendations.
5. For pipe installation under roads or within road rights-of-way, maximum lift thickness and compaction densities shall further meet requirements of the governing authority, which may be more stringent.

B. **Bedding:**

1. All pipe and fittings shall be uniformly and continuously supported over the entire length on firm, stable material. Bedding shall be compacted by appropriate, approved compaction methods and to appropriate density for the bedding material type as indicated in the applicable standard(s) referenced in Part 1 above or as directed by the Engineer.
2. Prepare pipe bedding immediately before pipe is installed.
3. It will be permissible to disturb the finished bedding over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle, provided such disturbed areas are filled with the embedment material. Provide bell holes at each bell joint.
4. Blocking shall not be used under piping except as specifically required in other sections.

C. **Embedment (Haunch Area and Initial Backfill):**

1. The embedment is the most important zone in terms of pipe performance. The pipe embedment shall be stable and placed in such a manner as to evenly support and physically shield the pipe from damage. Embedment material in the haunch area (from the bottom of the pipe to the pipe springline) provides the most resistance to pipe deflection and is essential to the integrity of flexible pipe. Initial backfill provides some pipe support and helps protect the pipe from damage.
2. Embedment material in the haunch area shall be placed under the pipe haunches by dumping and slicing with a shovel and hand tamping to fill all voids. Extra care shall be taken to ensure all voids are filled when using crushed aggregate.
3. Embedment materials shall be placed in compacted layers (or lifts) not exceeding 6-inches each, in such manner as to completely fill all voids and eliminate the possibility of settlement.
4. Compaction shall be performed by appropriate compaction methods, in appropriate lift thicknesses, and to appropriate densities for the embedment material type as indicated in the applicable standard(s) referenced in Part 1 above or as directed by the Engineer.
5. Distribute material on both sides of the pipe evenly to maintain alignment. Do not allow more than half the pipe diameter or one lift thickness (maximum 6") difference in elevation of the material on opposite sides of the pipe.
6. Maintain pipe alignment. When placing fill in the haunch area and initial backfill, take care to avoid moving the pipe or damaging pipe or joints. When compacting material in the haunch area, prevent pipe from raising due to the compaction effort.
7. Do not dump embedment material into a large pile in the trench prior to spreading it into layers for compaction.

D. **Final Backfill**

1. Place final backfill in approximately-uniform compacted layers (or lifts) not exceeding 12 inches each, in such manner as to fill the trench completely so that there are no voids and no settlement occurs. Final backfill is critical to the integrity of roads, driveways, parking areas, sidewalks, and structures. Under or within five feet (5') of driveways, roads, parking areas, sidewalks, or structures, maximum lift thickness shall not exceed 6 inches.
2. Compaction shall be performed by appropriate compaction methods in appropriate lift thicknesses not exceeding those indicated in the below schedule, and to at least the densities specified below, which refer to percentages of maximum density as determined by the noted test methods, for the backfill material type and the finished surface type. In cases where the applicable standard(s) referenced in Part 1 above are stricter or as otherwise directed by the Engineer, those requirements shall govern.

	Density % Std. Proctor (D698)	Density % Mod. Proctor (D1557)	Max. Lift Thickness as Compacted Inches
Backfill Around Structures	95	92	8
Select Sand	--	98	8
Crushed Stone Pipe Bedding	**	**	12
Backfill in Pipe Trenches – Open Terrain (Including Lawns and Other Grass Areas)	95	92	12
Backfill in Pipe Trenches – Under Roadways*, Driveways, Parking Lots, Sidewalks, Curbs, and Other Paved or Concreted Areas	98	95	8

* Backfill and compaction within five feet (5') horizontally of roadways shall be the same as under roadways.

** The aggregate shall be compacted to a degree acceptable to the Engineer by use of a vibratory compactor and/or crawler tractor.

3. Each layer shall be sufficiently compacted during backfill operations to uniformly develop lateral passive soil forces such that all trench backfilling shall be stable with surrounding soil and no settlement of adjacent soils or structures occurs.

E. **Filter Fabric**

1. Contractor shall install filter fabric at all interfaces between coarse and fine materials in the following situations:

   a. in areas with visible or otherwise known or suspected groundwater movement

   b. anywhere fine or soft consistency soils are encountered, bedding material shall be wrapped in filter fabric (trench bottom, side, and over top of haunch area) to prevent the migration of finer grained soils into this material or the migration of this material into the trench bottom or sidewall

   c. prevent migration of soil fines into, out of, or between layers of the embedment material

   d. when using ¾ inch minus or modified granular fill for bedding or embedment in coarse-graded soils to prevent fine particles from eroding into the surrounding soils

   e. if trench excavation is in unsuitable soils that extend above the foundation, Contractor shall place filter fabric between the unsuitable soils and all bedding, embedment, and backfill materials

   f. where required by the Drawings

   g. where directed by the Engineer

F. **Trench Dams/Plugs**

1. Under any of the following conditions, Contractor shall install trench dams or plugs. Trench dams shall be installed at intervals as shown on the Drawings or as directed by the Engineer (but not to exceed spacing of 400 ft.).
2. On both sides of any lake, pond, river, creek, or stream crossing installed by open-cut methods.
3. When any Select Fill bedding and/or embedment material is used in any of the following cases:
   a. Areas with known or suspected groundwater movement.
   b. Areas with maximum annual groundwater level above the bottom of the trench (excluding foundation).
   c. If subsurface flowing water is intercepted by the trench, trench dams shall be installed on both sides.
4. Where required by the Drawings.
5. Where directed by the Engineer.

3.07 BEDDING, EMBEDMENT, AND BACKFILLING – OPEN TERRAIN (INCLUDING LAWNS AND OTHER GRASS AREAS)

A. **Ductile Iron Pipe:**

1. Bedding:
   a. In Suitable Soil – When trench subgrade is free of rock particles larger than permitted in the embedment material, consistent (i.e. free of alternating hard and soft areas), and suitable to support the pipe without settlement, differential settlement, or soil displacement, bedding is not required (unless indicated on the Drawings or required in Section 01000, 01011, and/or 01075). When no bedding is required, pipe shall be laid directly on undisturbed soil prepared as specified in paragraph 3.05 G. 2.
   b. In Rock or Unsuitable Soil – Bedding shall consist of Common Fill or a Select Fill material having a maximum aggregate size as specified in Part 2 for the pipe size, with a minimum bedding depth of 4 inches.
   c. Regardless of the native soils, when pipe cover depths exceed the following limits, bedding shall consist of any Select Fill material, having a maximum aggregate size as specified in Part 2 for the pipe size, with a minimum bedding depth of 6 inches.
      i. 3” and 4” diameter: >60 ft. depth
      ii. 6” diameter: >30 ft. depth
      iii. 8” diameter: >20 ft. depth
      iv. 10” and 12” diameter: >15 ft. depth
      v. 16” and larger diameter: >10 ft. depth
2. Embedment:
   a. Haunch Area – Fill used in haunch areas shall consist of Common Fill or any Select Fill material having a maximum aggregate size as specified in Part 2 for the pipe size. However, where pipe bedding is provided, the

same material that is used for the bedding shall also be used in the haunch area.

b. Initial Backfill (to top of pipe) – Initial backfill shall consist of Common Fill or any Select Fill material having a maximum aggregate size as specified in Part 2 for the pipe size.

c. For any ductile iron pipe installed with cover depth exceeding the following limits, embedment shall be as shown on the Drawings or directed by the Engineer as designed for the specific conditions.

i. 8" and smaller diameter: >30 ft. cover.

ii. 10" to 20" diameter: >25 ft. cover.

iii. 24" and Larger diameter: >20 ft. cover.

3. Final Backfill:

a. Final backfill shall be Common Fill. Surface restoration (including topsoil where applicable) shall be in accordance with the applicable Specification section.

B. **PVC Pipe:**

1. Bedding:

a. Bedding shall consist of any Select Fill non-crushed, coarse aggregate (including ¾ inch Clean Granular Fill) having a maximum aggregate size as specified in Part 2 for the pipe size or B-Borrow Sand, with a minimum bedding depth of 6 inches.

b. ¾ inch Minus and Modified Granular Fill Material is not permitted for bedding under PVC pipe.

c. Aggregate over ¾-inch with angular edges shall not be used in contact with PVC pipe, regardless of pipe size.

2. Embedment:

a. Haunch Area – Fill used in haunch areas shall be the same Select Fill non-crushed, coarse aggregate or B-Borrow Sand used for the pipe bedding. ¾ inch Minus and Modified Granular Fill Material or aggregate over ¾ inch with angular edges are not permitted in the haunch area for PVC pipe.

b. Initial Backfill (to 12-inches above top of pipe) – Initial backfill shall consist of any non-crushed Select Fill material or B-Borrow Sand having a maximum aggregate size as specified in Part 2 for the pipe size. Aggregate over ¾ inch with angular edges are not permitted for initial backfill of PVC pipe.

c. For any PVC pipe installed with cover depth exceeding the following limits, embedment shall be as shown on the Drawings or directed by the Engineer as designed for the specific conditions.

I. DR 14 (<=12" size): >25 ft. cover.

3. Final Backfill:

a. Final backfill shall be Common Fill. Surface restoration (including topsoil where applicable) shall be in accordance with the applicable Specification section.

C. **HDPE Pipe:**

1. Bedding:
   a. Bedding shall consist of any Select Fill material having a maximum aggregate size as specified in Part 2 for the pipe size, with a minimum bedding depth of 6 inches.
2. Embedment:
   a. Haunch Area – Fill used in haunch areas shall be the same Select Fill material used for the pipe bedding.
   b. Initial Backfill (to 6-inches above top of pipe) – Initial backfill shall consist of the same Select Fill material used in the haunch area.
   c. For any HDPE pipe installed with cover depth exceeding the following limits, embedment material shall be as shown on the Drawings or directed by the Engineer as designed for the specific conditions.
      i. DR 11 (any size): >20 ft. cover.
      ii. DR 9 or DR 7.3 (>12" size): >20 ft. cover.
      iii. DR 9 or DR 7.3 (<=12" size): >25 ft. cover.
3. Final Backfill:
   a. Final backfill shall be Common Fill. Surface restoration (including topsoil where applicable) shall be in accordance with the applicable Specification section.

3.08 BEDDING, EMBEDMENT, AND BACKFILLING – UNDER OR WITHIN FIVE FEET OF ROADWAYS, DRIVEWAYS, PARKING LOTS, SIDEWALKS, AND OTHER PAVED OR CONCRETED AREAS (AND LOCATIONS WHERE FLOWABLE FILL IS USED AS FINAL BACKFILL)

Local City/Town standards may specify backfilling materials in conjunction with those specified below and shall be met by the Contractor.

A. **Ductile Iron Pipe (All Sizes):**

1. Bedding:
   a. Bedding shall consist of any Select Fill material having a maximum aggregate size as specified in Part 2 for the specified pipe diameter with a minimum bedding depth of 4 inches.
2. Embedment (Haunch Area and Initial Backfill to Top of Pipe):
   a. Fill used for pipe embedment shall be the same Select Fill material used for the pipe bedding. No other materials are permitted for pipe embedment.
   b. For any ductile iron pipe installed with cover depth exceeding the following limits, embedment shall be as shown on the Drawings or directed by the Engineer as designed for the specific conditions.
   c. 8" and smaller diameter: >30 ft. cover.
   d. 10" to 20" diameter: >25 ft. cover.
   e. 24" and Larger diameter: >20 ft. cover.

f. Final Backfill:

3. Final backfill shall be #53 crushed limestone coarse aggregate. Surface restoration (including topsoil where applicable) shall be in accordance with the applicable Specification section.

B. **Plastic Pipe (PVC or HDPE) 10" to 12":**

1. Bedding:
   a. Bedding shall consist of any Select Fill material having a maximum aggregate size as specified in Part 2 for the specified pipe diameter with a minimum bedding depth of 6 inches.
   b. Aggregate over ¾-inch with angular edges shall not be used in contact with PVC pipe.
   c. B-Borrow Sand

2. Embedment (Haunch Area and Initial Backfill):
   a. Fill used for pipe embedment shall be the Select Fill material used for the pipe bedding. No other materials are permitted for pipe embedment. Aggregate over ¾-inch with angular edges shall not be used in contact with PVC pipe.
   b. For any PVC pipe installed with cover depth exceeding the following limits, embedment shall be as shown on the Drawings or directed by the Engineer as designed for the specific conditions.
      i. DR 14 (10" to 12" size) : >25 ft. cover.
   c. For any HDPE pipe installed with cover depth exceeding the following limits, embedment material shall be as shown on the Drawings or directed by the Engineer as designed for the specific conditions.
      i. DR 11 (any size): >20 ft. cover.
      ii. DR 9 or DR 7.3 (>12" size): >20 ft. cover.
      iv. DR 9 or DR 7.3 (<=12" size): >25 ft. cover.

3. Final Backfill:
   a. Final backfill shall be #53 crushed limestone coarse aggregate. Surface restoration (including topsoil where applicable) shall be in accordance with the applicable Specification section.

C. **Plastic Pipe (PVC or HDPE) Smaller than 10":**

1. Bedding:
   a. Bedding shall consist of any Select Fill material having a maximum aggregate size as specified in Part 2 for the pipe size, with a minimum bedding depth of 6 inches. If required by the Engineer or governing authority, bedding material shall be crushed coarse aggregate having a maximum aggregate size as specified in Part 2 for the pipe size.
   b. Aggregate over ¾-inch with angular edges shall not be used in contact with PVC pipe.

2. Embedment (Haunch Area and Initial Backfill):
   a. Fill used for pipe embedment shall be the same Select Fill material (or the same crushed coarse aggregate, if required by the Engineer or governing

authority) used for the pipe bedding. Aggregate over ¾-inch with angular edges shall not be used in contact with PVC pipe.

b. For any PVC pipe installed with cover depth exceeding the following limits, embedment shall be as shown on the Drawings or directed by the Engineer as designed for the specific conditions.
   i. DR 14 (<=10" size): >25 ft. cover.

c. For any HDPE pipe installed with cover depth exceeding the following limits, embedment material shall be as shown on the Drawings or directed by the Engineer as designed for the specific conditions.
   i. DR 11 (any size): >20 ft. cover.
   ii. DR 9 or DR 7.3 (<=12" size): >25 ft. cover.

3. Final Backfill:
   a. Final backfill shall be #53 crushed limestone coarse aggregate. Surface restoration shall be in accordance with the applicable Specification section.

3.09 SPECIAL BACKFILLING USING FLOWABLE FILL

Flowable fill shall be used for final backfill (not for pipe bedding or embedment) if required by the governing authority (e.g. if required by the right of way excavation permit) or at the Contractor's option in lieu of the above requirements for backfilling under or within five feet (5') of driveways and roads.

A. Bedding and Embedment:

   1. When flowable fill is used for final backfill, pipe bedding and embedment shall be as specified above for installations under or within five feet (5') of roadways, driveways, and other paved and concreted areas.

B. Final Backfill:

   1. Final backfill shall be flowable fill. Surface restoration shall be in accordance with the applicable Specification section.

   2. Placement: Discharge the mixture from the mixing equipment into the space to be filled by a means approved by the Engineer. The flowable fill shall be brought up uniformly to the fill line. Each filling stage shall be as continuous as practicable. Do not place concrete on the flowable fill until all bleeding water has disappeared and the resistance, as measured by ASTM C403, is at least 60 psi, or as directed by Engineer. Do not place asphalt until at least 24 hours after the fill is completely in place.

   3. Limitations: Do not place flowable fill on frozen ground. Protect flowable fill from freezing until the material has stiffened and bleeding water has disappeared. As the temperature nears freezing, additional curing time shall be allowed as needed or as required by the Engineer.

C. When Contractor uses this method at his discretion in lieu of final backfill as specified above, it shall be provided at no additional cost to the Owner.

3.10 MAINTENANCE OF SURFACE CONDITIONS

Attend to the trench surface regularly during the course of the Contract. Take prompt corrective measures to correct any settlement or wash-out. Maintain the trench surface in a safe condition that does not interfere with natural drainage. Any material required for backfilling the trenches or for filling depressions caused by settlement or wash-out shall be supplied and placed by the Contractor at his expense.

3.11 TRENCH MAINTENANCE

Contractor shall be fully responsible for the condition of the trenches for a period of one (1) year from the date of the final acceptance of the Contractor's Work, or as required by federal, state, or local authorities. Any materials required for filling depressions caused by settlement or wash-out shall be supplied and placed by the Contractor at their expense.

END OF SECTION

SECTION 02220

CASING INSTALLATION

PART 1: GENERAL

1.01 SCOPE OF WORK

The work under this section consists of providing all labor, materials, tools, equipment, and services required to perform all casing installation and related work as indicated on the Drawings and as specified within this section and related sections of the Specifications. Contractor shall furnish and install all products that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

1.02 GENERAL REQUIREMENTS

A. The installation of casing pipe shall conform to these Specifications and any Federal, State or local Highway requirements or applicable Railroad requirements whichever may be more restrictive.

B. Contractor shall perform any general excavation and boring required prior to placing casing pipe. Material resulting from boring shall be disposed of off-site by the Contractor in a suitable manner. Contractor shall provide all necessary access including access ladders, ramps, etc. to bore and receiving pits in compliance with all applicable safety requirements prior to the commencement of the boring and jacking operations.

C. Contractor shall furnish the names and experience records of all Subcontractors proposed for this Work. The Contractor or Subcontractor performing the boring and jacking construction shall have a minimum of three (3) years' experience in boring and jacking casing pipe on similar projects of similar pipe diameters.

D. Highway crossings shall comply with standards set forth in the INDOT policies and procedures, Division of Highways (latest revision), and the "Standard Specifications for Highway Bridges" from AASHTO (latest revision).

E. Railway crossings shall comply with standards set forth under "Standard Specifications for Pipelines Conveying Non-Flammable Substances" in the *Manual of Railway Engineering* from the American Railway Engineering and Maintenance-of-Way Association,

F. The materials covered by these Specifications are intended to be standard materials of proven reliability and as manufactured by reputable manufacturers having experience in the production of such materials. The materials furnished shall be designed, constructed, and installed in accordance with the best practices and methods.

1.03 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, certifications, and other required submittals for all products furnished under this section in accordance with Section 01300, including the following:

A. Casing pipe Shop Drawings and material data from casing pipe manufacturer.

B. Bore pit excavation details including footprint drawing of bore pit, design and calculations for any sheeting or shoring utilized signed and sealed by a professional engineer registered in the State of Indiana.

C. Construction sequence plan including drilling, casing, and grouting placement procedures.

D. Casing spacer manufacturer's data and Shop Drawings.

E. Casing end seal manufacturer's data and Shop Drawings.

F. Casing field weld procedure details to be used, which shall be in accordance with AWWA C206 Sec. 4.6.

G. Experience qualifications of Contractor or Subcontractor.

H. Results of welder qualification testing conducted by an independent testing agency in accordance with American Welding Society D1.1 requirements. Results of previous qualification tests performed within six months from the date of pipe installation will be acceptable. Results from qualification tests performed prior to six months from the date of pipe installation will not be acceptable.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01500 Temporary Facilities

F. Section 01570 Traffic Regulation

G. Section 01600 Products

H. Section 02020 Dewatering

I. Section 02025 Existing Utilities and Structures

J. Section 02105 Clearing and Grubbing

K. Section 02210 Trenching, Backfilling and Compacting

L. Section 02230 Stream Crossing

M. Section 02540 Erosion and Sedimentation Control

N. Section 02558 Identification/Location Guide

O. Section 02610 Roadway Paving and Surfacing

P. Section 02620 Gravel Roads and Driveways

Q. Section 02820 Lawn Restoration and Landscaping

R. Section 03310 Cast-in-Place Concrete for Paving, Driveways, Sidewalks, Curbs, and Paved Ditches

S. Section 15000 Piping – General Provisions

T. Section 15105 Ductile Iron Pipe & Fittings

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASTM A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

B. ASTM A139 – Electro-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)

C. AWWA C200 – Steel Water Pipe, 6 In. and Larger

D. AWWA C206 – Field Welding of Steel Water Pipe

E. AWWA C600 – AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances

F. AASHTO "Standard Specifications for Highway Bridges"

G. INDOT policies and procedures

H. *Manual of Railway Engineering*, The American Railway Engineering and Maintenance-of-Way Association

PART 2: PRODUCTS

2.01 CASING PIPE

A. The casing pipe shall be smooth wall, longitudinally-rolled or spiral welded steel pipe. Smooth wall steel plates with a nominal diameter of over 54 inches shall not be permitted. Casing pipe shall be leak-proof construction and be capable of withstanding highway or railroad loadings where applicable. Casing pipe shall be steel pipe in sizes 8-inches nominal and larger manufactured from steel having a minimum yield stress strength of 35,000 psi.

B. The steel casing pipe diameter and wall thickness shall be as indicated in the table below or as indicated on the Drawings, whichever is larger. All casing thicknesses are for uncoated casings. The inside diameter of the casing pipe shall be at least four (4) inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe less than six (6) inches in diameter and at least six (6) inches greater than the outside diameter of the carrier pipe joints or couplings for carrier pipe six (6) inches and greater in diameter. Contractor shall ensure that casing pipe size is large enough to comply with these requirements and to afford easy removal of the carrier pipe without disturbing the casing pipe or roadbed. Consideration shall be given to the specific pipe product, joint types, joint restraints, and casing spacers to be used. If larger casing pipe size than indicated in the following table is necessary, Contractor shall provide the larger casing pipe at no additional cost to the Owner.

Casing Outside Diameter (inches)	Carrier Pipe Nominal Sizes Allowed (inches)	Casing Wall Thickness (inches)	
		Highway Crossings	Railroad Crossings
8.625	<=2	0.250	0.250
10.75	<=2	0.250	0.250
12.75	<=3	0.250	0.250
14	<=3	0.250	0.281
16	<=4	0.250	0.375
18	<=6	0.250	0.375
20	<=8	0.3125	0.375
22	<=10	0.375	0.375
24	<=12	0.375	0.406
30	<=16	0.500	0.469
36	<=20	0.500	0.532
42	<=24	0.5625	0.688
48	<=30	0.625	0.688
54	<=36	0.719	0.781
60	<=42	0.719	0.844
66	<=48	0.750	0.938
72	<=54	0.750	1.000

C. The casing pipe shall conform to AWWA C200 and ASTM A139, Grade B (without hydro-test) or ASTM A53, Grade B (without hydro-test).

2.02 SPLIT CASINGS

In locations where a casing is required to be installed around an existing water main, the Contractor shall install one of the following casing types:

A. Steel casing pipe as specified above, which is cut into two equal halves longitudinally (along the length of the pipe) by the supplier prior to shipment to the project site. The two halves shall be assembled over the existing water main, with casing spacers already installed; and the casing pipe shall be welded along the seam as specified herein. Only stainless steel casing spacers shall be used when this type of split casing is used (since plastic coatings could be damaged by welding of casing).

B. Split steel casings with weldable split sleeve and weld protection liner, to protect the carrier pipe and casing spacers, as manufactured by Westatlantic Tech Corp. Except when flanged gasketed maintenance pipe casing is used, all split casings installed on carrier pipes made of PVC, HDPE, fiberglass and other materials potentially subject to damage from welding shall be split steel casings with weld protection liners unless otherwise approved by the Engineer.

2.03 CARRIER PIPE

In cases where required by the Drawings or otherwise approved by the Engineer, water tight split casings shall be flanged gasketed galvanized steel maintenance pipe with EPDM or NBR seals and bolted, flanged fasting joints. End seals shall be supplied by the casing manufacturer and shall be water tight unless otherwise indicated on the Drawings. Flanged gasketed maintenance pipe shall be as manufactured by Westatlantic Tech Corp.

A. The carrier pipe shall be ductile iron restrained joint pipe as specified in Section 15105, unless otherwise indicated in Section 01011 or shown on the Drawings.

2.04 GROUT

A. Grout shall be composed of Portland Cement and sand, consisting of one part Portland Cement to three parts sand. Sand shall conform to the requirements of ASTM C144. Water amount shall be the minimum amount necessary to achieve desired consistency without compromising strength requirements. The minimum compressive strength at 28 days shall be 4000 psi.

B. For annular spaces wider than 1-1/2 inch and/or where free passage of grout will not be obstructed by coarse aggregate, 1-1/2 parts of coarse aggregate having a top size of 3/8 inch should be added.

C. Contractor or boring Subcontractor may use admixture approved by the Engineer to allow workability of grout at his option and at no additional cost to the Owner.

2.05 CASING SPACERS

A. Casing spacers shall be sized according to the manufacturer's specifications for pipe sizes from the following list of approved manufacturers and casing types:

1. Cascade Water Works Manufacturing Company (Stainless Steel only).
2. Pipeline Seal and Insulator, Inc. (Carbon Steel with polyvinyl chloride or the Ranger II model).
3. Advanced Products and Systems, Inc. (Model SI).
4. Power Seal Pipeline Products Corp. (Model 4810).
5. RACI (polyethylene model F-60 for 12-inch carrier pipe and smaller). RACI shall not be used for carrier pipe larger than 12-inch.

B. At the sole discretion of the Engineer, alternate manufactures in lieu of those described above and new or improved products by the same manufactures may be permitted. To seek approval, adequately describe any proposed alternate product and submit the same with Shop Drawings and specifications to the Engineer. The Contractor shall not proceed to employ said alternate products prior to receiving written approval of from the Engineer.

C. Timber skids are not allowed.

2.06 CASING END SEALS

A. End seals shall consist of pull-over type rubber seals that are designed to be installed after pipe installation by wrapping the seal around the pipes and securing the overlapping seam with pressure-sensitive butyl mastic (or other approved adhesive) to seal the seam.

B. End seals shall be at least 1/8-inch thick EPDM or Neoprene rubber.

C. End seals shall be attached to the casing and carrier pipe with Type 304 or 316 stainless steel bands, at least ½-inch wide, with entirely non-magnetic worm gear mechanism.

D. End seals and bands shall be properly sized for the casing and carrier pipe with the manufacturer's recommended seam overlap.

E. Acceptable Manufacturers:

1. Cascade Waterworks Manufacturing Model CCES
2. Advance Products Systems Model AW

PART 3: EXECUTION

3.01 EXCAVATION

Excavation, backfilling and compaction for jacking and receiving pits and for open cut installation shall conform to the requirements set forth in Section 02210.

3.02 ALIGNMENT AND GRADE

Locate pipelines to cross roadways or tracks at approximately right angles where practicable, but preferably at not less than 45 degrees. Do not place pipelines in culverts or under bridges where there is a likelihood of their restricting the area required for the purposes for which the bridges or culverts were built, or of endangering the foundations. Install the casing pipe on an even grade for its entire length and sloped to one end or as noted in a profile plan if provided. Satisfy a maximum tolerance of 1.5% (18” in one hundred feet) with the desired location of the casing or as otherwise required by regulation or specified on the Drawings, whichever is more restrictive.

3.03 WELDING

A. Connect steel casing sections by full-circumference metal arc-welding. All joints shall be butt welded with a full depth, single "V" groove weld. Welding shall conform to AWWA Standard C206.

B. Welding shall be performed by certified welders. The Contractor shall be responsible for the qualification of welders with qualification testing conducted by an independent testing agency in accordance with American Welding Society D1.1 requirements. All costs associated with qualification testing shall be included in the unit prices bid.

3.04 DEPTH OF INSTALLATION

Unless the depth of casing pipe is specifically specified on the Drawings, the casing pipe depth shall be in accordance with highway or railroad requirements.

3.05 INSTALLATION OF CASING

Refer to Indiana American Water Standard Detail Drawings for a typical casing installation detail.

Install casing pipes by one of the following methods:

A. Jacking:

This method shall be in accordance with the current American Railway Engineering and Maintenance-of-Way Association Specifications, Chapter 1,

Part 4, Section 15, "Earth Boring and Jacking Culvert Pipe through Fills", except that steel pipe shall be used with welded joints. Conduct this operation without hand mining ahead of the pipe and without the use of any type of boring, auguring or drilling equipment.

Design the bracing, backstops, and jacks so that the jacking can progress without stoppage (except for adding lengths of pipe).

B. Drilling:

This method employs the use of an oil field type rock roller bit, or a plate bit made up of individual roller cutter units, welded to the pipe casing being installed. Turn the pipe for its entire length from the drilling machine to the head to give the bit the necessary cutting action against the ground being drilled. Inject high density slurry (oil field drilling mud) through a supply line to the head to act as a cutter lubricant. Inject this slurry at the rear of the cutter units to prevent any jetting action ahead of the pipe. Advance the drilling machine on a set of steel rails (thus advancing the pipe) by a set of hydraulic jacks. The method can be used to drill earth or rock.

If required, casing installation may be accomplished by the directional drill method with the following criteria: The drilling operation shall not result in a boring hole larger than 24” in diameter.

C. Boring:

This method consists of pushing the pipe into the fill with a boring auger rotating within the pipe to remove the soil. When augers or similar devices are used for pipe placement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.

If an obstruction is encountered during installation that stops the forward action of the pipe, and if it becomes evident that it is impossible to advance the pipe, operations will cease and the pipe shall be abandoned in place and filled completely with grout.

If voids are encountered or occur outside the casing pipe, grout holes shall be installed in the top section of the casing pipe at 4 foot (maximum) centers and the voids filled with grout with sufficient water added to produce a flowable mixture and at sufficient pressure to prevent settlement. The Contractor shall be prepared to bore through weathered or partially weathered rock, if encountered, with a specialized bit or hand-mine. Costs associated with this provision shall be deemed as included in the Unit Price Bid for each location and no additional payment will be made. Grout holes shall only be used in casings where it is feasible. Grout around outside of casing pipe when bore hole diameter is great than outside diameter of casing pipe by more than 1 inch.

In the event an obstruction is encountered during the boring and jacking operation, and the casing pipe is at least 30-inches in diameter, the auger shall be withdrawn and the obstruction removed. If a boulder is encountered and is removed by blasting or other approved method, the void shall be filled with grout, as previously specified. No blasting shall be permitted until a detailed blasting plan is submitted to and approved by the INDOT, and the Engineer. No blasting shall be permitted within railroad right of way.

The recommended methods and details shown on the Drawings and specified herein, are intended to indicate the minimum acceptable standard of quality required for the casing/tunnel installation. Other methods of installation, based on acceptable industry standards and techniques, may be acceptable for the installation. Under no conditions shall jetting or wet boring of the casing/tunnel be allowed.

Prior to the beginning of any casing/tunnel excavation, a surface settlement monitoring grid system shall be installed on the highway/railroad. This grid shall consist of PK nails installed along the tunnel centerline at ten foot intervals. Additional lines of PK nails shall be installed ten feet each side of the centerline. These points shall be initially read and the elevations recorded prior to the start of the casing/tunnel construction. If no visible settlement is occurring during casing/tunnel excavations, these points shall be read only at such times as the Contractor's surveyor is present to transfer the line and grade into the casing/tunnel. These points shall be checked and elevations recorded on a daily basis, until the casing/tunnel installation is completed. Elevations of casing and pavement or railroad tracks shall be referenced to the nearest benchmark elevation and recorded on the record drawings.

3.06 CARRIER PIPE INSTALLATION

The carrier pipe and casing shall be separated by casing spacers. The spacing of casing spacers shall be in accordance with the manufacturer’s recommendation to support the weight of the pipe and contents. As a minimum, a casing spacer shall be placed within a maximum of 3 feet on each side of a joint and evenly spaced along the carrier pipe with 3 casing spacers per each length of carrier pipe—or more frequently if recommended by the casing spacer manufacturer. Maximum distance between casing spacer and internal wall of casing pipe shall be 2-inches. The required procedure to install the carrier pipe is to attach the casing spacers and assemble the pipe joints outside the casing and push the assembled carrier pipe through the casing on the casing spacers. Timber skids are not allowed. Polyethelene encasement is not required on the carrier pipe located inside the casing.

3.07 PROTECTION AT ENDS OF CASING

A. After installation of the carrier pipe within the casing and successful pressure testing of the carrier pipe, provide casing end seals in accordance with the Owner’s standard details at each end of casing pipe as a barrier against backfill

debris and seepage. End seals shall be as specified above and shall be installed in accordance with manufacturer's recommendations.

B. Prior to installation of end seals, the carrier pipe shall be properly and sufficiently secured to prevent movement.

C. End seals shall overlap the casing pipe by at least two inches (2"). Bands shall be placed approximately 1½-inches from each edge of the end seal.

D. Grout shall not be used to seal casing pipe ends or to fill the annular space within the casing.

END OF SECTION

SECTION 02230

STREAM CROSSING

PART 1: GENERAL

1.01 SCOPE OF WORK

The work under this section consists of providing all labor, materials, tools, equipment, and services required to perform stream crossings as indicated on the Drawings and as specified within this section and related sections of the Specifications.

A. Perform the stream crossings in such a manner as to protect the water main from erosion and to restore, as much as practicable, the stream banks and bottom to their original condition and in compliance with requirements of the regulating agencies.

B. Protect the water main from erosion by concrete encasement around the pipe or by a sufficient depth of compacted backfill as shown on the Drawings.

1.02 PROFILES AND TOPOGRAPHY

A. Contours, topography and profiles of the ground as may be shown on the Drawings are believed to be reasonably correct, but are not guaranteed and are presented only as an approximation. It is the Contractor's responsibility to verify proposed centerline elevations at a maximum spacing of 50-feet, including deepest channel point, prior to attempting the installation.

B. The Contractor accepts the construction site with the conditions that existed at the time of bidding. Contractor is responsible for documenting any change in conditions since bidding and shall notify Engineer and provide all such documentation prior to commencing the stream crossing.

1.03 PERMITS

A. Owner or Engineer shall provide Contractor with applicable permits for stream crossing construction activities.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 02020 Dewatering

E. Section 02105 Clearing and Grubbing

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 02458 Horizontal Directional Drilling (HDD)

H. Section 02540 Erosion and Sedimentation Control

I. Section 02558 Identification/Location Guide

J. Section 02820 Lawn Restoration and Landscaping

K. Section 03305 Cast-in-Place Concrete for Pipe Work

L. Section 15000 Piping - General Conditions

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly.

A. Indiana Administrative Code Title 327 Water Pollution Control Division (327 IAC)

B. Indiana Administrative Code Title 327 (327 IAC) 8-3.2-10 Water mains near surface water bodies.

PART 2: PRODUCTS

2.01 MATERIALS

A. Valves shall be installed on both sides of the stream crossing outside of the floodway or as otherwise shown on the Drawings and/or directed by the Engineer.

B. Marker posts shall be installed on both sides of the stream crossing outside of the floodway or as otherwise shown on the Drawings and/or directed by the Engineer.

PART 3: EXECUTION

3.01 CONSTRUCTION PROCEDURE

A. The Drawings shall indicate the methodology to be used for the required stream crossing (i.e., open cut, directional drill or jack and bore) in compliance with the applicable stream opening permit(s). Any and all required permits shall be

obtained by the Owner. Contractor shall comply with construction procedures stipulated in the permit(s) and indicated on the Drawings. The methodology shown on the Drawings shall be used and not altered in any way.

3.02 OPEN CUT CROSSING

A. Stream Division

1. Construct a cofferdam or barricade of sheet piling, sandbags or a turbidity curtain to keep the stream from continually flowing through the disturbed areas. Turbidity curtains shall be a pre-assembled system and used only parallel to flow.
2. Stage construction by confining first one-half of the channel until work there is completed and stabilized, then move to the other side to complete the crossing.
3. Route the stream flow around the work area by bridging the trench with a rigid culvert, pumping or constructing a temporary channel. Temporary channels shall be stabilized by rock or completely lining the channel bottom and side slopes with geotextile fabric.

B. The crossing width of clearing shall be minimized through the riparian area. The limits of disturbance shall be as shown on Drawings.

C. Clearing shall be done by cutting NOT grubbing. The roots and stumps shall be left in place to help stabilize the banks and accelerate revegetation. Roots and stumps within the trench area shall only be removed when the water main is being installed.

D. Material excavated from the trench shall be placed at least 20 feet from the streambanks and in compliance with regulatory requirements. To the extent other constraints allow, stream shall be crossed during periods of low flow.

E. Water mains installed under a stream shall be provided with a minimum five feet (5') of cover below the stream bed and a minimum five feet (5') of cover at the stream banks.

F. The time between initial disturbance of the stream area and final stabilization shall be kept to a minimum. Excavation within the stream area, including between top of bank and top of bank and an additional 10 feet on each side, shall not begin until all the materials required for the entire crossing are on-site and ready for installation. When possible, pipe and fittings shall be preassembled. Once excavation begins within the stream area, all construction work shall be accomplished as expeditiously as possible in accordance with the Drawings, applicable permit(s) and as directed by the Engineer.

3.03 DEWATERING

A. Dewatering or pumping water containing sediment shall not be discharge directly to a stream. The flow shall be routed through a settling pond, silt sack,

dewatering sump or a flat, well-vegetated area adequate for removing sediment before the pumped water reaches the stream or drainage system.

B. Dewatering operations shall not cause significant reductions in stream temperatures. If groundwater is be discharged in high volumes during summer months, it shall first be routed through a settling pond or overland through a flat well-vegetated area.

3.04 STREAM BANK RESTORATION

A. Restore the stream banks by backfilling the main trench with mechanically compacted backfill of earth or rip rap, approved by the Engineer and in compliance with regulatory requirements, to the original ground surface or as shown on Drawings. The limits of compaction shall extend from the top of bank to top of bank on each side of the crossing as determined by the Engineer or as shown on the detail drawings provided. Where stream bank exceeds a 3:1 slope, special erosion control and anchoring are required as shown on the Drawings or otherwise directed by the Engineer.

B. Immediately following the completion of a stream crossing, place straw bales or silt-fence along the trench excavation on each stream bank from within two (2) feet of the edge of water to beyond the limits of the excavated trench width per detail on straw bale and fabric fence. Straw bales or silt-fence shall remain in place until after the stream banks have been fine graded, fertilized and seeded, and the seeding has grown sufficiently to protect the stream banks from erosion.

3.05 STREAM BOTTOM RESTORATION

If the Drawings call for open cut across the stream bottom, backfill the trench within the stream bank (high water to high water) with mechanically compacted earth or riprap that has been approved by the Engineer and meeting regulatory requirements. Rip rap placement must be flush with existing stream bottoms from upstream to downstream.

3.06 TRENCHLESS CROSSINGS

In cases where stream crossings are made by horizontal directional drilling or boring and jacking (with casing installation), installation shall conform to Section 02458 or 02220, respectively.

A. Maximum depth of cover shall not exceed 8 feet below the bottom of stream without Engineers approval, unless otherwise indicated.

B. Minimum depth of cover shall exceed 5 feet below the bottom of stream without Engineers approval, Unless otherwise indicated.

END OF SECTION

SECTION 02350

PIPE BURSTING OF WATER MAINS

PART 1 -- GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to construct new piping by pipe bursting as indicated on the Drawings and as specified within this section and related sections, resulting in a complete, finished water main installation. Contractor shall furnish and install all piping and other required materials that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

B. The pipe bursting process involves the replacement of existing water main by installing new pipe material within the enlarged bore created by the use a static, hydraulic, or pneumatic hammer "moling" device, suitably sized to break the existing pipe or by using a modified boring "knife" with a flared plug that crushes the existing pipe. Forward progress of the "mole" or the "knife" may be aided by hydraulic equipment or other apparatus. Replacement pipe is pulled into the bore. Water services are reconnected to the new pipe through small excavations from the surface. All excavations required for reconnecting of service flows, entry pits, exit pits, obstruction removal, point repairs, among others, are to be kept to a minimum and all damage to surface and underground features, facilities, utilities, and improvements are to be repaired by Contractor at no additional cost to Owner.

C. Only the static pipe bursting method is permitted and covered by this section. Hydraulic or pneumatic methods of pipe bursting are only permitted where shown on the Drawings, specified in Section 01011, or allowed in writing by the Engineer. If hydraulic or pneumatic methods are permitted, Contractor shall submit equipment to be used, detailed procedures, and Work Plan, which must be approved by the Engineer prior to beginning Work.

D. Pre-chlorinated pipe bursting method is permitted and covered by this section. This method is permitted only when approved by the Owner and in locations indicated on the drawings. Prior to undertaking any Work, Contractor shall submit a detailed pre-chlorination procedure, which shall include any modifications to the flushing, testing, and disinfection procedures specified in Sections 15020, 15025, and 15030. The pre-chlorination procedure shall be approved by the Owner prior to commencing Work.

1.02 GENERAL REQUIREMENTS

A. Pipe bursting Contractor/Subcontractor is directed to and shall comply with all related sections indicated below under Related Work.

B. All Work performed under this section shall be in conformance with all other applicable sections of the Specifications, regardless of whether or not individually identified herein.

C. Contractor shall provide adequate site security and shall be responsible for the integrity of the pipe until after the installation, final testing of the pipeline, and acceptance of the Work by the Engineer and Owner.

1.03 COORDINATION OF WORK

A. Contractor shall coordinate all pipe bursting Work performed under this section by Contractor or Subcontractor and shall be responsible to ensure a complete, finished system as required by and in full conformance with the Drawings and these Specifications.

B. Coordinate and schedule shutdowns, connections to existing pipelines, flow bypass, temporary water service and all other Work as required by Sections 01000, 15000 and other sections of the Specifications.

C. Coordinate with other utilities and structures as requires by Section 02025 and this section. The kinds, locations and sizes of the existing underground utilities which may be shown on the Drawings are intended only as a guide to the Contractor and are not guaranteed. Contractor shall be responsible for notifying all utility owners along the route and in the vicinity of the pipe bursting installation prior to the construction and for all required test borings and excavations. Contractor shall be required to perform soft digs to verify existing utility locations and depths of all existing utilities in proximity to the water main to be pipe burst, and this work shall be at no additional cost to the Owner or Engineer.

D. Coordinate all pipe bursting work, including connections to existing pipelines with Engineer and Owner (refer to Section 15000 for further requirements). The Engineer and Owner must be notified 48 hours in advance of starting each phase of the Work. Pipe bursting shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer's approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the Work as authorized under the Contract. It shall be the responsibility of Engineer or Owner to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

E. If the Contractor fails to begin the pipe bursting at the agreed time, the Engineer or Owner shall establish the next mutually convenient time to begin. To avoid undue hardship of either party, reasonable and mutual cooperation should be exercised where starting times are concerned. If one party fails to meet the agreed schedule, the other party is expected to consider a delayed start if the installation cannot be completed during daylight hours.

1.04 PROFILES AND TOPOGRAPHY

A. Contours, topography and profiles of the ground as may be shown on the Drawings are believed to be reasonably correct, but are not guaranteed and are presented only as an approximation. It is the Contractor's responsibility to verify proposed pipeline elevations as necessary prior to attempting the pipe bursting. Contractor shall notify Owner and Engineer of any discrepancies from the Drawings identified.

B. Prior to performing Work, Contractor shall verify by potholing horizontal location and vertical elevation of each existing utility including all structures that are in proximity to the existing pipeline to be pipe bursted. Contractor shall maintain a written record of such items and furnish Owner written report of existing data. No contract price adjustment will be allowed for field verification of existing information. Contractor shall be responsible for all damages incurred to existing facilities damaged as a result of pipe bursting operations.

1.05 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer's literature and product data, certifications and other required submittals for all products furnished under this section in accordance with Section 01300 as well as the following information:

A. QUALIFICATIONS OF PIPE BURSTING CONTRACTOR/SUBCONTRACTOR

The Qualifications of the pipe bursting Contractor/Subcontractor shall be submitted. The pipe bursting Contractor/Subcontractor shall show that he has completed at least 5 successful static pipe bursting projects of similar size and length within the past 5 years. These Qualifications shall include detailed descriptions of the following, which shall be sufficient to verify the requirements of Article 1.04 below:

1. Name, business address and telephone number of the pipe bursting Contractor/Subcontractor.
2. A list of at least five references of previously-completed projects of similar size and length, including project engineer's and customer's names, addresses, telephone numbers, pipe materials (existing and new), pipes sizes (existing and final diameters), and lengths where the static pipe bursting method was used.
3. Name(s) of all supervisory personnel to be directly involved with pipe bursting for this project. For each individual, list previous pipe bursting projects and the individual's responsibilities on that project.
4. Verification of training by the pipe bursting system manufacturer utilized stating that the operators and supervisory personnel have been fully trained in the use of the pipe bursting system by an authorized representative of the equipment manufacturer.
5. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the

supervisory personnel for the pipe bursting method will be directly involved with and used on this project.

B. WORK PLAN

The following Work Plan and other information is required from the Contractor or pipe bursting Contractor/Subcontractor and shall also be supplied to the pipe supplier or manufacturer promptly upon request:

1. Pipe bursting equipment information and certification indicating the applicability of equipment, operator, and methods commensurate with the size and scope of the project, including any proposed lubricants (if applicable) to be used in the operation.
   a. Pipe Bursting Machine Detail Sheet
   b. Bursting/Splitting Head Detail Sheet
   c. Expander and Pulling Head Connection Detail Sheet
   d. Pipe Material Detail Sheet
   e. Fluid/Chemical MSDS
   f. Certifications
2. Written description of the construction methods and equipment to be used, with access shaft or pit sizes required for equipment and material.
3. Engineering drawings and details for the particular pipe bursting process to be employed on the Work, including maximum pulling forces and capabilities for injection of lubricant to assist in the installation.
4. Contingency plan, including the following:
   a. Unforeseen obstructions that stop or delay the operation
   b. Unforeseen deflections that would over bend the HDPE pipe
   c. Excessive surface heaving or subsidence
   d. Damage to existing utility installations
   e. Required spot repairs of the existing line
5. For each pipe bursting operation, indicate all excavation locations (including insertion and access pits, valve and fitting replacements, and other excavations), excavation dimensions, interfering utilities, and flow bypass.
6. A flow bypass and temporary water service plan in accordance with Sections 01000, 01500 and 15000.
7. Work schedule identifying construction sequencing, work hours, and working dates for each installation.

C. Pre-chlorination procedures when pre-chlorination will be used.

D. Approval: No field work shall commence without approval by the Engineer. Details and design calculations shall be submitted and approved in advance of the pipe bursting operation to prevent delays in work. All final layout work, including grades, shall be the Contractor's responsibility.

E. The Contractor shall provide a Maintenance of Traffic Plan in accordance with Section 01570. Specifically note in the Maintenance of Traffic Plan any street

intersections that are to remain open as required during the pipe bursting operation, or traffic detours to be implemented. Contractor shall install a temporary sleeve across the street intersections through which the pipe can be pulled or shall construct a temporary bridge for the pipe over the intersections as required.

F. As-built Records:

1. The Contractor shall furnish red-line plan and profile drawings, on the same horizontal and vertical control datum shown on the Contract Documents, based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation.
2. Other as-built information and Record Documents shall be as required in Sections 01300 and 01700.

1.06 QUALITY ASSURANCE

A. The pipe bursting equipment operator(s) shall be trained to operate the specific equipment for the Owner's project with at least 3 years' experience in pipe bursting obtained within the last five years. Perform pipe bursting operations under the constant direction of a pipe bursting supervisor who shall remain on site and be in responsible charge throughout the pipe bursting operation. The Contractor's supervisor shall have supervised pipe bursting of a minimum of 5,000 linear feet of pipe of a similar or greater diameter, of similar materials, over similar lengths, and with similar subsurface conditions.

B. Substitutions of pipe bursting personnel and/or methods will not be allowed without written authorization of the Engineer. If pipe bursting is performed by non-approved personnel or methods, it may result in removal of that pipe bursting Contractor/Subcontractor from the project; and any work performed by the non-approved personnel or by non-approved methods will be rejected.

C. The completed pipeline interior shall be smooth and continuous, without unacceptable deflection (based on the pipe manufacturer's recommendations, Section 15125, and the relevant standards referenced therein), over the entire length of the installation. Owner and Engineer reserve the right to perform any suitable internal inspections of the completed pipeline before or after acceptance to verify adherence to these requirements.

D. Adherence to this section, or the Engineer's approval of any aspect of any pipe bursting operation covered by this section, shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the Work authorized under the Contract.

1.07 WARRANTY

A. The Contractor shall warrant a useable pipeline that is of the diameter, pressure rating, and other characteristics specified in the Contract Documents. The pipeline shall be smooth and continuous over the entire length of the installation.

B. The Contractor shall also warrant that the equipment used on this Project, where covered by patents or license agreements, is furnished in accordance with such agreements and that the prices bid for the Work on the Project cover all applicable royalties and fees in accordance with such license agreements. The Contractor shall defend, indemnify and hold the Owner and Engineer harmless from and against any and all cost, loss, or damage or expense arising out of or in any way connected with any claim of infringement of patent, trademark, or violation of license agreement.

1.08 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01500 Temporary Facilities

F. Section 01570 Traffic Regulation

G. Section 01600 Products

H. Section 01700 Project Closeout

I. Section 02020 Dewatering

J. Section 02025 Existing Utilities and Structures

K. Section 02210 Trenching, Backfilling and Compacting

L. Section 02540 Erosion and Sedimentation Control

M. Section 02558 Identification/Location Guide

N. Section 02820 Lawn Restoration and Landscaping

O. Section 15000 Piping – General Provisions

P. Section 15020 Disinfecting Pipelines

Q. Section 15025 Flushing and Cleaning Pipelines

R. Section 15030 Pressure and Leakage Tests

S. Section 15105 Ductile Iron Pipe and Fittings

T. Section 15125 High Density Polyethylene (HDPE) Pipe

U. Section 15130 Piping Specialties

V. Section 15170 Tapping Sleeves, Saddles and Valves

W. Section 15185 Abandonment of Mains and Hydrants

X. Section 15200 Service Lines

1.09 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. AWWA Manual M55 – PE Pipe Design and Installation

B. *Guideline for Pipe Bursting*, International Pipe Bursting Association, Division of NASSCO, Owings Mills, MD.

C. *Pipe Bursting Good Practices Guidelines*, Bennett, D., Ariaratnam, S. and Wallin, K., The North American Society for Trenchless Technology.

PART 2 -- PRODUCTS

2.01 PIPE MATERIALS

Unless otherwise specified in the Contract Documents, pipe installed by pipe bursting shall be solid-wall DR 9 high density polyethylene (HDPE) pipe in compliance with Section 15125 or 15200 and specifically recommended by the manufacturer for pipe bursting.

2.02 INSPECTION OF PIPE

All pipe and fittings used in the Work may be factory inspected by a recognized third-party inspection agency engaged by the Engineer or Owner. Inform the Engineer, Owner and the inspection agency of the name and address of the manufacturing plant or other sources of materials to be used in the Work and

shall coordinate with the manufacturer to assure that the inspection agency has access at the manufacturer's plant and adequate assistance and notice so that each item may be examined. All reports shall be made to the Engineer and Owner and the cost of the services of the inspection agency shall be borne by the Owner. Such third-party inspection by the Owner shall not relieve the Contractor of his responsibility to furnish materials in accordance with the applicable standards.

2.03 BURSTING LUBRICANTS

A. Bursting lubricants may be used at the request of the Contractor upon written approval of the Engineer.

2.04 ALLOWABLE TYPES OF PIPE BURSTING SYSTEMS

A. STATIC PIPE BURSTING SYSTEMS:

1. Static pipe bursting systems shall be characterized by a tapered or blunt nosed pull head being pulled through the host pipe and breaking the host pipe by applying radial pressure to the host pipe. The host pipe fails by 'hoop' tensile stress applied by the head, and is fragmented and pushed into the surrounding bedding and soil as the pull head progresses. When required to burst existing pipe material, pull head shall include a pipe splitter.
2. The pull head shall be followed by an expansion head which shall further push the fragmented pipe into the surrounding soil and bedding to a diameter that allows the insertion of the new pipe (with tracer wires) behind it. Under no circumstances shall the pipe pull head be attached directly to the new pipe and used to expand or otherwise increase the diameter of the host pipe (or fragmented host pipe) without the use of an expander.
3. The pull head may be advanced by a hydraulic or winching mechanism.
4. Equipment shall be configured with adequate knives or other appropriate devices to minimize interruptions in the installation process due to obstruction removal and other problems.

B. PNEUMATIC OR PERCUSSIVE BURSTING SYSTEMS SHALL NOT BE ALLOWED unless specified in Section 01011 or allowed in writing by the Engineer.

2.05 PIPE PULL HEADS

A. Pipe pull heads shall be utilized and employ a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.

B. Pipe pull heads shall be designed for use with the existing host pipe and new HDPE pipe, and shall be as recommended by the pipe manufacturer.

C. The diameter of the pulling/pushing head shall be at least 0.5-inch greater than the bell outside diameter of the pipe being pulled, unless otherwise approved by the Engineer.

2.06 LOCATION (TRACER) WIRE

Location (tracer) wire shall be provided as specified for pipe bursting applications in Section 02558.

PART 3 -- EXECUTION

3.01 GENERAL

A. Protect the new pipe and components during all phases of Work, including hauling, installation, entry into the entry pit, and prevention of scarring or gouging of the pipe or components. Refer to Section 15000 for further requirements.

B. Contractor shall take care not to damage any new materials during pipe bursting operations. All pipes shall be visually inspected for gouges. Gouges in excess of ten percent (10%) of the pipe wall thickness are excessive and are not acceptable. Refer to Section 15125 for requirements in the event of excessive gouges or other damage.

C. Owner, Engineer and Resident Project Representative shall have access at all times to any measuring or gauging devices used for the horizontal drill as well as any drilling logs maintained by the Contractor.

3.02 SITE DISTURBANCE AND SOIL EROSION

A. All soil erosion and sediment control Work shall be performed in accordance with Section 02540.

B. The Contractor shall be responsible for the preservation of all existing trees, plants, and other vegetation that are to remain within or adjacent to the construction site and shall also be responsible for protecting existing concrete curb, fence, utilities, and other structures that are located within or adjacent to the construction site.

C. The Contractor assumes all liability for damage resulting from pipe bursting operations.

3.03 PERSONNEL REQUIREMENTS:

A. Provide a competent and experienced supervisor representing the pipe bursting Contractor/Subcontractor who must be present at all times during actual operations. A responsible representative, who is thoroughly familiar with the equipment and type work to be performed, must be in direct charge and control

of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual pipe bursting operations. Supervisor shall have minimum 5 years pipe bursting experience.

B. Have a sufficient number of competent workers on the job at all times to insure the pipe bursting is completed in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the pipe bursting operation must be on the job site at the beginning of work. If HDPE is specified, HDPE pipe thermal butt fusion welding shall be completed by a welder certified by the manufacturer of the pipe or pipe welding equipment, in accordance with the Plastic Pipe Institute "Handbook of Polyethylene Pipe," Polyethylene Joining Procedures, and 49 CFR 192, Subpart F, latest edition and in accordance with the requirements in Section 15125.

3.04 FLOW BYPASS AND TEMPORARY WATER SERVICE

A. Unless otherwise indicated in Section 01011, flow bypass, temporary valves, temporary fire hydrants (where existing fire hydrants are present) and temporary water service shall be provided for all existing pipelines to be replaced by pipe bursting (and any other pipelines that must be shut down during the Work) in conformance with the Drawings, Section 15000, and other requirements of the Contract Documents.

B. Traffic on roadways shall not be impeded by temporary water service piping, and Contractor shall maintain vehicular access to all driveways throughout the Work as specified in Section 15000. Temporary water service piping shall be protected at driveways and road crossings with cross-over ramps or by other methods approved by the Resident Project Representative and the agency with jurisdiction over the roadway.

3.05 CLEANING, TV INSPECTION, AND PREPARATION OF EXISTING PIPELINE

A. The host pipe shall be cleaned and inspected by CCTV prior to the bursting operation as directed by the Engineer.

B. Cleaning and CCTV inspection of the host pipe shall indicate condition of host pipe and suitability of host pipe for HDPE pipe insertion by pipe bursting methods.

C. Location of all service connections, fittings, valves and appurtenances shall be recorded.

D. Obstructions considered detrimental to the pipe bursting operation which may include corporation taps, fittings, valves, and valve bodies, and deformed piping shall be remedied prior to bursting and HDPE pipe insertion.

E. All existing valves, tees, bends, and other fittings within the limitations of the pipe bursting shall be replaced prior to pipe bursting (or after pipe bursting if these points are used as insertion/access pits).

F. Spot repairs (if applicable) shall be made in accordance with the Contract Documents.

G. The Contractor shall be aware that there may be sediment and buildup of tuberculation inside the existing water lines, and proposed pipe bursting equipment and methods shall properly account for this possibility.

H. Any known pre-existing concrete encasements shall be excavated and broken out prior to the bursting operation to allow the steady and free passage of the pipe bursting head.

3.06 LOCATION AND PROTECTION OF UNDERGROUND UTILITIES

A. Contractor shall positively identify and verify location, depth and size of all existing underground utilities and facilities potentially impacted by pipe bursting or other project activities and provide the Engineer with a comprehensive report of these facilities before starting any construction. Contractor shall take necessary precautions to protect all such utilities and facilities from damage, including exposing all existing utilities and facilities that are located in proximity to the water main to be pipe burst—i.e. within an envelope of possible impact of the bursting operation as determined for the project specific site conditions. It is the Contractor's responsibility to determine this envelope, safe burial depth and offset from existing utilities, subject to approval by the Owner. This will include, but is not limited to soil conditions and layering, utility proximity and material, pipe bursting system and equipment, and foreign subsurface material.

B. If existing utilities or other obstructions prohibit pipe bursting, or if other unusual site conditions are discovered, the Contractor shall request a review of site conditions by the Engineer and shall propose an alternate construction method (e.g. open-cut) for review and approval by the Engineer.

C. The Contractor shall be held completely and solely responsible for any damages incurred. Damage caused by the Contractor or pipe bursting Contractor/Subcontractor shall be repaired or replaced at the Contractor's cost and responsibility, regardless of whether such utilities or facilities are shown on the Drawings or not.

3.07 EXCAVATION AND ACCESS PITS

A. Location and number of insertion or launching pits shall be as indicated on the Contract Drawings.

B. Access pit length shall be such that the minimum bending radius for the HDPE pipe is not exceeded. Sheeting, shoring and bracing requirements shall be in accordance with the Contract Documents and applicable jurisdictional standards.

C. Access pit excavations shall be performed at all points where the new pipe will be inserted into the existing pipeline. When possible, access pit excavations

shall coincide with host pipe lateral connection points or other appurtenance installations.

3.08 PRE-CHLORINATED PIPE BURSTING

Chlorination of pipes prior to bursting shall be carried out per AWWA C651 standard for disinfecting water mains and in cooperation with the Owner's maintenance personnel. This method shall include the following:

A. Disinfect all equipment, tools, end caps, pipe fittings or products that may contact the pipe.

B. Disinfection shall be carried out by immersing or rinsing items in a sodium hypochlorous acid solution containing one to five percent chlorine measured by weight.

C. Pipe shall be fused into a string of sufficient length to complete the designated section. Maximum allowable length of pre-chlorinated pipe segments is 800 feet.

D. If required by the Engineer, surface upon which the product pipe rests during chlorination shall be relatively impervious, such as asphalt, concrete or stone, and free from visible contamination.

E. Coiled pipe must be laid horizontally to allow all air to be expelled.

F. Swabbing, chlorination and testing shall be accomplished by:

1. Swab inserted at the lowest end of the pipe.
2. Swabs shall be designated by the manufacturer as suitable for potable water system use and be manufactured by Knapp Industries or equal.
3. Calcium hypochlorite granules in accordance with Section 15020 shall be placed behind the swab.
4. Pressure tight end cap shall be mounted to the low end of the pipe by fusing or mechanical assembly.
5. Potable water shall be introduced through the end cap at a controlled rate such that the swab is propelled at a velocity less than or equal to one foot per second. All air shall be dispelled from the pipe.
6. Upon discharge of the swab from the elevated end of the pipe, elevated end shall be capped with a pressure tight seal. Seal shall have a NPT threaded tapped access hole sized in accordance with Section 15025 to purge air, flush, pressure test, disinfect, and sample the pipeline. Additional potable water shall be added after capping to ensure no air remains between the caps.
7. Pressure test the pipe as required in Section 15030.
8. Chlorinated solution shall be maintained for a minimum of 24 hours prior to flushing when the water temperature is above 41 degrees F or 48 hours when

water temperature is 41 degrees F or less. Time for retention of chlorinated solution shall not exceed 72 hours as required by Section 15020 so as to prevent damage to the pipe or end caps.

9. After designated holding time, the pipe shall be drained, flushed and filled with potable water to expel the highly chlorinated solution. Spent chlorinated solution shall be dechlorinated and disposed of, and pipe shall be tested and flushed, all in accordance with Sections 15020 and 15025.
10. Drain the section of pipe prior to pipe bursting. Pipe shall be drained on the day of pipe bursting and sealed after draining. Dispose of chlorinated water per Section 15020.

G. Dilute chlorinated solutions for pre-chlorinated pipe bursting over five days old shall be disposed of properly and not used as a disinfection agent.

3.09 PIPE BURSTING OPERATION

A. Pipe fusion process shall be in accordance with Section 15125. Pipe shall be assembled and fused on the ground in sections equivalent to the length of the anticipated pull. During installation, all bending and loading of the pipe shall be in conformance with manufacturer's recommendations and shall not damage the pipe.

B. Pipe shall be secured to the pulling/pushing device in accordance with standard practice.

C. The new HDPE pipe shall be inserted immediately behind the bursting head in accordance with the pipe manufacturer's recommended procedures. The bursting equipment shall be specifically designed and manufactured for the type of insertion process being used.

D. The Contractor shall provide equipment, planning, and job execution necessary to accomplish the work in an efficient manner and consistent with the objectives of this Section, including preventing damage to existing infrastructure, maintaining pedestrian and vehicle access, and providing continual water service to customers.

E. The Contractor shall utilize pipe bursting/crushing equipment with adequate pulling/pushing force to complete pulls in a timely manner. The Contractor shall provide equipment on the pulling mechanism to verify the pulling/pushing force exerted on the pipe does not exceed the manufacturer's recommendation for allowable pulling force to prevent damage to the pipe. Allowable pulling force for all diameters shall be determined by the Contractor depending on the pipe size, wall thickness, manufacturer, field conditions, pull distance, bearing capacity of soils, adjacent infrastructure, related equipment and cable strength, and related considerations.

F. Interruptions in the installation process shall be avoided or minimized to the extent possible.

G. Equipment used to perform the Work shall be located away from buildings so as not to minimize noise impact. Provide silencers or other devices to reduce machine noise as required by the Engineer or local requirements.

3.10 JOB CONDITIONS

A. Any nighttime work is strictly regulated and will be allowed only with prior approval granted by the Owner subject to regulatory agencies having jurisdiction. All pipe bursting operations shall be accomplished during daylight hours, unless approved by the Engineer. Pipe bursting work shall not begin after the hour pre-established as the latest starting time that will allow completion during daylight hours, unless approved by the Engineer. The Contractor shall provide a Work Plan submittal indicating the proposed hours of operation and length of work week. All work plans shall be subject to compliance with all applicable regulatory requirements for construction activities and any off site impacts.

B. When hazards of nighttime work are carefully considered and determined to be insignificant, nighttime work may be allowed only to complete a properly planned pipe bursting installation, and only if, in the opinion of the Engineer, a delay was caused by reasonably-unavoidable circumstances and such nighttime work is necessary to avoid placing an undue economic hardship on the Contractor.

C. In emergency situations, or where delay would increase the likelihood of a failure, nighttime work may be allowed to complete a delayed pipe bursting installation.

D. Pipe pullback operations shall continue on a 24-hour per day basis until pipe pullback is complete, but work shall be properly planned and scheduled to avoid or minimize pipe pullback operations at night to the extent possible.

3.11 INSTALLATION ACCEPTANCE AND CLEANUP

A. Defects which may affect the integrity or strength of the pipe in the opinion of the Engineer shall be repaired or the pipe replaced at the Contractor's expense.

B. All exposed pipe that is pulled into the receiving pit behind the pull head shall be inspected for damage. Depending on the gouging, abrading or damage witnessed, the pipe may be accepted, de-rated, reinstalled, or abandoned as unusable per the Contract Documents. If the newly installed pipe is deemed damaged and unusable, the Contractor shall dig and replace the pipe to the extent directed by the Engineer at no additional expense to the Owner.

C. Following the installation, the project site shall be returned to a condition equal to or better than the pre-construction condition of the site. All excavations will be backfilled and compacted and all surfaces shall be restored per the Contract Documents.

D. Contractor shall verify that all utilities, structures, and sub-surface features within the envelope of possible impact of the bursting operation as determined for the project specific site conditions are sound and in proper working order.

3.12 FLUSHING, PRESSURE/LEAKAGE TESTING AND DISINFECTION

A. Prior to pipe pullback, perform an allowable leakage test in accordance with AWWA C600 and Section 15030 or a low pressure air test (procedure shall be proposed by Contractor and approved by Engineer) on the full length of pipe after all sections have been welded, fused or assembled. In the event that available lay down area does not permit assembly of the entire pipe length prior to pullback, the two assembled sections shall be tested independently.

B. A hydrostatic pressure test shall also be performed on the complete, installed pipe (i.e. after completion of all pipe bursting procedures) in accordance with AWWA C600 and as described in Section 15030.

C. The pipe shall be flushed and disinfected as described in Sections 15020 and 15025 or as otherwise approved in advance by the Engineer. Contractor shall provide Engineer with full work plan including any alternative testing methods.

3.13 CONNECTION TO ADJOINING PIPE

A. Perform connections in accordance with Sections 01000, 15000, 15105, 15120, 15125, 15130, and 15170, as applicable, from the pipe installed by pipe bursting to adjacent pipe, with support, backfill and compaction per Section 02210.

END OF SECTION

SECTION 02458

HORIZONTAL DIRECTIONAL DRILLING (HDD)

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to construct new piping by horizontal directional drilling as indicated on the Drawings and as specified within this section, resulting in a complete, finished water main installation. Contractor shall furnish and install all piping and other required materials that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

1.02 GENERAL REQUIREMENTS

A. HDD Contractor/Subcontractor is directed to and shall comply with all related sections indicated below under Related Work.

B. All Work performed under this section shall be in conformance with all other applicable sections of the Specifications, regardless of whether or not individually identified herein.

C. Contractor shall provide adequate site security and shall be responsible for the integrity of the pipe until after the pullback, final testing of the pipeline, and acceptance of the Work by the Engineer and Owner.

1.03 COORDINATION OF WORK

A. Contractor shall coordinate all work by HDD Contractor/Subcontractor and shall be responsible to ensure a complete, finished system as required by and in full conformance with the Drawings and these Specifications.

B. Coordinate and schedule connections to existing pipelines and all other Work as required by Sections 01000, 15000 and other sections of the Specifications.

C. Coordinate with other utilities and structures as requires by Section 02025 and this section. The kinds, locations and sizes of the existing underground utilities which may be shown on the Drawings are intended only as a guide to the Contractor and are not guaranteed. Contractor shall be responsible for notifying all utility owners along the route and in the vicinity of the HDD installation prior to the construction and for all required test borings and excavations. Contractor may be required to perform soft digs to verify existing utility depths, and this work shall be at no additional cost to the Owner or Engineer.

D. Coordinate all HDD work, including connections to existing pipelines with Engineer and Owner (refer to Section 15000 for further requirements). The Engineer and Owner must be notified 48 hours in advance of starting each phase of the Work. The directional bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer's approval

for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the Work as authorized under the Contract. It shall be the responsibility of Engineer or Owner to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

E. If the Contractor fails to begin the directional bore at the agreed time, the Engineer or Owner shall establish the next mutually convenient time to begin. To avoid undue hardship of either party, reasonable and mutual cooperation should be exercised where starting times are concerned. If one party fails to meet the agreed schedule, the other party is expected to consider a delayed start if the installation cannot be completed during daylight hours.

1.04 PROFILES AND TOPOGRAPHY

A. Contours, topography and profiles of the ground as may be shown on the Drawings are believed to be reasonably correct, but are not guaranteed and are presented only as an approximation. It is the Contractor's responsibility to verify proposed centerline elevations at a maximum spacing of 50-feet (including deepest channel point where applicable) prior to attempting the directional bore.

B. Prior to performing Work, Contractor shall verify by potholing horizontal location and vertical elevation of each existing utility including all structures that will be along the pipeline route. Contractor shall maintain a record of such items on the Contractor’s red-line markups and other Record Documents as necessary to fully document existing data (refer to Section 01300). No contract price adjustment will be allowed for field verification of existing information. Contractor shall be responsible for all damages incurred to existing facilities damaged as a result of directional drilling operations.

1.05 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer’s literature and product data, certifications, and other required submittals for all products furnished under this section in accordance with Section 01300 as well as the following information:

A. QUALIFICATIONS OF HDD CONTRACTOR/SUBCONTRACTOR

The Qualifications of the horizontal directional drilling Contractor/Subcontractor shall be submitted. The HDD Contractor/Subcontractor shall show that he has completed at least 5 successful HDD projects of similar size and length within the past 5 years. These Qualifications shall include detailed descriptions of the following, which shall be sufficient to verify the requirements of Article 1.04 below:

1. Name, business address and telephone number of the horizontal directional drilling Contractor/Subcontractor.
2. A list of at least five references of previously-completed projects of similar size and length, including project engineer’s and customer’s names, addresses, telephone numbers, pipe materials, pipes sizes, and lengths where the HDD method was used.

3. Name(s) of all supervisory personnel to be directly involved with HDD for this project. For each individual, list previous HDD projects and the individual's responsibilities on that project.
4. Verification of training by the directional drilling system manufacturer utilized stating that the operators and supervisory personnel have been fully trained in the use of the system by an authorized representative of the equipment manufacturer.
5. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel for the HDD method will be directly involved with and used on this project.

B. When required, the Contractor shall provide a Work Plan submittal indicating the proposed hours of operation and length of work week. All work plans shall be subject to compliance with all applicable regulatory requirements for construction activities and any off site impacts.

C. Submit to the Engineer copies of a report of schedules, calculations, field survey information, procedures and any supplemental subsurface soil condition investigations performed along the path of the proposed directional bore. Number of copies of the report shall be as specified in Section 01300. The report shall summarize the subsurface conditions that are known to the Contractor, including the proposed pipeline installation procedure based upon factual, best available information. If the subsurface conditions are known to the Contractor by previous work or geotechnical studies done in the immediate area, the information shall be recorded in the report along with any additional geotechnical studies performed by the Contractor. The report shall include the following:

1. Subsurface Information (if available)
   a. Report any subsurface conditions known to the Contractor by previous work or prior geotechnical studies performed in the immediate project area (except information included in the Contract Documents).
   b. Additional borings performed by the Contractor and analysis of soils along the path of the proposed directional bore: The Contractor shall be responsible for obtaining and including in his bid price the cost of any additional borings along the pipe alignment that may be necessary to design the proposed directionally drilled installation. For installations 16-inch nominal diameter or larger (or where otherwise required by the Contract Documents), supplemental borings shall be performed by the Contractor. In such cases, test borings shall be performed to a minimum depth of ten (10) feet below the proposed pipe invert unless rock is encountered, in which case test borings shall penetrate at least two feet into rock. Testing shall include standard United States Geological Survey (USGS) classification of soils, standard penetration tests, split spoon sampling and sieve analysis. Rock sampling and analysis shall include Mohr's Hardness and friction coefficient.
2. Drilling Equipment and Methods
   a. Submit details of equipment and written procedure with working drawings describing in detail the proposed boring method and the entire operation to be used. This shall include, but not be limited to, entry and exit pits; settlement pit; size, capacity and arrangement of drilling and pulling equipment; layout of carrier pipe; details and spacing of pipe rollers; type of

current head; method of monitoring and controlling line and grade; method of detection of surface movement; and layout of any proposed construction staging areas.

b. In addition, submit for approval nameplate data for the drilling equipment, mobile soil spoils removal unit, and Material Safety Data Sheets (MSDS) information for the drilling slurry compounds. This must be submitted and reviewed by the Engineer before Work can proceed.

3. Piping
   Submit Shop Drawings showing the pipe lengths, design details, joint details and structural performance data for the Engineer's review. Submittals shall include, but are not limited to, the following:
   a. All welding or fusion procedures to be used in fabrication of the different pipe materials and installation methods.
   b. Certified records for hydrostatic testing of all pipe materials to be used.
   c. An affidavit stating that all pipe materials furnished under this section have been manufactured in the United States of America and comply with all applicable provisions of referenced AWWA standards.

4. Proposed Alignment
   Submit a graph in plan and profile plotting the pilot drilling hole alignment for review, including entry/exit angles and radius of curvature. After completion of the directional bore, submit a final pipe alignment drawing.

5. Schedule (when required)
   Time schedule for completing the Directional Drilling, including any delays due to anticipated soil conditions.

6. Calculations (for all HDD installations 16-inch nominal diameter and larger and any other installations where required by the Owner or Engineer):
   a. Submit detailed design calculations for several representative loading conditions for the proposed directional bore. If requested by the Engineer, submit calculations to support the design of any particular location of pipe anywhere along the length of the directional bore at no additional cost to the Owner.
   b. Design calculations shall be presented in a neat, readable format, with all figures, values and units included to facilitate ease of verification.
   c. Calculations shall be submitted to demonstrate that the pipe thickness design is sufficient to meet all design criteria specified.
   d. Calculations shall address the following loading conditions:
      i. Pre-installation: Hoop and longitudinal stress during hydrostatic test; spanning stress with pipe full of water and supported on installation rollers, and maximum roller / support spacing.
      ii. Installation/Post-Installation: Longitudinal stress from pulling force; longitudinal curvature stress at point of entry and in final position; external pressure from drilling fluid, overburden, and loads from the obstacle being crossed.
      iii. Post-Installation/In-Service: Hoop and longitudinal stress during hydrostatic test; internal working and surge pressure; buckling with internal vacuum (50-year unconstrained critical collapse pressure).
   e. Perform and submit to the Engineer fluids pressure versus overburden strength calculations. These calculations shall be performed to determine minimum acceptable cover requirements and prevent drilling fluids breakout to the ground surface.
   f. All calculations shall bear the seal of a Registered Professional Engineer.

Licensure in the State that the work is performed is required.

D. Approval: No field work shall commence without approval by the Engineer. Details and design calculations (when required) shall be submitted and approved in advance of the drilling operation to prevent delays in work. All final layout work, including grades, shall be the Contractor's responsibility.

E. The Contractor shall provide a Maintenance of Traffic Plan in accordance with Section 01570 (when applicable). Specifically note in the Maintenance of Traffic Plan any street intersections that are to remain open as required during the pipe pullback operation, or traffic detours to be implemented. Contractor shall install a temporary sleeve across the street intersections through which the pipe can be pulled or shall construct a temporary bridge for the pipe over the intersections as required.

F. As-built Records:

1. During pullback, maintain records for submission to Engineer and Owner indicating job, date, time, constant pipe footage progress, mud flow rates, pulling forces required and torque readings. Document the pull head location for each length of drill stem pipe for as-built records. The MGS pullback data shall be recorded for every pilot hole drill stem length during the actual directional bore operation.

2. The Contractor shall furnish “as-built” plan and profile drawings, on the same horizontal and vertical control datum shown on the Contract Documents, based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation.

3. In addition, Contractor shall maintain a daily project log of drilling operations and guidance system log. Daily logs shall include as a minimum the following every 15 minutes throughout each drill pass, back ream pass, or pipe installation pass: Drilling fluid pressure, drilling fluid flow rate, drill thrust pressure, drill pullback pressure, and drill head torque.

4. Other as-built information and Record Documents shall be as required in Sections 01300 and 01700.

1.06 QUALITY ASSURANCE

A. The HDD equipment operator(s) shall be trained to operate the specific Horizontal Directional Drilling equipment for the Owner’s project with at least 3 years’ experience in directional drilling obtained within the last five years. Perform HDD operations under the constant direction of a drilling supervisor who shall remain on site and be in responsible charge throughout the drilling operation. The Contractor’s supervisor shall have supervised directional drilling of a minimum of 5,000 linear feet of pipe of a similar or greater diameter, of similar material, over similar lengths, and with similar subsurface conditions such as soil only, rock, mixed face.

B. The requirements set forth in this section specify a wide range of procedural precautions necessary to insure that the basic, essential aspects of a proper directional bore installation (a.k.a. HDD installation) are adequately controlled.

Strict adherence shall be required under specifically covered conditions outlined in this section.

C. Perform the Work in general conformance with ASTM Standard F1962.

D. Adherence to the requirements contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this section, shall in no way relieve the Contractor of its ultimate responsibility for the satisfactory completion of the Work.

1.07 WARRANTY

A. The Contractor shall warrant a useable pipeline that is of the diameter, pressure rating and other characteristics specified in the Contract Documents. The pipeline shall be smooth and continuous over the entire length of the installation.

B. The Contractor shall also warrant that the equipment used on this Project, where covered by patents or license agreements, is furnished in accordance with such agreements and that the prices bid for the Work on the Project cover all applicable royalties and fees in accordance with such license agreements. The Contractor shall defend, indemnify and hold the Owner and Engineer harmless from and against any and all cost, loss, or damage or expense arising out of or in any way connected with any claim of infringement of patent, trademark, or violation of license agreement.

1.08 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01500 Temporary Facilities

F. Section 01570 Traffic Regulation

G. Section 01600 Products

H. Section 01700 Project Closeout

I. Section 02025 Existing Utilities and Structures

J. Section 02210 Trenching, Backfilling and Compacting

K. Section 02220 Casing Installation

L. Section 02230 Stream Crossing

M. Section 02540 Erosion and Sedimentation Control

N. Section 02558 Identification/Location Guide

O. Section 02820 Lawn Restoration and Landscaping

P. Section 03305 Cast-In-Place Concrete for Pipe Work

Q. Section 15000 Piping - General Provisions

R. Section 15020 Disinfecting Pipelines

S. Section 15025 Flushing and Cleaning Pipelines

T. Section 15030 Pressure and Leakage Tests

U. Section 15105 Ductile Iron Pipe and Fittings

V. Section 15120 Polyvinyl Chloride (PVC) Pipe

W. Section 15125 High Density Polyethylene (HDPE) Pipe

X. Section 15130 Piping Specialties

Y. Section 15170 Tapping Sleeves, Saddles and Valves

1.09 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings

B. AWWA C200 - Steel Water Pipe, 6 In. and Larger

C. AWWA C206 - Field Welding of Steel Water Pipe

D. AWWA C213 - Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

E. AWWA Manual M55 – PE Pipe Design and Installation

F. Ductile Iron Pipe Research Association (DIPRA) Horizontal Directional Drilling with Ductile Iron Pipe Handbook

PART 2: PRODUCTS

2.01 PIPE MATERIALS

Unless otherwise specified in the Contract Documents, pipe installed by horizontal directional drilling shall either be high density polyethylene pipe (HDPE), Certa-Lok™ restrained joint C900 polyvinyl chloride (PVC) pipe, steel casing pipe, or ductile iron pipe specifically recommended by the manufacturer for directional drilling. Unless otherwise specified in the Contract Documents, the water main pipe shall be installed without a casing pipe.

A. POLYETHYLENE PIPE

1. High density polyethylene (HDPE) pipe shall be AWWA C906 compliant, NSF 61 certified, and furnished in forty (40) to fifty (50) foot lengths. HDPE pipe and its installation shall conform to the requirements of Section 15125.
2. Minimum thickness of HDPE pipe shall be determined by the Contractor's calculations (as specified herein) for the specific installation (including proposed radius of curvature and resulting pull stresses) but shall not be less than DR 11 wall thickness when measured in accordance with ASTM D2122. If any portion of the pipe will be installed with more than 20 feet of cover, the entire pipe installed by HDD shall be not less than DR 9.
3. Pipes shall be jointed to one another by thermal butt-fusion in accordance with ASTM D3261 and Section 15125. Electrofusion shall not be permitted.

B. RESTRAINED JOINT POLYVINYL CHLORIDE (PVC) PIPE (12-INCH DIAMETER AND SMALLER)

1. PVC pipes used for HDD shall be restrained joint in accordance with Section 15120. Fused joint PVC shall not be permitted.
2. Restrained joint polyvinyl chloride (PVC) pipe shall be AWWA C900 compliant, NSF 61 certified, and furnished in twenty foot (20') lengths. Restrained joint PVC pipe and its installation shall conform to the requirements of Section 15120.
3. Restrained joint PVC pipe used for HDD installations shall be DR 14 wall thickness when measured in accordance with ASTM D2122. PVC pipe shall not be used if the minimum required thickness determined by the Contractor's calculations (as specified herein) for the specific installation (including proposed radius of curvature and resulting pull stresses) is greater than the thickness of DR 14 C900 PVC pipe.

C. DUCTILE IRON PIPE

1. Ductile iron pipe and its installation shall conform to the requirements of Section 15105.
2. Ductile iron pipe class shall be determined by the Contractor's calculations (as specified herein) for the specific installation but shall be not less than the

pressure class requirements specified in Section 15105. Utilize ductile iron pipe equipped with restrained joints recommended for the installation by the pipe manufacturer and suitable for the specific design conditions. Gripping push-on joint gaskets, retainer ring gaskets, or restrained joint type gaskets are not permitted.

3. All ductile iron pipe shall be installed per Ductile Iron Pipe Research Association (DIPRA) Horizontal Directional Drilling with Ductile Iron Pipe Handbook to include strict adherence to maximum joint deflection allowances. All pipe shall be encased in two layers of polyethylene encasement per DIPRA installation procedures as specified in Section 15130.

D. STEEL CASING PIPE

1. Steel pipe shall only be used as a casing pipe and shall meet the requirements of AWWA C200 and Section 02220. Pipe shall be either spiral seam or longitudinally rolled pipe.
2. Steel pipe sections shall be connected by welding. All welding shall conform to AWWA C206.
3. Minimum thickness of steel pipe shall be determined by the Contractor's calculations (as specified herein) for the specific installation but shall not be less than a diameter to thickness ratio of 180. When installed under a roadway or railroad, minimum casing pipe thickness shall be as specified in Section 02220 unless otherwise indicated on the Drawings.

2.02 PIPE THICKNESS DESIGN

A. The following design criteria shall be used in calculating pipe thickness for HDPE, PVC, steel, or ductile iron pipe:

• Working Pressure	150 psi unless otherwise indicated on the Drawings or specified
• Test Pressure	Per Section 15030
• Surge Pressure	Working pressure + 100 psi
• Dead Load	Earth cover as shown on Drawings, but not less than 15 feet.
• Buckling Design	Considering dead load, internal vacuum, HS-20 Wheel Loading and a hydrostatic load over top of pipe to grade.
• Max. Allowable Joint Deflection	One half manufacturer's recommended deflection for size and type of joint supplied (ductile iron pipe only)
• Minimum Design Radius	As specified herein
• Radius of Curvature	90% of Actual Design Radius
• Downhole Friction Factor	1.0
• Factor of Safety for Drilling Fluid Density	1.5

B. The stresses in the pipe shall be calculated for the pre-installation, installation, and post installation loading conditions specified in Part 1 of this section. Thickness

shall be selected so that stresses do not exceed the following under any of the loading conditions.

- All conditions except internal surge pressure — 50% of minimum yield point
- Internal surge pressure condition — 75% of minimum yield point

C. The Contractor shall increase the minimum “in-service” thickness as necessary to support the stresses and loadings that are expected to be encountered during the installation of the HDD pipeline. The final selected thickness shall be supported by calculations as required herein. No additional cost shall be considered by the Owner for pipe thickness greater than the specified minimum “in-service” thickness.

2.03 DEVIATIONS

Contractor’s submittal of a “Voluntary” Alternate bid using material that does not meet all the requirements of these Specifications, shall include a description of the deviation with data showing the magnitude of the deviation. Acceptance of such deviations to these Specifications shall be subject to the review and approval of the Owner before a contract can be awarded.

2.04 INSPECTION OF PIPE

All pipe and fittings used in the Work may be factory inspected by a recognized third-party inspection agency engaged by the Engineer or Owner. Inform the Engineer, Owner and the inspection agency of the name and address of the manufacturing plant or other sources of materials to be used in the Work and coordinate with the manufacturer to assure that the inspection agency has access at the manufacturer's plant and adequate assistance and notice so that each item may be examined. All reports shall be made to the Engineer and Owner and the cost of the services of the inspection agency shall be borne by the Owner. Such third-party inspection by the Owner shall not relieve the Contractor of his responsibility to furnish materials in accordance with the applicable standards.

2.05 EQUIPMENT

A. General: All equipment for the directional bore shall have the capacity, stability, and necessary safety features required to fully comply with the Specifications and requirements of this section without showing evidence of undue stress or failure. It shall be the responsibility of the Contractor to assure that the equipment to be used in the directional bore is in sound operating condition. Backup equipment shall be required in the event of an equipment breakdown and where the condition of the equipment to be used indicates that routine component replacement or repair will likely be necessary during the directional bore.

B. Directional Drilling System: The directional drilling system shall consist of over the road transportable field power unit, mud-mixing and recycling unit, a trailer or carriage-mounted drill unit, and all other support accessory vehicles and equipment. All system components shall be in sound operating condition with no broken welds, excessively worn parts, badly bent, or otherwise misaligned

components. All drill pipe, reamers, pullback heads, swivels, drill heads and collars, pipe cradles, pipe rollers, ropes, cables, clamps, and other non-mechanical but essential items shall be in sound condition and replaced immediately when need is apparent. The equipment must be capable of drilling the specified length in a single bore.

1. Mud-Mixing and Recycle Units: The mud-mixing and recycle unit shall be a self-contained system designed to provide a supply of high-pressure bentonite based cutting fluid to the drill unit. It shall contain a fluid storage tank and a complete bentonite and drilling fluid additive(s) mixing system. The cutting fluid shall be mixed on site. The cutting fluid shall be formulated for this specific project and anticipated conditions. It shall permit changes to be made to the bentonite and drilling fluid additive(s) concentrations during drilling in response to changing soil conditions. The field power unit shall contain the high pressure cutting fluid pumping system. The recycle units shall be of a capacity to minimize the production of new cutting fluid and maximize the reuse and recirculation of original cutting fluid produced.

2. Directional Drill System: A carriage-mounted version of the drill system shall include a thrust frame. Both the trailer-mounted and carriage-mounted drill system shall be designed to rotate and push 10-foot (3-meter) minimum hollow drill sections into the tunnel being created by the boring head. The drill sections shall be made of a high strength S-grade steel that permits them to bend to a 30-foot (9-meter) radius without yielding. Drill end fittings shall permit rapid makeup of the drill sections while meeting the torque, pressure and lineal load requirements of the system. The boring head itself shall be capable of housing a probe used by the Magnetic Guidance System (MGS) to determine tool depth and location from surface and to orient the head for steering. The MGS shall have a minimum accuracy of plus (+) or minus (-) two (2) percent of the vertical depth.

   The drilling equipment must be fitted with a permanent alarm system capable of detecting an electric current. The system shall have an audible alarm to warn the operator when the drill head nears electrified cables. The drilling equipment shall be grounded, protected, and operated in accordance with manufacturer's requirements for electric strike safety.

   The control console shall contain a calibrated display of inclination, azimuth, tool face location, mud pump rates, and torque pressures. The downhole steering system accuracy shall be plus or minus one percent (± 1.0%) of the horizontal bore length such that the difference between actual depth and machine calculated depth is not more than 1 foot per hundred feet.

4. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the Engineer prior to commencement of the Work. The proposed device or system shall be evaluated prior to approval or rejection on its potential ability to complete the pipe placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular condition of the project. Water sluicing methods, jetting with compressed air, or boring or tunneling devices with vibrating type heads that do not provide positive control of the line and grade shall not be allowed.

C. Spoils Equipment: The cutting fluid removal system shall include a self-contained vacuum truck which has sufficient vacuum and tank capacity to remove excess cutting fluid mixture and cuttings from the project site as required or directed by the Engineer. Spoils are not to be discharged into sewers or storm drains.

The Contractor shall contain all drilling and pipe lubricating mud by taking special measures to prevent run-off into adjacent properties and/or waterways. All surplus drilling and pipe lubricating mud shall be removed from the site and properly disposed of by the Contractor. The Contractor shall also be responsible for all required erosion control measures.

D. Magnetic Guidance System: A Magnetic Guidance System (MGS) probe and location of the drill head during the drilling operation. The tracker shall be capable of tracking at all depths up to one hundred feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The tracker shall be accurate to +/-2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet. Ferrous materials shall not influence or affect the MGS readings or accuracy.

Components: The Contractor shall supply all components and materials to install, operate, and maintain the MGS. This shall include, but not be limited to the following:

- MGS Probe and Interface
- Computer, Printer, and Software
- DC Power Source, Current Control Box, and Coil/Tracking Wire.

The Magnetic Guidance System (MGS) shall be a Tensor TruTracker MGS, or other licensed and industry approved wire guidance system. The Engineer shall be advised of the unit to be used and is subject to his approval. Set up and operate the MGS using personnel experienced with this system.

E. "Walk-over" Cable locating and tracking system: For watermains 12-inch diameter and smaller, a "Walk-over" tracking system shall be used as approved by the Engineer. Contractor shall provide Engineer with current calibration certification of MGS in accordance with manufacturer's specifications.

F. If equipment breakdown or other unforeseen stoppages occur and forward motion of the directional cutting head is halted at any time other than for reasons planned in advance (addition of drill stems, etc.), the boring path shall be filled with a proper bentonite solution immediately, or as directed by the Engineer.

G. The boring tool shall have steering capability and have an electronic tool detection system. The position of the tool during operation shall be capable of being determined accurately, horizontally within 1% of the horizontal distance of the borehole and vertically within 2% of the vertical depths of the borehole. The boring tool shall have a nominal steering radius of 9 meters (30 feet).

2.06 DRILLING FLUIDS:

A. A mixture of Bentonite drilling clay, project specific cutting fluid additives, and potable water shall be used as the cutting fluid (MUD) and over ream hole filler for the directional bore. The drilling fluid mixture used shall have a pH of 7 or higher,

less than 2 percent sand, and a clean fluid density less than 10.5 pounds / gallon. The following minimum viscosities as measured by a March Funnel are provided as a guideline:

- Rock Clay 60 sec.
- Hard Clay 40 sec.
- Soft Clay 45 sec.
- Sandy Clay 90 sec.
- Stable Sand 80 sec.
- Loose Sand 110 sec.
- Wet Sand 110 sec.

These viscosities may be varied to best fit the soil conditions encountered as recommended by the drilling mud and fluid additive manufacturer, and as approved by the Engineer.

B. Where sandy or granular materials are encountered, a cement slurry or polymer supplement shall be considered for added strength and stability of the bore and over ream hole.

C. Clay must be totally inert and contain no risk to the environment. Contractor shall utilize one or more of the following additives to the drilling fluid: Hydrogel 125 Bentonite, Extra High Yield Bentonite, Soda Ash, Dril-Trol QD, Thinz-It, Borzan, or Plugz-it Max.

D. Provide Owner, Engineer, and have on site at all times the Material Safety Data Sheets (MSDS) for all drilling compounds and chemicals. No drilling fluid materials or additives shall be used that are determined to be detrimental to streams or watercourses should an accidental discharge occur.

2.07 LOCATION (TRACER) WIRE

Location (tracer) wire shall be provided as specified for directional drilling applications in Section 02558.

PART 3: EXECUTION

3.01 GENERAL

A. Protect the new pipe and components during all phases of Work, including hauling, installation, entry into the entry pit, and prevention of scarring or gouging of the pipe or components. Refer to Section 15000 for further requirements.

B. Contractor shall take care not to damage any materials during HDD operations. All HDPE and PVC (restrained joint C900) pipes shall be visually inspected for gouges. Gouges in excess of ten percent (10%) of the pipe wall thickness are excessive and are not acceptable. Refer to Section 15120 or 15125, as applicable, for requirements in the event of excessive gouges or other damage.

3.02 SITE DISTURBANCE AND SOIL EROSION

A. Sediment barriers shall be constructed as shown on the Drawings or where directed by the Engineer. All soil erosion and sediment control Work shall be performed in accordance with Section 02540.

B. The Contractor shall be responsible for the preservation of all existing trees, plants, and other vegetation that are to remain within or adjacent to the construction site and shall also be responsible for protecting existing concrete curb, fence, utilities, and other structures that are located within or adjacent to the construction site.

C. The Contractor assumes all liability for environmental damage and cleanup due to inadvertent discharges of slurry or other causes. Slurry materials shall be selected based on the soil conditions encountered to minimize the risk of mud returns.

3.03 PERSONNEL REQUIREMENTS:

A. Provide a competent and experienced supervisor representing the drilling Contractor/Subcontractor who must be present at all times during actual operations. A responsible representative, who is thoroughly familiar with the equipment and type work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual directional pilot hole, over reaming and pullback operations. Supervisor shall have minimum 5 years directional drilling experience.

B. Have a sufficient number of competent workers on the job at all times to insure the directional bore is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual directional bore operation must be on the job site at the beginning of work. If HDPE is specified for the carrier pipe, HDPE pipe thermal butt fusion welding shall be completed by a welder certified by the manufacturer of the pipe or pipe welding equipment, in accordance with the Plastic Pipe Institute “Handbook of Polyethylene Pipe,” Polyethylene Joining Procedures, and 49 CFR 192, Subpart F, and in accordance with the requirements in Section 15125.

C. If steel pipe is specified for the casing pipe, welding shall be performed by certified welders according to the requirements of Section 02220.

3.04 ALIGNMENT AND GRADE

A. Contractor shall positively identify and verify location, depth, and size of all existing underground utilities and facilities in the vicinity of the proposed HDD installation and provide the Engineer with a comprehensive report of these facilities before starting any construction. Contractor shall take necessary precautions to protect all such utilities and facilities from damage, including exposing those utilities and facilities that are located within the possible influence of the directional drilling operations as determined for the project specific conditions. It is the Contractor’s responsibility to determine this zone of influence, safe burial depth and offset from existing utilities. This will include, but is not limited to soil conditions and layering, utility proximity and material, boring system and equipment, and foreign subsurface material.

B. Contractor shall be held completely and solely responsible for any damages incurred. Damage caused by the Contractor or drilling Contractor/Subcontractor

shall be repaired or replaced at the Contractor's cost and responsibility, regardless of whether such utilities or facilities are shown on the Drawings or not.

C. If utilities of unknown depth or other obstructions require grade or alignment deviations from the Drawings, the grade and/or alignment may be adjusted with Engineer's approval. All adjustments shall permit gradual bends of the pipe to the original alignment beyond the directional bore section. At unusual site conditions, the Contractor may request a review of site conditions by the Engineer for additional adjustment, and such determination shall be final. An adjustment in alignment, position, or elevation approved by Engineer shall not be cause for an adjustment of costs.

D. Pilot hole shall be drilled along the path shown on the Drawings with the following tolerances:

1. Vertical tolerance: Minimum cover below channel bottom as specified on the plans.
2. Horizontal tolerance: Horizontal tolerance shall be plus/minus two feet (24 inches) from the centerline of the proposed pipe alignment as shown on the Drawings.
3. Design Curve Radius: No curve is acceptable with a radius less than 40 times the outer diameter for HDPE pipe, 100 times the outer diameter for ferrous pipe, or 300 times the nominal diameter of restrained joint PVC pipe.
4. Alignment: 5% of depth per 100 feet.
5. Entry Point Location: The pilot shall initially penetrate the ground surface at the exact location intended, which shall not deviate more than two feet (2') from the centerline of the proposed pipe alignment as shown on the Drawings. The entry point may be moved along the pipeline alignment up to twenty-five feet (25') further from the original entry point only with Engineer's approval.
6. Exit Point Location: The pilot hole shall finally penetrate the ground surface within plus or minus two (2) feet of the alignment shown on the Drawings and within plus or minus twenty five feet (25') of the length shown on the Drawings. Exit point lengths greater than twenty-five (25) feet from the original point shown on the Drawings require Engineer's approval.
7. Entry and exit points normally will not be allowed closer to the banks of a waterway being crossed than shown on the Drawings.
8. The installed pipeline cover requirements as shown on the Drawings, or as specified herein, is mandatory.

E. Any installation that deviates from the plan by more than these tolerances may be rejected and any rejected installation shall be reconstructed at the Contractor's expense.

F. The vertical profile as shown on the Drawings is the minimum depth to which the pipeline shall be installed. Contractor may, at his option and with the permission of Engineer and Owner, elect to install the pipe at a greater depth than shown on the Drawings, at no additional cost to the Owner. Contractor to verify that any changes in vertical or horizontal alignment will not result in exceeding the design stress of the pipe and result in stretching of the pipe.

3.05 INSTALLATION:

A. The following is a general outline of steps for the directional bore operation, which shall be followed except as otherwise approved by the Engineer:

1. Clear the right of way and temporary work space as shown on the Drawings. Contractor to install and maintain all soil erosion and sediment control devices, until project completion with approved permanent site stabilization.

2. Lay out the HDD pipe alignment using a qualified land survey team to confirm accurate horizontal distances, either physically measured or shot by Electronic Distance Measurement. Entry and exit points shall be located and marked with survey hubs or markers.

3. Haul, string, and assemble restrained pipe. Except when the cartridge method is used where site constraints prevent pre-assembly of the pipe (as approved by the Engineer), perform leakage test of the assembled pipeline section prior to installation as specified below. If sufficient linear footage of lay down area for the pipe string is not available, the finished pipeline may be assembled in as few sections as possible, with each section leakage tested separately. The Contractor shall be responsible for ensuring that the drill rig has adequate pullback capacity to overcome the increased frictional resistance resulting from the stoppage of pipe pullback to perform the final weld, fusion or assembly of pipe sections.

   All assembled pipe sections shall be securely plugged at the end of each work day. The pipe interior shall be protected at all times against dirt, dust, drilling mud, pipe cuttings, debris, animal access, and other sources of contamination.

4. Provide adequate support rollers for the pipeline during pullback of the pipe string into the pre-drilled hole. The rollers and cradles shall be of a type that will prevent damage to the pipe and tracer wires and shall be of sufficient number, as recommended by pipe manufacturer, to prevent over stressing due to sag bends during the pullback procedure. The pipe shall be supported at all times, including pullback, to maintain a free stress arc which limits pipe bending and internal hoop stresses to within manufacturer's limits.

   Pipe which is not properly protected and supported and shows indications of excessive stressing, gouges exceeding allowance specified above, cuts, abrasions or other damage which may affect the operational performance intended for the pipe, as recommended by pipe manufacturer, shall be removed from the site and replaced at no additional cost as directed by the Owner or Engineer.

5. Mobilize the drilling equipment, erect the rig, drill a pilot hole, enlarge the hole as necessary to a minimum diameter of 1.5 times the nominal diameter of the pipe, and pullback the prefabricated pipe string.

   Prior to beginning the pilot hole over reaming, furnish to the Engineer an as-built plan and profile of the actual pilot hole installation to confirm the installation is in compliance with the Contract Documents. Pilot hole alignment

shall be accepted by Engineer or Owner in writing prior to reaming and pipe installation.

The Contractor shall be responsible for selecting the reaming process to be utilized, whether forward and/or back reaming will be undertaken, and the number of reaming passes to be made.

6. Supply portable mud tanks or construct temporary mud pits to contain excess drill fluids during construction and slurry material displaced by the pipe during installation. Mud pits are to be protected at all times against unauthorized access and shall be stabilized at all times against surface water runoff and containment berm failure. Pump, haul and dispose of any drill cuttings and excess drill fluids to a receiving site permitted to accept the spoils, all in a manner consistent with the local and state regulations at no additional cost to the Owner.

7. Pull back the bore pipe in one continuous section using a swivel to minimize the rotation of the pipe during pullback. Swivel shall utilize lubricated internal bearings which are fully protected from external contamination and over lubrication. Demonstrate the swivel operation prior to the Engineer prior to the pullback operation. Ensure pullback forces do not exceed 5 percent strain on HDPE pipe.

8. Concrete anchor collars shall be constructed as shown on the Drawings or where directed by the Engineer.

B. Water used to fill the carrier pipe to counter pipe flotation shall be potable water. Contractor shall disinfect all piping and hoses used for water addition to the carrier pipe.

C. Regardless of the pipe material, unless not permitted by the right-of-way owner, inject a low strength cement slurry into the bore hole for approximately 50 feet at each end of the drilled pipeline. Where cement slurry cannot be used, provide restraint at both ends of the pipeline outside the bore to hold the pipe in place. The type of restraint shall be submitted to the Engineer in advance of the Work and must be approved by the Engineer prior to the start of construction.

D. Owner, Engineer and Resident Project Representative shall have access at all times to any measuring or gauging devices used for the horizontal drill as well as any drilling logs maintained by the Contractor.

E. In the event that the Contractor must abandon the drill hole before completion of the directional bore, the Contractor shall seal the borehole with neat cement grout starting at the low point or end of the drill hole and redrill the directional bore at no extra cost to Owner.

F. HDPE pipe shall be installed so as to not exceed manufacturer’s design maximum tensile stress with a factor of safety of 2.0.

G. Contractor shall monitor the ground surface within the vicinity of the directional bore during HDD operations for any evidence of drilling fluid fracture. Where the directional bore crosses under a stream or other waterway, Contractor shall monitor the stream or waterway for any evidence of drilling fluid fracture. In the event that a drilling fluid fracture, inadvertent returns, or returns loss occurs during

pilot hole drilling operations, Contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a Marsh funnel and then wait another 30 minutes. If mud fracture or return loss continues, Contractor shall cease operations and notify Engineer. Corrective procedures shall be reviewed and approved by the Engineer prior to resuming work.

3.06 JOB CONDITIONS

A. Any nighttime work is strictly regulated and will be allowed only with prior approval granted by the Owner subject to regulatory agencies having jurisdiction. All HDD operations shall be accomplished during daylight hours, unless approved by the Engineer. HDD work shall not begin after the hour pre-established as the latest starting time that will allow completion during daylight hours, unless approved by the Engineer. The Contractor shall provide a Work Plan submittal indicating the proposed hours of operation and length of work week. All work plans shall be subject to compliance with all applicable regulatory requirements for construction activities and any off site impacts.

B. When hazards of nighttime work are carefully considered and determined to be insignificant, nighttime work may be allowed only to complete a properly planned HDD installation, and only if, in the opinion of the Engineer, a delay was caused by reasonably-unavoidable circumstances and such nighttime work is necessary to avoid placing an undue economic hardship on the Contractor.

C. In emergency situations, or where delay would increase the likelihood of a failure, nighttime work may be allowed to complete a delayed HDD installation.

D. Pipe pullback operations shall continue on a 24-hour per day basis until pipe pullback is complete, but work shall be properly planned and scheduled to avoid or minimize pipe pullback operations at night to the extent possible.

3.07 INSTALLATION ACCEPTANCE AND CLEANUP

A. Defects which may affect the integrity or strength of the pipe in the opinion of the Engineer shall be repaired or the pipe replaced at the Contractor's expense.

B. All exposed carrier pipe that is pulled into the receiving pit behind the pull head shall be inspected for damage. Depending on the gouging, abrading or damage witnessed, the pipe may be accepted, de-rated, reinstalled, or abandoned as unusable per the Contract Documents. If the newly installed pipe is deemed damaged and unusable, the Contractor shall dig and replace the pipe to the extent directed by the Engineer at no additional expense to the Owner.

C. Following the installation, the project site shall be returned to a condition equal to or better than the pre-construction condition of the site. All excavations will be backfilled and compacted and all surfaces shall be restored per the Contract Documents.

D. Contractor shall verify that all utilities, structures, and sub-surface features within the envelope of possible impact of the HDD operation as determined for the project specific site conditions are sound and in proper working order.

3.08 FLUSHING, PRESSURE/LEAKAGE TESTING AND DISINFECTION

A. Except when the cartridge method is used where site constraints prevent pre-assembly of the pipe (as approved by the Engineer), perform an allowable leakage test in accordance with AWWA C600 and Section 15030 or a low pressure air test (procedure shall be proposed by Contractor and approved by Engineer) on the full length of pipe prior to pipe pullback but after all sections have been welded, fused or assembled. In the event that available lay down area does not permit assembly of the entire pipe length prior to pullback, the two assembled sections shall be tested independently.

B. A hydrostatic pressure test shall also be performed on the complete, installed pipe (i.e. after completion of all HDD procedures) in accordance with AWWA C600 and as described in Section 15030.

C. The carrier pipe shall be flushed and disinfected as described in Sections 15020 and 15025 or as otherwise approved in advance by the Engineer.

D. As an alternative, but only when approved by the Owner, the carrier pipe can be filled with potable water, pressure tested and disinfected prior to insertion. Contractor shall provide Engineer with full work plan to employ this alternative.

3.09 CONNECTION TO ADJOINING PIPE

A. Perform connections in accordance with Sections 01000, 15000, 15105, 15120, 15125, 15130, and 15170, as applicable, from the directionally drilled pipe to adjacent pipe, with support, backfill and compaction per Section 02210.

END OF SECTION

SECTION 02540

EROSION AND SEDIMENTATION CONTROL

PART 1: GENERAL

1.01 SCOPE OF WORK

The work under this section consists of providing all labor, materials, tools, equipment, and services required to design, perform and maintain all temporary and permanent erosion and sedimentation control throughout the Work area (including borrow, storage and disposal areas) as indicated on the Drawings and as specified within this section and related sections of the Specifications.

A. Erosion and sedimentation control shall include excavation, grading, temporary seeding, permanent seeding, maintenance, legal sediment disposal, permits and all other required Work and shall be in accordance with the IDEM SWQM.

B. In addition to the requirements of these Specifications, comply with all local Soil and Water Conservation District (SWCD) laws, rules and regulations and all other Federal, State, County and local requirements for erosion and sedimentation control. Contractor shall be required to install and maintain all required Soil and Erosion Control measures as required by the controlling authority and as detailed in the Contract Documents. If the contract's erosion control permit falls under the authority of a proposed road project, the Contractor shall maintain all Soil and Erosion Control measures installed by others. If the Contractor damages the existing Soil and Erosion control measures during installation of the mains, the Contractor shall repair or replace the items as required.

C. The Contractor shall be responsible for implementing the Best Management Practices (BMPs) to prevent and minimize erosion and resultant sedimentation in all cleared and grubbed areas during and after construction. This section covers the work necessary for the installation of pipe lines and measures for the prevention of soil erosion and control of sedimentation. The Contractor shall furnish all material, labor and equipment necessary for the proper installation, maintenance, inspection, monitoring, reporting and removal of erosion prevention and sediment control measures and, if applicable, to cause compliance with all local permits and the State of Indiana Department of Environmental Management and State of Indiana Department of Natural Resources.

1. For disturbances over one (1) acre, the Owner or Engineer shall submit under Indiana Department of Environmental Management (IDEM) Rule 5 a Notice of Intent (NOI) for coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit Rule for Stormwater Discharges Associated with Construction Activity. Upon request, Contractor shall provide any required supporting documents, including Storm Water Pollution Prevention Plan (SWP3). The construction site shall comply with all terms and conditions of the General Permit Rule 327 IAC 15-5 (Rule 5).

2. Contractor shall not commence construction activities until given notice from the Owner or Engineer, which is typically after thirty (30) calendar days following submittal of the NOI. Contractor shall verify requirements governed by specific community MS4 districts that may have additional requirements that shall be met prior to initiation of land disturbance.
3. Construction activities shall not begin prior to verification that the Construction Plan meets the minimum requirements of the Rule and the submittal of the NOI letter.
4. Contractor must notify IDEM and the review authority of the actual start date within 48 hours of starting land disturbance activities.
5. Contractor shall implement the Construction Plan throughout the life of the project. The Construction Plan must be implemented before, during, and after construction activities.
6. Contractor shall post the approved NOI Stormwater permit at the Work site.
7. Contractor shall comply and maintain fueling area spill containment.
8. Contractor shall provide dewater pump discharge water filtration bags.

D. The project will be inspected by the local MS4 Coordinators, any and all fines or penalties related to an issued Notice of Violation (NOV) accessed by the controlling authority shall be the responsibility of the Contractor.

1.02 GENERAL REQUIREMENTS

A. Any disturbance as the result of modifications to the site drainage's features or topography requires protection from erosion and sedimentation.

B. All excavations shall be in conformity with the lines, grades, and cross sections shown on the Contract Drawings or established by the Engineer.

C. It is the intent of this Specification that the Contractor conducts the construction activities in such a manner that erosion of disturbed areas and off site sedimentation be absolutely minimized.

1.03 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, certifications, and other required submittals for all products furnished under this section in accordance with Section 01300 as well as the following submittals:

1. Certificate of compliance with the standards specified below for each source of each material.
2. List of disposal sites for waste and unsuitable materials and evidence of all required approvals and permits for use of those sites.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 01700 Project Closeout

G. Section 02105 Clearing and Grubbing

H. Section 02210 Trenching, Backfilling and Compacting

I. Section 02230 Stream Crossing

J. Section 02820 Lawn Restoration and Landscaping

K. Section 15000 Piping General Provisions

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, Engineer shall determine which requirements shall prevail.

A. Indiana Administrative Code Title 327 Water Pollution Control Division (327 IAC)

B. Indiana Construction/Land Disturbance Storm Water Permitting General Permit Rule 327 IAC 15-5 (Rule 5).

C. Indiana Department of Environmental Management (IDEM) Storm Water Quality Manual (SWQM) Chapter 7: Storm Water Quality Measures – Construction and Land-Disturbing Activities.

D. IDEM Rule 5 Guidance for Construction Plan/Storm Water Pollution Prevention Plan Development.

PART 2: PRODUCTS

2.01 MATERIALS - GENERAL

A. Materials for use in erosion and sedimentation control devices shall be in accordance with IDEM SWQM, local SWCD and MS4 requirements, the Drawings, and the SWP3.

PART 3: EXECUTION

3.01 INSTALLATION AND MAINTENANCE

A. All installation and maintenance shall be conducted in accordance with this Specification and the IDEM SWQM. In the event of a discrepancy between this Specification, Manufacturer's recommendations and the IDEM SWQM, the more stringent requirements shall take precedence.

B. If applicable, all requirements of the NPDES Permit shall be followed. In the event of a discrepancy between this Specification and the NPDES Permit requirements, the more stringent requirements shall take precedence.

C. If possible, erosion and sedimentation control devices shall be established prior to clearing operations in a given area. Where such practice is not feasible, the erosion and sedimentation control device(s) shall be established concurrent with the clearing operations or immediately following completion of the clearing operations.

D. The Contractor shall furnish the labor, materials and equipment required for routine maintenance of all erosion and sedimentation control devices. At a minimum, maintenance shall be scheduled as required for a particular device to maintain the removal efficiency and intent of the device. Note that specific maintenance intervals for various measures and practices are specified within the IDEM SWQM. Of the maintenance requirements specified herein and in the IDEM SWQM, the more stringent shall take precedence for each and every sediment and erosion control measure utilized on the site. Maintenance shall include but not be limited to 1) the removal and satisfactory, legal disposal of accumulated sediment from traps or silt barriers and 2) replacement of filter fabrics used for silt fences and stone impaired by sediment in stone filters, gravel construction entrances, etc. Maintenance as noted in items 1) and 2) above shall be performed as required, and at least once every 3 months for the duration of construction activities. Sediment removed from erosion and sedimentation control devices shall be disposed of in locations that will not result in off-site sedimentation as acceptable to the Engineer, at no additional cost to the Owner. If no suitable on site locations are available, all such sediment will be legally disposed of off site, at no additional cost to the Owner.

3.02 ADDITIONAL REQUIREMENTS

A. The Contractor shall provide adequate means to prevent any sediment from entering any storm drains, curb inlets (curb inlet filter box), ditches, streams, or bodies of water downstream of any area disturbed by construction. Excavation materials shall be placed upstream of any trench or other excavation to prevent sedimentation of offsite areas. Silt fence will be provided, at no additional cost to

the Owner, around excavation materials if deemed necessary by the Engineer. In areas where a natural buffer area exists between the work area and the closest stream or water course, this area shall not be disturbed.

B. The Engineer may direct the Contractor to place any additional sediment and erosion control devices at other locations not shown on the Drawings.

3.03 INSPECTIONS AND MAINTENANCE

A. The Contractor shall designate an Authorized Representative to perform inspections and maintenance as described within the General Permit.

END OF SECTION

SECTION 02558

IDENTIFICATION/LOCATION GUIDE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this Section consists of providing all labor, materials, tools, equipment, and services required to provide identification tape, location (tracer) wire, test/tracer boxes, and marker posts as indicated on the Drawings and as specified within this section and Sections 01011, 02210, and 15000. Contractor shall furnish tracer wire, identification tape, test/tracer boxes, marker posts, and all other materials that are not furnished by Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

1.02 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, certifications and other required Submittals for all products furnished under this section in accordance with Section 01300.

1.03 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 01700 Project Closeout

G. Section 02210 Trenching, Backfilling and Compacting

H. Section 15000 Piping – General Provisions

I. Section 15130 Pipe Specialties

1.04 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI, etc.) shall mean the most current available revision.

PART 2: PRODUCTS

2.01 DETECTABLE IDENTIFICATION TAPE (FOR WATER MAINS AND HYDRANT BRANCHES)

A. Detectable identification tape shall be manufactured of laminated polyethylene with a minimum overall thickness of 6 mil, including a 0.3-mil thick metallic foil core encased between two layers of clear polyethylene film. The tape and ink shall be chemically inert and highly resistant to alkalis, acid and other destructive agents found in soil. Detectable tape width shall be 2 inches.

B. Detectable tape shall have Blue background color (per APWA color code standards) and shall be imprinted "CAUTION - WATER LINE BURIED BELOW" with abrasion-resistant black letters using permanent ink. Imprint shall repeat itself a minimum of once every 2 feet for entire length of the tape.

C. Tape shall conform to the following requirements:

Property	Method	Value
Width		2 inches
Overall Thickness	ASTM D-2103	6.0 mil
Thickness Foil Core	ASTM D-2103	0.3 mil
Foil Purity	-	>= 99%
Weight	ASTM D-2103	34 lbs./1000 sq. ft.
Tensile Strength	ASTM D-882	3600 psi (45 lbf. for 2" tape)
Elongation	ASTM D-882	60%
PPT Resistance	ASTM D-2582	15.5 lbf.
Printability	ASTM D-2578	>= 40 Dynes
Tape Color	APWA	Blue
Imprint (black)		"CAUTION – WATER LINE BURIED BELOW"

D. Detectable identification tape shall be Terra Tape® Sentry Line® detectable tape as manufactured by Reef Industries, Inc., Houston, Texas.

E. Splices shall be made with Terra Clips manufactured by Reef Industries, Inc.

2.02 LOCATION (TRACER) WIRE

A. For piping installed by open cut or bore-and-jack (i.e. casing installations per Section 02220):

1. Location wire shall be direct burial #10 or #12 AWG (0.1019- or 0.0808-inch diameter conductor, respectively), 21% conductivity solid annealed copper-clad, carbon steel core high-strength tracer wire, with at least **430 pounds average tensile break load**, minimum 10% elongation, with 30 mil high-molecular weight, high-density, blue polyethylene jacket complying with ASTM D1248, 30 volt rating.

2. Location wire shall be from Copperhead Industries, LLC, part number 1230B-HS (#12 AWG); DURAtrace CCS (**#10 AWG**) by DURAtrace; PRO-TRACE HF-CCS PE30 (**#10 AWG**) as manufactured by Pro-Line.

B. For piping installed by directional drilling (per Section 02458):

1. Location wire shall be direct burial #10 or #12 AWG (0.1019- or 0.0808-inch diameter conductor, respectively), 21% conductivity solid annealed copper-clad, high-carbon steel core hard drawn extra-high strength horizontal directional drill tracer wire with at least **1,150 pounds average tensile break load**, minimum 1% elongation, with 45 mil high-molecular weight, high-density, blue polyethylene jacket complying with ASTM D1248, 30 volt rating.
2. Splices shall not be permitted on tracer wire installed by HDD.
3. Location Wire for HDD applications shall be from Copperhead Industries, LLC, SoloShot part number 1245B-EHS (#12 AWG) or PRO-TRACE HDD-CCS PE45 (#12 AWG) as manufactured by Pro-Line.

C. For piping installed by pipe bursting method (per Section 02350)

1. Location wire shall be direct burial copperclad steel reinforced tracer wire specifically designed for use in pipe bursting applications.
2. Wire shall be 7 X 7 stranded copper clad steel with 0.208-inch bare outside diameter, a 50 mil HDPE jacket and at least **4,700 pounds average tensile break load**. Wire shall be rated 30 volts, and insulation shall be rated 600 volts.
3. Splices shall not be permitted on tracer wire installed by pipe bursting.
4. Location wire for pipe bursting applications shall be SoloShot Xtreme from Copperhead Industries, LLC.

D. Wire shall be blue in color per APWA color code.

E. Wire insulation shall be highly resistant to alkalis, acid and other destructive agents found in soil.

F. The location wire shall have water-blocking characteristics, be corrosion resistant, and have UV protection.

G. All splices shall be encased with a waterproof connector rated at 30 Volts for direct bury and submersion applications that is recommended by the wire manufacturer for the intended application and installation method. Connectors shall be furnished by the same supplier as the wire.

2.03 TEST/TRACER BOXES

A. All test/tracer boxes shall be 18-inch long, adjustable-to-grade, 4-inch inside diameter, ABS plastic box flared and squared at base with a 1 ½" cast iron flange at top for heavy-duty installation at grade. Lid shall be a one piece locking cast iron lid with "Test Station" marked on lid and shall contain 5 screw-type brass terminals (or other quantity as approved) on a non-conductive terminal board, which shall be secured in place beneath the lid.

B. Test/tracer boxes shall be Model T4 as manufactured by Handley Industries, Inc., Jackson, Michigan.

2.04 MARKER POSTS

A. Marker posts shall be fiber-composite marker posts with a minimum length of 66-inches, 4-inch width, and a concave design that allows the post to flatten out completely upon vehicle or direct tire impact at highway speed, then snap back to its normal upright position. Tensile strength as tested per ASTM D-638 shall be at least 50,000 psi. The posts shall be UV-stabilized for fade resistance, and color shall be standard blue for water. Posts shall be temperature stable and remain flexible from -40 to at least 140 degrees F.

B. The decals must be UV stable, all-weather type with a no dig symbol and standard 811 logo. Decals shall use contrasting color-fast vertical white lettering on blue background (except as otherwise indicated below).

Installed Location	Text	Rhino Decal
Pipeline	WARNING: WATER PIPELINE	GD8-1333K
Butterfly & Gate Valves	WARNING: WATER VALVE	GD8-5226K
Blow-Off Assemblies	WARNING: WATER LINE BLOW OFF (blue lettering on white background)	GD-5411K (plus 811 patch decal)
Air Valves	WARNING: AIR RELEASE VALVE	GD-5472K

C. All marker posts shall be Rhino FiberCurve™ with SunCoat™ coating or Carsonite Curv-Flex™ Marker. Where required in Section 01011, marker posts shall be provided with PolyTech Coating™. Marker posts shall be manufactured by one of the following approved manufacturers:

Rhino Marking and Protection Systems
A Division of REPNET, Inc.
280 University Drive Southwest
Waseca, MN 56093
1-800-522-4343

Carsonite International
605 Bob Gifford Boulevard
Early Branch, SC 29916
1-800-648-7916

PART 3: EXECUTION

3.01 GENERAL

A. Install identification tape and location wire over the centerline of all buried potable water mains, hydrant branches, and trenched services as indicated on the Drawings and as specified within this Section and Sections 02210 and 15000

3.02 INSTALLATION OF DETECTABLE IDENTIFICATION TAPE

A. Install detectable identification tape with all trenched potable water lines (including mains and fire hydrant branches, but not service lines) in accordance with the manufacturer's installation instructions and as specified herein. This

tape shall provide an early warning at shallow depth excavation and assists with locating the pipe during excavation.

B. Install identification tape one foot above the top of the pipe, but not less than one foot below finished grade.

Detectable identification tape shall be installed continuous from valve to valve and valve to hydrant. Splice detectable identification tape per manufacturer's instructions to maintain electrical continuity.

3.03 INSTALLATION OF LOCATION (TRACER) WIRE

A. Install location (tracer) wire with all pipe (regardless of pipe material, size, or function) in accordance with the manufacturer's installation instructions and as specified herein and in Sections 02210, 02458, and 15000.

B. For piping installed by open cut method:

1. Install the location wire directly on top of the buried pipe, but outside the polyethylene encasement (when applicable), prior to placing backfill. Wire shall be taped to the pipe or polyethylene encasement with polyethylene tape at a minimum spacing of 10 feet.
2. The wire shall be contiguous except at test stations, valve boxes (where approved), and where splicing is permitted as specified herein. Splices shall be completed per the manufacturer's recommendations and shall be watertight.
3. At every valve box (including fire hydrant branch valves), the wires (one in each direction) shall be extended upward along the exterior of the valve box for connection of locating equipment and taped to the valve box approximately twelve inches (12") below grade with polyethylene tape. Provide adequate slack in the wire leads both above and below the tape to reduce breakage from pulling or settlement. Each wire shall penetrate the valve box through a drilled hole fitted with a rubber grommet approximately six inches (6") below grade. If directed by the Owner, loop the location wire into the valve box to maintain continuity of the wire through the valve box installation. Wires shall be provided with at least three feet (3') of extra slack on each tracer wire (total of 6' extra wire when looped) at each valve box. Neatly coil the extra wire inside the valve box within easy reach. Do not allow wires to become twisted together.
4. Maximum spacing between accessible test points shall be 1,250 feet. Where spacing between valve boxes exceeds 1,250 feet, location wire shall be terminated at a separate test/tracer wire box.
5. Contractor shall test continuity of all wires upon completion of backfill. Any wire that fails the continuity test shall be replaced by the Contractor.

C. For piping installed by bore-and-jack (i.e. casing installations per Section 02220), horizontal directional drilling (per Section 02458), or pipe bursting (per Section 02350):

1. Wire shall either be wrapped around the pipe or taped with polyethylene tape to the pipe at a minimum spacing of 10 feet before installation.

2. The wire shall be contiguous between drill/bore entry and exit with no splices. Install a test/tracer wire box at each end.
3. Regardless of the piping material, a minimum of three (3) tracer wires shall be affixed to the pipe and installed simultaneously with pullback of the pipe (HDD) or jacking of the pipe (casing installations).
4. When ductile iron pipe is used, tracer wires shall be installed outside the polyethylene encasement.
5. Contractor shall test continuity of all wires upon completion of HDD pipe pullback (or upon sealing the casing ends for casing installations). If all wires fail the continuity test, the directional drill or casing installation will be rejected.
6. Connectors shall be furnished by the same supplier as the wire. Connectors shall be connected to one or the three installed tracer wires.

3.04 INSTALLATION OF TEST/TRACER WIRE BOXES

A. Unless otherwise indicated in Section 01011 or directed by the Owner, install test/tracer wire boxes at every dead-end, at the beginning and end of every project, at other locations as necessary to provide access to tracer wire at intervals not to exceed 1250 feet, and at other locations designated on the Drawings.

B. Test/tracer wire boxes shall be installed flush with grade in non-traffic areas unless otherwise noted.

C. Wires shall be connected to the provided terminals and shall be provided with at least three feet (3') of extra slack on each tracer wire at each box. Do not allow wires to become twisted together.

3.05 INSTALLATION OF MARKER POSTS

A. Install marker posts using manual driver equipment designed for their installation per the manufacturer's guidelines. Place at locations indicated on the Drawings, in Section 01011, or as directed by the Engineer.

B. If soil conditions dictate (i.e. in order to avoid damage to the posts), use a pilot hole driver designed for the purpose.

C. Install marker posts to a depth of approximately 18 inches or more as recommended by the manufacturer.

END OF SECTION

SECTION 02610

ROADWAY PAVING AND SURFACING

PART 1: GENERAL

1.01 SCOPE OF WORK

The Work under this section consists of providing all labor, materials, tools, equipment, and services required to perform paving and related Work as indicated on the Drawings and as specified within this section and related sections of the Specifications.

A. This section includes replacement of all pavement, traffic control devices (including traffic detector loops), pavement striping, traffic calming features, and signage that are damaged or disturbed as a result of the Work or related activities and all other such Work as shown on the Drawings.

B. The Drawings shall indicate the extent of paving criteria required. However, **the Contractor shall be responsible to verify applicable local/municipality paving requirements prior to submitting bids and shall comply with all applicable paving requirements at no additional cost to the Owner.**

C. All Work under this section shall be performed as required by applicable local, state, and federal regulations. Replacement will be at least equal to the type of pavement and related items that existed before the Work began and to the satisfaction of the Resident Project Representative and agencies with jurisdiction.

D. Paving Subcontractor shall spread and roll and/or tamp temporary bituminous pavement, complete, in place, and maintain the same all as specified or as directed by the Resident Project Representative.

E. During the entire period of construction of the project, keep all streets, curbs, drives and walks in clean, usable, and safe conditions for public use. Keep the work area free from accumulations of waste material, rubbish and other debris resulting from the Work. Clean all roadways daily. Sweep, scrape, shovel or use whatever other approved means, including mechanical pickup sweeper that may be necessary to clean and maintain the roadways to the satisfaction of Owner and the agency having jurisdictional control over said road.

F. After the new main is installed and backfilled, the Contractor shall be responsible for trimming the existing pavement edges to insure a substantially straight line edge between existing pavement and new pavement. The trimming is to remove any ragged edges incurred during construction.

G. Before final acceptance, any trench settlement is to be corrected to the satisfaction of the Resident Project Representative and agency having jurisdictional control over the road. Contractor shall replace pavement, curbs, drives and walks designated by the Engineer with the type of replacement specified.

1.02 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer's literature and product data, certifications, and other required submittals for all products furnished under this section in accordance with Section 01300. In addition, the Qualifications of the paving Subcontractor shall be submitted as follows:

A. The paving Subcontractor shall show that he has performed satisfactory asphalt paving work for at least the past five (5) consecutive years. These Qualifications shall include detailed descriptions of the following, which shall be sufficient to verify the requirements of Article 1.04 below:

   1. Name, business address and telephone number of the paving Subcontractor.
   2. A list of at least five references of previously-completed projects of similar size or larger demonstrating experience over the past 5 consecutive years, including project engineer's and customer's names, addresses and telephone numbers.
   3. Name(s) of all supervisory personnel to be directly involved with paving for this project. For each individual, list previous paving projects and the individual's responsibilities on that project.
   4. The Contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel for the paving work will be directly involved with and used on this project.

B. Paving Subcontractor shall be authorized by the state, municipality, or other local agency having jurisdiction over the roadway to perform the required Work.

1.03 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01500 Temporary Facilities

F. Section 01570 Traffic Regulation

G. Section 01600 Products

H. Section 01700 Project Closeout

I. Section 02025 Existing Utilities and Structures

J. Section 02210 Trenching, Backfilling and Compacting

K. Section 02540 Erosion and Sedimentation Control

L. Section 02820 Lawn Restoration and Landscaping

M. Section 03310 Cast-In-Place Concrete for Paving, Driveways, Sidewalks, Curbs, and Paved Ditches

N. Section 15000 Piping – General Provisions

O. Section 15130 Piping Specialties

1.04 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. Indiana Department of Transportation (INDOT) Standard Specifications

PART 2: PRODUCTS

2.01 MATERIALS

A. Temporary Asphalt - Cold mix asphalt will not be allowed as permanent pavement; all paving must be completed using hot mix asphalt. With the approval of the local municipality, in conditions when hot mix asphalt is not available, the Contractor shall cap all trenches with concrete to 1.5” below existing grade and provide cold mix asphalt on top as temporary asphalt to finish the trench to grade. The cold patch material shall be maintained by the contractor to the satisfaction of the Resident Project Representative and the agency with jurisdiction over the roadway until hot mix asphalt is available. When conditions allow, the Contractor shall remove the cold mix asphalt and provide hot mix asphalt over the concrete using a tack coat between the layers. Cold mix asphalt and tack coat materials shall be as specified in INDOT Standard Specifications Section 403 and 406, respectively.

B. Permanent Asphalt Pavement - All work including materials and placement of hot mix asphalt (HMA) shall be provided in accordance with INDOT Standard Specifications Sections 402 and 900. Local pavement standard cross-sections shall apply where available. Where not available, pavement sections including all layers listed for the applicable road type (as determined by the authority with jurisdiction) shall be used according to the table below:

Asphalt Pavement Sections			
Layer	Residential	Collector	Arterial/Comm.
1	HMA Surface, Type A, 9.5mm, 1.5 in.	HMA Surface, Type B, 9.5mm, 1.5 in.	HMA Surface, Type B, 9.5mm, 1.5 in.
2	HMA Inter., Type A, 19mm, 2.5 in.	HMA Inter., Type B, 19mm, 2.5 in.	HMA Inter., Type B, 19mm, 2.5 in.
3	HMA Base, Type A, 25mm, 2.5 in.	HMA Base, Type B, 25mm, 4 in.	HMA Base, Type B, 25mm, 4 in.
4	HMA Base, Type A, 25mm, 4 in.	HMA Inter., Type B (Open-Graded), 19mm, 2 in.	HMA Inter., Type B (Open-Graded), 19mm, 2 in.
5	INDOT Subgrade Type 1A	HMA Base, Type B, 25mm, 3 in.	HMA Base, Type B, 25mm, 6 in.
6		INDOT Subgrade Type 1A	INDOT Subgrade Type 1A

C. Asphalt Sealer, where called for on the Drawings, shall be provided as specified in INDOT Standard Specifications Section 404 and Section 902. Other materials suitable for asphalt sealer as listed in Section 902 may be provided as approved by the Engineer.

D. Concrete Pavement - All work, including materials associated with rigid Portland cement concrete pavement (PCCP) shall be provided in accordance with Section 03310. Aggregates shall be as specified in INDOT Standard Specifications Section 900. Placement shall be in accordance with Section 03310 and INDOT Standard Specifications Section 500. Local pavement standard cross-sections shall apply where available. Where not available, pavement sections including all layers listed for the applicable road type (as determined by the authority with jurisdiction) shall be used according to the table below:

	Concrete Pavement Sections			
		Layer Thickness		
Layer	Material	Residential	Collector	Arterial/Comm.
1	PCCP (in.)	6	9	10
2	#8 Compacted Agg. (in.)	NA	3	3
3	#53 Compacted Agg. (in.)	6	6	6
4	Subgrade Prep.	INDOT Type 1A	INDOT Type 1A	INDOT Type 1A

E. Concrete Cap – Concrete caps in trenches and other similar situation shall be provided in accordance with Section 03310. Aggregates shall be as specified in INDOT Standard Specifications Section 900. Placement shall be in accordance with Section 03310 and INDOT Standard Specifications Section 500. The thickness shall be the same thickness as the existing pavement section. The concrete cap may extend up to grade or stop 1.5" below grade to receive an asphalt surface coat, also provided by the Contractor, as directed by the Engineer.

F. Traffic control devices (including traffic detector loops), pavement striping, traffic calming features, and signage shall be replaced to match conditions prior to the Work (or as otherwise indicated on the Drawings or required by the authority with jurisdiction) and shall meet all federal, state, municipal, and other local requirements.

PART 3: EXECUTION

3.01 INSTALLATION

A. Paving Subcontractor performing the Work under this section shall have performed satisfactory asphalt paving work for at least the past five (5) consecutive years and be authorized by the state, municipality, or other local agency having jurisdiction over the roadway to perform the required Work.

B. Saw or line cut the existing pavement, where necessary, as required by local, State or Federal regulations. The edges of the face of the old pavement or base shall be left vertical. Trim ragged edges so as to provide a substantially straight line juncture between the old and new surfaces.

C. Mill & grind - Contractor shall mill, grind, scarify existing surface to ensure adequate bond between the new asphalt and existing surface. Contractor shall

protect existing concrete curbs, gutters, manhole structures and storm sewer inlets.

D. Place the pavement replacement so as to conform in grade to the existing streets, drives and sidewalks. The type of pavement replacement shall be as shown on the pavement replacement details in accordance with applicable Federal, State or local standards. If there are no such applicable standards, replacement will be made to the satisfaction of the Engineer in accordance with this section.

E. After restoration of all asphalt surfaces, the Contractor shall be responsible for sealing all asphalt joints with INDOT approved joint sealer.

F. Roll and tamp in place a 2 inch thick (minimum) course of bituminous material over trenches where temporary pavement is ordered. Remove temporary pavement prior to the placing the permanent pavement. The cost shall be included in the contract price. The finished temporary surface shall be flush with the adjacent undisturbed surface. Maintain the temporary bituminous surface until the temporary surface is replaced.

G. Before the completion of each day's work, in traveled areas, pave the pipe trench with 6 inches of stabilized base, unless another method of pavement restoration is required by the authorized agency with jurisdiction over the roadway. Place final paving over the stabilized base, overlap each side of the trench a minimum of 6 inches, and feather to meet the existing pavement; unless another method of pavement restoration is required by the agency with jurisdiction over the roadway.

H. No permanent bituminous top paving shall be placed within twenty (20) days, or other specified timeframe required by law or regulation, after the backfilling is completed, except by order of the Engineer. Place final pavement at least 20 days and not more than 45 days or other specified timeframe required by law or regulation after the backfilling is completed, unless otherwise directed by the Engineer.

I. Instead of temporary paving, the use of steel roadway plates may be required if an excavation within traveled areas is subject to repeated access prior to backfill/final paving. The use of steel roadway plates shall be in strict accordance all applicable regulations with the Federal, State, County, and/or Local Agency having jurisdiction. Properly secure the steel roadway plates so that they will not be "dragged" from place by a braking truck or "pushed" from place by a snowplow. Submit load bearing calculations, when requested by the Engineer, sealed by a Professional Engineer who is licensed to practice in the State of Indiana. Calculations must demonstrate that the steel roadway plate is properly designed and installed to accommodate HS-20 or higher vehicular loadings, as applicable, based upon plate dimensions (L x W x T), steel strength, and the size of the excavation (L x W) to be protected.

3.02 MAINTENANCE

A. Following the certification of completion by the Engineer, maintain the surfaces of curbs and gutters, paved surfaces and sidewalks for a period of one year thereafter, or for such greater period as may be required by Federal, State or local authorities. Supply all material and labor required for such maintenance. The Work shall be done in a manner satisfactory to the Owner at no additional cost to the Owner.

END OF SECTION

SECTION 02620

GRAVEL ROADS AND DRIVEWAYS

PART 1: GENERAL

1.01 SCOPE OF WORK

The Work under this section consists of providing all labor, materials, tools, equipment, and services required to perform construction, repair, reconstruction and replacement of gravel roads and driveways as indicated on the Drawings and as specified within this section and related sections of the Specifications.

A. This section shall include replacement of gravel roads and driveways that have been damaged or disturbed during the course of the Work.

B. All Work under this section shall be performed as required by applicable local, state, and federal regulations. Replacement will be at least equal to the type of pavement and related items that existed before the Work began and to the satisfaction of the Resident Project Representative and agencies with jurisdiction.

C. During the entire period of construction of the project, keep all roads and driveways in clean, usable, and safe conditions for public use. Keep the work area free from accumulations of waste material, rubbish and other debris resulting from the Work. Clean all roadways daily. Scrape, shovel or use whatever other approved means that may be necessary to clean and maintain the roadways to the satisfaction of Owner and the agency having jurisdictional control over said road.

D. Before final acceptance, any trench settlement is to be corrected to the satisfaction of the Resident Project Representative and agency having jurisdictional control over the road.

1.02 GENERAL REQUIREMENTS

A. All new gravel roads and driveways shall be constructed to the limits, grades, thicknesses and types as shown on the Drawings but not less than the thicknesses specified herein.

B. Repair, reconstruction and replacement of existing gravel roads and driveways (or any portion thereof) shall match the types, limits, grades, and thicknesses of existing roads or driveways, unless otherwise indicated.

C. Except as otherwise provided in the Specifications or on the Drawings, all work shall be in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications, latest edition except that any reference to "INDOT", "Department" or "Unit" shall mean the "Owner".

D. **The Contractor shall be responsible to verify applicable local paving requirements prior to submitting bids.**

1.03 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01500 Temporary Facilities

E. Section 01570 Traffic Regulation

F. Section 01600 Products

G. Section 01700 Project Closeout

H. Section 02025 Existing Utilities and Structures

I. Section 02210 Trenching, Backfilling and Compacting

J. Section 02540 Erosion and Sedimentation Control

K. Section 02610 Roadway Paving and Surfacing

L. Section 02820 Lawn Restoration and Landscaping

M. Section 03310 Cast-In-Place Concrete for Paving, Driveways, Sidewalks, Curbs, and Paved Ditches

N. Section 15000 Piping – General Provisions

O. Section 15130 Piping Specialties

PART 2: PRODUCTS

2.01 GRAVEL

A. All materials used for gravel roads and driveways shall be in accordance with INDOT Section 904, Aggregates.

B. Unless otherwise approved by the Engineer, materials shall be in accordance with the following:

1. Coarse Aggregate, Class D or Higher, Size No. 53
2. Coarse Aggregate, Class D or Higher, Size No. 73

PART 3: EXECUTION

3.01 INSTALLATION

A. All work associated with gravel roads and driveways shall be in accordance with INDOT Section 904, Aggregate.

B. All gravel shall be free of soil contamination, large rocks and other debris.

C. Subgrade shall be compacted in accordance with INDOT 207.04 (as shown on the Drawings, where so indicated). In areas of 500 ft or less in length, or for temporary runarounds, proofrolling will not be required. Proofrolling will not be required in trench sections where proofrolling equipment cannot be used.

D. Unless otherwise approved by the Resident Project Representative, aggregate shall not be placed when the air temperature is less than 35°F. Aggregate shall not be placed on a frozen subgrade. Frozen aggregates shall not be placed.

E. The Aggregate shall be spread in uniform lifts with a spreading and leveling device approved by the Engineer. The spreading and leveling device shall be capable of placing aggregate to the depth, width, and slope specified. The compacted depth of each lift shall be a minimum of 3 in. and a maximum of 6 in., except where utilized as a shoulder. The compacted depth of a lift for a shoulder shall be a minimum of 3 in. and a maximum of 9 in. The aggregate shall be handled and transported to minimize segregation and loss of moisture. In areas inaccessible to mechanical equipment, approved hand spreading methods may be used.

F. Aggregates shall be immediately compacted to a minimum of 100% of the maximum dry densities in accordance with AASHTO T99. Compaction equipment shall be in accordance with INDOT 409.03 (d). Density of the compacted aggregate will be determined in accordance with INDOT 203.24(b). The aggregate shall meet the compaction requirements at the time subsequent courses are placed. All displacement or rutting of the compacted aggregate shall be repaired prior to placing subsequent material.

G. The top of each aggregate course shall be checked transversely and all deviations in excess of ½ in shall be corrected. If additional aggregate is required, the course shall be remixed and re-compacted.

END OF SECTION

SECTION 02820

LAWN RESTORATION AND LANDSCAPING

PART 1: GENERAL

1.01 DESCRIPTION

The Work under this section consists of providing all labor, materials, tools, equipment, and services required to perform restoration of lawn and other grassy areas and to perform landscaping as indicated on the Drawings and as specified within this section and related sections of the Specifications.

A. This section shall include final grading, topsoiling, seeding, and miscellaneous site work not included under other sections, but required to complete the Work as shown on the Drawings and specified herein. Under this section, all areas of the project site disturbed by excavation, materials storage, temporary roads, etc., shall be reseeded, sodded or otherwise restored as specified herein, except for areas to be restored per Sections 02610, 02620 or 03310.

B. Restore and replace shrubbery, fencing, or other disturbed surfaces or structures to conditions equal to that before the Work began and to the satisfaction of the Resident Project Representative.

1.02 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, certifications, and other required submittals for all products furnished under this section in accordance with Section 01300, including the following:

A. Grass Seed Mix composition

B. Top soil composition

C. Fertilizer composition

D. Mulch (Seed Cover)

E. Certification of all materials.

F. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.
2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
3. Label data substantiating that trees, shrubs, plants and planting materials comply with specified requirements.

G. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and week seed content. Include the year of production and date of packaging.

H. Planting schedule indicating anticipated dates and locations for trees, bushes, and other special landscaping required on the Drawings or in Section 01011.

I. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.03 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of one year after date of Final Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.

C. Remove and replace dead planting materials immediately. All plants to be replaced in-kind and size specified in the original design.

D. Replace planting materials that are in an unhealthy condition at end of warranty period.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01570 Traffic Regulation

F. Section 01600 Products

G. Section 01700 Project Closeout

H. Section 02105 Clearing and Grubbing

I. Section 02210 Trenching, Backfilling and Compacting

J. Section 02540 Erosion and Sedimentation Control

K. Section 15000 Piping – General Provisions

L. Section 15130 Piping Specialties

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASTM D5268 Topsoil Used for Landscaping Purposes

B. ASTM D 977 / AASHTO M140 Emulsified Asphalt

C. ASTM D2397 / AASHTO M208 Cationic Emulsified Asphalt

D. ANSI Z60.1 American Standard for Nursery Stock

E. ANSI A300 Standards

F. 2013 Weed Control Guide for Ohio and Indiana (Ohio State University Extension)

PART 2: PRODUCTS

2.01 CONTRACTOR'S RESPONSIBILITIES

A. Furnish and submit certification for materials used as specified in the General Conditions, Division 1 and Division 2.

2.02 TOPSOIL

A. Upon completion and approval of the rough grading, the Contractor shall place clean topsoil over all areas disturbed during construction under any contract except those areas which will be paved, graveled or rip rapped. Topsoil shall not be placed in a frozen or muddy condition and shall contain no toxic materials harmful to grass growth. Topsoil shall be as defined.

B. Topsoil shall not contain more than 40 percent clay in that portion passing a No. 10 sieve. Topsoil shall contain between 5 percent and 20 percent organic matter as determined by loss on ignition of samples oven-dried to constant weight at 212 degrees Fahrenheit.

C. Provide new topsoil which is fertile, friable, natural loam, surface soil, free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones and other extraneous or toxic matter harmful to plant growth. Topsoil shall be weed-free and shall have been previously treated for weed control.

D. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site and approved by the Engineer. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 6 inches.

E. Topsoil is considered the surface layer of soil and sod, suitable for use in seeding and planting. It shall contain no mixture of refuse or any material toxic to plant growth.

2.03 FERTILIZER

A. Fertilizer shall be a complete commercial fertilizer of neutral character with components derived from commercial sources. Fertilizer shall include fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium.

B. Fertilizer analysis to be used shall be determined from post-construction field soil sampling in appropriate number taken by the Contractor and analyzed by the Office of Indiana State Chemist (OISC) or other qualified independent soil testing laboratory. Contractor shall provide fertilizer in accordance with the recommendations of the OISC.

C. If authorized by the Resident Project Representative, in lieu of field soil sampling, fertilizer shall be lawn or turf grade 12-12-12.

D. Fertilizer shall be delivered in standard size bags marked with the weight, analysis of contents, and the name of the manufacturer. Fertilizer shall be stored in weatherproof storage areas and in such a manner that its effectiveness will not be impaired.

E. Fertilizer for trees, shrubs and ornamental plants shall be a complete, commercially available inorganic material. Fertilizer shall contain sulfur coated slow release components.

2.04 GRASS SEED

A. Grass Seed: Fresh, clean dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

B. <u>Lawns and all other areas:</u>

Seed areas where lawns are or have been regularly maintained, whether residential, commercial or office areas, with the following mixture or a mixture as required by the Soil Conservation District or other governing authority. Grass seed mix shall be as follows:

Seed Description	Percent by Weight
Turf Type Tall Fescue Blend	80%
Kentucky Bluegrass	10%
Perennial Ryegrass (Lolium multiflorm)	10%

2.05 SOD

A. Where sod is required it shall be green, freshly cut, and of good quality with grass free from all noxious weeds. It shall contain all the dense root system of the grass and shall not be less than 1-1/2 inches thick. Provide strongly rooted sod, not less than two years old and free of weeds and undesirable native grasses. Provide only sod capable of growth and development when planted (viable, not dormant).

B. Sod seed mixture shall consist of the seed mixture as stated in Part 2 Products, paragraph 2.04 Grass Seed.

C. Sod shall be mowed prior to cutting.

D. Size of sod pad shall be cut not less than 12 inches x 24 inches nor more than 42 inches x 96 inches. Torn or uneven ends are unacceptable.

E. Sod shall not break apart when handled and be moist and shall be fresh upon arrival to site.

F. Sod shall be scrim free during installation.

2.06 MULCH (SEED COVER)

A. Unless otherwise indicated on the Drawings or otherwise required by the Contract Documents and/or approved permits, seed covering blanketing (mulch) shall consist of straw with biodegradable materials reasonably free of weed seed and foreign materials that could affect plant growth. Seed coverings with nylon mesh or nylon binders are not acceptable.

B. Peat Mulch (where required): Provide Dakota peat moss in natural, shredded, or granulated form, of fine texture, with a pH range of 4 to 6 and a water-absorbing capacity of 1100 to 2000 percent.

C. Fiber Mulch (where required): Biodegradable dyed-wood cellulose-fiber mulch, nontoxic, free of plant growth- or germination-inhibitors, with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

D. Asphalt Emulsion Tackifier (where required): Asphalt emulsion, ASTM D 977, Grade SS-1, nontoxic and free of plant growth- or germination-inhibitors.

E. Nonasphaltic Tackifier (where required): Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application, nontoxic and free of plant growth- or germination-inhibitors.

F. Mineral Mulch (where required): Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:

1. Type: Decomposed granite.
2. Size Range: 1/2 inch (19 mm) maximum, 1/4 inch (6 mm) minimum.
3. Color: Readily available natural gravel color range, similar to naturally occurring onsite materials.

2.07 ASPHALT EMULSION (WHERE REQUIRED)

A. Emulsion shall be non-toxic to plants and shall conform to AASHTO M140 or AASHTO M208.

2.08 TREES, SHRUBS AND ORNAMENTAL PLANTS

A. Trees, shrubs and ornamental plants that replace existing trees, shrubs and ornamental plants shall be the same types as those removed, unless otherwise shown on the Drawings.

B. New trees, shrubs and ornamental plants shall be as shown on the Drawings.

C. Provide nursery-grown trees, shrubs, and ornamental plants with healthy root systems developed by transplanting or root pruning complying with recommendations and requirements of ANSI Z60.1 "Standard for Nursery Stock" and as specified.

D. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

E. Grade: Provide trees, shrubs and ornamental plants of sizes and grades conforming to ANSI Z60.1 for type of trees, shrubs and ornamental plants required. Trees, shrubs and ornamental plants of a larger size may be used if acceptable to Resident Project Representative, with a proportionate increase in size of roots or balls.

F. Label ten percent (10%) of all trees, shrubs, and ornamental plants, but at least one (1) of each variety, and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

G. Plants protected by federal trademark or patent must include labels with the correct name with genus and species along with registered cultivar name and be attached to all plants delivered and planted.

2.09 STAKES

A. Upright Stakes: Round, 2 inch, pressure-preservative-treated lodge poles, free of knots, holes and other defects.

B. Tie Wire: ASTM A641 (ASTM A641M), Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter.

C. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch (13 mm) in diameter, black, cut to lengths required to protect tree trunks from damage.

D. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

PART 3: EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Trees, shrubs and ornamental plants: Do not prune before delivery, except as approved by Resident Project Representative. Protect bark, branches, and root systems from sunburn, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape.

C. Carefully deliver and unload trees, shrubs and ornamental plants from trucks and trailers. Do not drop trees, shrubs or ornamental plants. Deliver trees, shrubs, ground covers, and ornamental plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist. Contractor is responsible for providing water to plant material on site.

D. Do not remove container-grown stock from containers before time of planting.

E. Water root systems of trees, shrubs and ornamental plants stored on site with a fine-mist spray. Water as necessary to maintain root systems in a moist condition.

3.02 PREPARATION OF SODDED OR SEEDED LAWN AREAS

A. Topsoil Areas

Prior to preparation of areas to be sodded or seeded, remove existing grass, vegetation, and turf. Dispose of such material outside of Owner's property. Remove and dispose of all imported granular fill, grass, weeds, roots, sticks, stones, and other debris 1-inch or greater in diameter. Do not turn over any removed material into the soil being prepared for sodding or seeding.

1. Loosen subgrade of areas to be seeded or sodded to a minimum depth of 4 inches. Remove stones over 1-1/2inch in any dimension and sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.
2. Place 6 inches of topsoil over area to be seeded. Place 4 inches of topsoil in areas to be sodded.
   a. Spread planting soil mixture to minimum depth required to meet lines, grades, and elevations shown, after light rolling and natural settlement.
   b. Place approximately one-half of total amount of planting soil required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil.
   c. Allow for sod thickness in areas to be sodded.
3. Grade areas to be seeded or sodded to smooth, even surface with loose, uniformly fine texture. Roll and rake and remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.
4. Moisten prepared areas to be seeded or sodded before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
5. Restore areas to be seeded or sodded to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.
6. Topsoil shall be spread in place for sufficient quantity for certain plant beds and backfill or shrubs and trees as specified.

B. Ditch and Swale Erosion Protection

1. All ditches and swales indicated on the Contract Drawings shall be lined with a rolled erosion control product (RECP). Installation shall be in accordance with Section 02540 Erosion and Sedimentation Control.

3.03 FERTILIZING

A. Apply fertilizer uniformly to all areas to be seeded at the rate of 1 pound per 100 square feet in topsoil. Disk, harrow, or rake the fertilizer thoroughly into the soil to a depth of not less than 2 inches. Immediately before sowing the seed, rework the surface until it is a fine, pulverized, smooth seed bed varying not more than 1 inch in 10 feet.

3.04 GRASS SEEDING

A. Seed between February 15 and June 1 and between August 15 and November 1. Do not sow seed during adverse weather conditions. Do not broadcast seed during high wind. Do not sow seed when the moisture content of the soil is too low or too high for seed germination.

B. Seed immediately after preparation and fertilization of the seed bed. Mix the seed thoroughly and sow it evenly over the prepared areas at the rate of 3 pounds per

1,000 square feet. Sow the seed dry or hydraulically. After sowing, rake or drag the area to cover the seed to a depth of approximately 1/4 inch.

C. Sod or erosion control blanketing shall be required on all areas with slopes greater than 10%.

3.05 HYDROSEEDING

Hydroseeding shall be required where indicated on the Drawings, specified in Section 01011 or 01075, or otherwise required by authorities with jurisdiction over the Work area. Otherwise, Contractor shall perform seeding by hydroseeding method only when and where authorized by Resident Project Representative. Commercial hydromulching equipment shall be used.

A. New Lawns:

Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application with the hydromulching equipment.

1. Hydroseed mixture shall contain the following:

Material	Quantity
Seed	2 lbs./1,000 S.F.
Fertilizer	As indicated by Laboratory Analysis
Wood Fiber	1,500 lbs./acre

2. Mix slurry with nonasphaltic tackifier.
3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at the minimum rate of 500 lbs. per acre (5.5 kg per 100 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1,000 lbs. per acre (11 kg per 100 sq. m).

B. Existing Lawns:

After the surface treatment is completed and accepted by the Resident Project Representative, seed mix shall by hydroseeded. The following materials shall be combined to form a seed mulch mixture for hydroseeded applications.

1. Seed mix
2. Binder
3. Wood Fiber Mulch
4. Sufficient water to form a homogenous mixture capable of being applied by hydromulching equipment.

C. Hydroseeding that is deposited on adjacent trees, shrubs, ornamental plants, roadways, driveways, sidewalks, in paved drainage ditches, on structures, and upon any area where seeding is not specified, as well as hydroseeding that is placed in excessive depths on seeding areas shall be removed.

D. Seeding areas flooded or eroded as a result of irrigation shall be repaired, reseeded, and re-fertilized by the Contractor at his expense.

E. Care During Construction: The Contractor shall be responsible for protecting and caring for seeded areas until final acceptance of the Work and shall repair, at his expense, any damage to seeded areas caused by pedestrian or vehicular traffic, erosion due to excessive water application or other causes.

F. Germination: Seed germination is dependent upon a variety of factors, many of which are interacting. Temperature, light, time of year, internal seed dormancy, gas exchange, and moisture are involved in seed germination. If necessary for proper germination and to establish the seeding, a temporary aboveground irrigation system shall be designed, installed and maintained by the Contractor to germinate and establish seeding (the use of a water truck for this purpose is not acceptable). A temporary irrigation controller capable of providing a minimum of six irrigation run cycles per day shall be installed along with temporary remote control valves.

1. Watering should not be so much that it runs off or puddles. Frequent light applications of water are generally needed for good germination results. It may be necessary to irrigate several times per day if it is hot, windy, or the soil is well drained or sloped. Irrigation up to 6 times per day is not uncommon. Irrigation should be checked daily for runoff and drying between cycles. Careful attention by the Contractor is required because too wet or too dry of conditions will affect germination.

2. Following germination of approximately 80% of the Pure Live Seed, or as accepted by the Resident Project Representative, the Contractor shall request start of the seed establishment period. The establishment period shall be for 90 days from the start date set by the Resident Project Representative.

3. Establishment: Establishment is considered to be after germination and before plant maturity. Water during the establishment period shall be that of gradual decrease in water application. The intent is to provide water in soil profiles where it is retained and where root growth occurs. Note: Decreasing the water frequency allows for natural characteristics of drought tolerance to develop.

4. The Contractor shall inspect the ground closely as soon as plants have emerged, as many seedlings are small and inconspicuous. Adjust water frequency accordingly. Inspection of plants and soil will determine the watering requirements during the establishment period. Wilting is an obvious sign of water stress. Overwatered plants may appear yellow due to nutrient deficiency or very lush with excess growth. Overwatered plants will not develop drought resistance.

5. Water after germination should be 1 to 3 times per week on average, however, this is a variable depending on many factors. Water should be allowed to soak the soil profile as deeply as possible to encourage deep rooting. As the plants mature and develop woody tissue, the water can be decreased dramatically and temporary irrigation can be suspended or removed.

6. The Contractor shall be responsible to re-apply hydromulch and seed until establishment is acceptable to the Resident Project Representative with no increased costs to the Contract.

3.06 SODDING

A. Sod all areas as noted in the Drawings. As a minimum, sod shall be fibrous, well rooted approved grass type. The grass shall be cut to a height of less than three (3) inches. Edges of sod shall be cleanly cut, either by hand or machine, to a uniform thickness of not less than one and one-half (1-%) inches, to a uniform width of not less than sixteen (16) inches, and in strips of not less than three (3) feet in length. Sod shall be free from all primary noxious weeds as defined by the applicable Indiana Seed Law (IC 15-15-1).

B. Lay sod with tight staggered joints. On slopes, start placement at the foot of the incline. Use wood pegs driven flush to hold sod in place on slopes 4:1 or greater. Use two wood pegs per strip of sod. Roll the sod lightly after placement. Fill any open joints with topsoil and/or sod.

C. Lay sod perpendicular to direction of slope and in a manner permitting end of pad joints to alternate. Lay sod tightly together. Do not stretch pad or overlap joints. Tamp, secure sod on slopes greater than one vertical to three horizontal. Netting scrim must be removed.

D. Water sod immediately after installation to a depth of 1 inch below sod. After a short drying period, roll sod and smooth minor surface irregularities.

3.07 MULCHING

A. All lawn restoration shall be mulched using straw mulch or straw mats per the following schedule:

1. For slopes less than 2:1 grade: tack down straw with emulsion per article 3 3.08.
2. For slopes greater than 2:1 grade; Western Excelsior Excel SS-2 Rapid-Go straw matting pinned with 6” long by 1” crown 11 gauge staples per manufacturers recommendation.

B. Place mulching material evenly over all seeded areas within 48 hours of seeding. Place mulch at the rate of approximately 2 tons per acre, when seeding is performed in recognized growing season and at the approximate rate of 3 tons per acre when seeding is performed in a recognized non-growing season if applicable.

C. No mulch shall be incorporated into backfill of planted areas. Mulch only on surface at final grade.

3.08 EMULSION

A. Keep mulching materials in place with asphalt emulsion applied at a minimum rate of 60 gallons per ton of mulch or by other methods approved by the Engineer. When mulch is displaced, immediately repair any damage to the topsoil and fertilizer, reseed, and re-mulch per the requirements of this section.

3.09 PLANTING GROUND COVER AND PLANTS

A. Space ground cover and plants as indicated.

B. Space ground cover and plants not more than 48 inches (600 mm) apart.

C. Dig holes large enough, 1 ½ times rootball size, to allow spreading of roots, and backfill with planting soil. Water thoroughly after planting.

3.10 PREPARATION FOR TREES, SHRUBS AND ORNAMENTAL PLANTS

A. Examine areas to receive landscaping for compliance with specified requirements and for conditions affecting performance of work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Lay out individual tree, shrub and ornamental plant locations and areas for multiple plantings. Stake locations, outline areas, and secure Owner's or Resident Project Representative's acceptance before the start of planting work.

C. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

D. Mix soil amendments and fertilizers with topsoil at rates indicated for lawn areas. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.

E. Backfill for trees, shrubs and ornamental plants shall be native soil.

3.11 EXCAVATION AND PLANTING FOR TREES, SHRUBS AND ORNAMENTAL PLANTS

A. For pits and trenches, excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation. For container-grown trees, shrubs and ornamental plants: Excavate to 1-1/2 time the container width. Follow ANSI A300 Standards for planting.

B. Obstructions: Notify Engineer if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations. For hardpan layer, increase planting pit.

C. Fill excavations with water and allow to percolate out, before placing setting layer and positioning trees, shrubs and ornamental plants.

D. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Carefully remove containers so as not to damage root balls.
2. Place stock on setting layer of compacted planting soil.
3. Place backfill around ball in layers, tamping to settle backfill. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

E. Perform planting in accordance with ANSI A300 Standards.

3.12 PRUNING AND STAKING OF TREES, SHRUBS AND ORNAMENTAL PLANTS

A. Prune, thin, and shape trees, shrubs and ornamental plants according to ANSI A300 Standards.

B. Upright Staking and Tying: Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade.

C. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.13 WATERING

A. Thoroughly water seed and sod immediately after seeding and sodding.

B. Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm).

C. Contractor shall provide temporary water supply in accordance with Section 01500.

3.14 MAINTENANCE

A. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

B. Carefully maintain, tend, and water all seeded and sodded areas necessary to secure a good turf. Fill, grade, and reseed or re-sod all areas that have settled. Maintain the condition of the sodded areas for a period sufficient for the grass to root into the topsoil. Maintain the condition of the seeded areas in accordance with

the requirements of this section for a period of one year from the date of final completion. Maintain the condition of the sodded areas for a period sufficient for the grass to root into the topsoil.

C. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than 60 days after date of final acceptance.

D. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season. Lawns shall be substantially complete when entire area is covered uniformly.

E. Maintain and establish lawns by watering, fertilizing, weeding, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

F. During the growing season, the Contractor and Owner shall be required to re-visit the site within 30 days after seeding, if germination is less than 40%, the Contractor shall be required to overseed the areas. If after an additional 30 days the germination is less than 50%, the Contractor shall be required to remove the straw mats, prepare and rake the soils, re-seed the insufficient areas and re-mulch the entire area.

G. The Contractor shall be responsible for maintaining all seeded areas through the end of his warranty period. Maintenance shall include but not be limited to, annual fertilization, repair of seeded areas, and weed control. The Contractor shall maintain, at his own expense, all seeded areas until acceptance of the Work. Slopes shall be protected from damage due to erosion, settlement, and other causes and shall be repaired promptly at the Contractor's expense.

H. All seeded areas shall be inspected on a regular basis and any necessary repairs or reseedings made within the planting season, if possible. If the stand should be over 60% damaged, it shall be re-established following the original seeding recommendations.

I. Weed growth shall be maintained mechanically and/or with herbicides. When chemicals are used, the Contractor shall follow the current 2013 Weed Control Guide for Ohio and Indiana (Ohio State University Extension) weed control recommendations and adhere strictly to the instructions on the label of the herbicide. No herbicide shall be used without prior approval of the Engineer.

J. Maintain trees, shrubs and ornamental plants by cultivating, watering, weeding, fertilizing, tightening and repairing stakes, and resetting to proper grades or vertical position. Spray as required to keep trees, shrubs and ornamental plants free of insects and disease. Maintain trees, shrubs and ornamental plants for 1 year following final acceptance.

K. Maintain ground cover and plants by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings for 3 months following final acceptance.

3.15 CLEANUP

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. The Contractor shall remove from the site and legally dispose of all surplus soil and waste material, including excess subsoil excavated from his work, unsuitable soil, trash and all other debris including, but not limited to, branches, paper, and rubbish in all landscape areas, and remove temporary barricades as the work proceeds.

C. All areas shall be kept in a neat, orderly condition at all times. Prior to final acceptance, the Contractor shall clean up the entire landscaped area to the satisfaction of the Engineer.

D. After restoration is completed, the Contractor shall return to the site and remove the straw matting after germination has been established. The removal of the straw matting will be established by the Owner.

END OF SECTION

SECTION 03305

CAST-IN-PLACE CONCRETE FOR PIPE WORK

PART 1: GENERAL

1.01 SCOPE OF WORK

The work under this section consists of providing all labor, materials, tools, equipment and services required for the placing of all cast-in-place concrete for thrust blocking, pipe encasement, anchor collars, earth retaining walls, manhole bases and other below-grade cast-in-place concrete for water main projects as shown on the Drawings or required by the Engineer. Section 03310 specifies cast-in-place concrete for paving, driveways, sidewalks, curbs and paved ditches.

1.02 SUBMITTALS

Contractor shall submit the following in accordance with Section 01300:

A. Concrete Mix Designs: Submit a mix design for each class of concrete required for the project including:

1. Mix proportions by weight, water/cement ratio, slump range and air content.
2. Sieve analysis of fine and coarse aggregate.
3. Documentation of average compressive strength.
4. Complete list of materials specified in Paragraph 2.01 with product information verifying compliance with all specified requirements.

1.03 QUALITY ASSURANCE

Perform Work in accordance with ACI 301 and ACI 304.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 03310 Cast-in-Place Concrete for Paving, Driveways, Sidewalks, Curbs, and Paved Ditches

H. Section 03450 Precast Concrete Structures

I. Section 15000 Piping – General Provisions

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ACI 301 - Specifications for Structural Concrete

B. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete

C. ACI 305 - Hot Weather Concreting

D. ACI 306 - Cold Weather Concreting

E. ACI 308 - Guide to Curing Concrete

F. ACI 309 - Recommended Practices for Consolidation of Concrete

G. ASTM C33 - Standard Specification for Concrete Aggregates

H. ASTM C94 - Standard Specification for Ready-Mixed Concrete

I. ASTM C136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregate

J. ASTM C150 - Standard Specification for Portland Cement

K. ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete

L. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

M. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars

N. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

O. NRMCA: National Ready Mixed Concrete Association

PART 2: PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I or Type II.

B. Fly Ash: ASTM C618, Type C or Type F.

C. Slag (GGBFS): ASTM C989

D. Fine Aggregate: ASTM C33.

1. Natural Sand: clean, hard, durable particles.

E. Coarse Aggregate: ASTM C33.

1. Washed gravel and/or crushed stone: clean, hard, durable particles, uniformly graded with a maximum size of 1 inch.
2. Tested for gradation in accordance with ASTM C136.

F. Water: ASTM C1602.

G. Water-Reducing Admixture: ASTM C494, Type A.

H. Retarding Admixture: ASTM C494, Type B

I. Accelerating Admixture: ASTM C494, Type C.

2.02 CONCRETE MIXES

A. Proportion concrete mixes to provide workability and consistency to allow concrete to be easily worked into corners of the forms and around reinforcement without segregation or excessive bleeding.

1. Fly ash or slag shall be used as a cement replacement with a maximum substitution rate as listed in ACI 301 Table 4.2.2.7.b.2.

B. Slump shall be 5 to 8 inches for all mixes containing a water-reducing admixture and 3 to 5 inches for all mixes not containing a water-reducing admixture.

C. Concrete Mix Classes: Fly ash and/or slag required for all mixes.

1. Class A1 concrete: thrust blocking, pipe encasement, anchor collars
   a. Minimum compressive strength at 28 days: 3,500 psi
   b. Air content: optional
   c. Admixtures: optional
2. Class B concrete: manhole bases, concrete fill.
   a. Minimum compressive strength at 28 days: 3,000 psi
   b. Air content: optional
   c. Admixtures: optional

2.03 REINFORCING STEEL

A. Reinforcing bars shall be billet steel grade conforming to the requirements of ASTM A615, Grade 60. All reinforcing shall be deformed bars.

B. Welded wire fabric reinforcing shall conform to the requirements of ASTM A 1064 and the details shown on the Drawings.

PART 3: EXECUTION

3.01 FORMWORK

A. Build all forms mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations. Construct and maintain forms so as to prevent warping and the opening of joints.

B. The forms shall be substantial and unyielding. Design the forms so that the finished concrete conforms to the proper dimensions and contours. Design the forms to take into account the effect of the vibration of concrete during placement.

3.02 PLACING REINFORCING STEEL

A. Place all steel reinforcement accurately in the positions shown on the Drawings. Secure the steel reinforcements firmly in place during the placing and setting of concrete. When placed in the Work, it shall be free from dirt, detrimental rust, loose scale, paint, oil or other foreign material.

B. Maintain distances from the forms by means of stays, blocks, ties, hangers or other approved supports. Furnish all reinforcement in full lengths as indicated on the Drawings. Splicing of bars will not be permitted without the approval of the Engineer, except where shown on the Drawings. Stagger splices as far apart as possible. Unless otherwise shown on the Drawings, bars shall be lapped 36 diameters to make the splice.

C. Lap welded wire mesh at least 1/2 mesh plus end extension of wires but not less than six (6) inches in slabs on the ground.

D. Laps of welded wire fabric shall be in accordance with ACI 301. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

3.03 CONVEYING AND PLACING CONCRETE

A. No concrete shall be placed prior to approval of the concrete mix design. Concrete placement shall conform to the recommendations of ACI 304.

B. Convey concrete from the mixer to the forms as rapidly as practical by approved methods which will prevent segregation and loss of ingredients.

C. Clean formwork of dirt and construction debris, drain water, and remove snow and ice. After the forms have been inspected, deposit the concrete in approximately horizontal layers to avoid flowing along the forms. Place all concrete in the dry free from standing water. Deposit all concrete continuously or in layers of a thickness such that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the sections. Place the concrete to create a monolithic structure where the component parts of which are securely bonded together. Compact the concrete during placement by suitable means. Work the concrete around the reinforcement and embedded fixtures and into corners and angles of forms, taking care to avoid overworking which may result in segregation.

   Do not drop concrete into forms from a height greater than 5 feet. Use a spout to deposit concrete from a greater height; or, provide openings in the forms to limit the height of drop. Obtain the approval of the Engineer before using any other method of placing concrete from a height greater than 5 feet.

D. Direct concrete through chutes to prevent it from striking reinforcement or sides of the form above the level of placement. Avoid segregation and coating of the surfaces with paste which may dry before concrete reaches its level.

E. Submit a concrete mix design to the Engineer for approval prior to placing any concrete by pumping.

F. All concrete shall be placed in the structure within 90 minutes after batching per ASTM C94. Do not place concrete which has partially hardened or been contaminated by debris.

3.04 BATCHING AND MIXING CONCRETE

A. Batch and mix concrete in accordance with ASTM C94. Mix concrete until a uniform distribution of materials is achieved.

B. No water shall be added to the concrete during transport. The addition of water to the concrete at the site shall be in accordance with ASTM C94 and ASTM C1302 and have the approval of the Resident Project Representative

C. Provide one copy of concrete delivery ticket to the Resident Project Representative immediately upon arrival to the site. The delivery ticket shall list the quantity of concrete in the load, the concrete class, the design strength and all admixtures.

D. Place concrete in all slabs, mats and beams for the full depth of the member to prevent a horizontal cold joint from occurring.

E. Site mixed concrete shall not be used unless approved by the Engineer.

3.05 CURING

A. Perform work in accordance with ACI 308.

B. Maintain concrete in a moist condition for a minimum of 1 day The Contractor shall use one of the following methods to insure that the concrete remains in a moist condition for the minimum period stated above.

1. Ponding or continuous fogging or sprinkling.
2. Application of mats or fabric kept continuously wet.
4. Application of sheet materials conforming to ASTM C171.

C. Formed surfaces may be cured by leaving forms in place. When forms are removed before the end of the curing period, place cotton mats, sheet material or curing compound on concrete surfaces.

D. If a curing compound is employed, it shall be applied per the manufacturer's direction and recommended rate of application. Surfaces damaged by construction operations during curing shall be resprayed at the same rate.

3.06 HOT WEATHER CONCRETING

A. Follow the provisions of ACI 305, ACI 308, and Paragraph 3.05 when ambient temperature is greater than 90°F at time of placement.

B. Transport, place and finish concrete as quickly as practicable.

C. Maximum temperature of concrete during placing is 90°F. Ice or liquid nitrogen may be added to the concrete at the batch plant.

3.07 COLD WEATHER CONCRETING

A. Follow the provisions of ACI 306 when the ambient temperature is less than 40°F at time of placement or expected to be less than 40°F during the curing period.

B. Control concrete setting time with the use of accelerating admixtures as required to facilitate placing and finishing operations. Do not use calcium chloride in excess of 2% by weight in the concrete free of steel reinforcement.

C. Exposed subgrade, formwork and reinforcing shall be warmer than 35°F prior to placement of concrete.

D. The temperature of the concrete during placing shall be between 55°F and 90°F. Provide proper protection of concrete from direct ambient air temperatures below 40°F for a minimum of 3 days or as approved by the Engineer.

3.08 THRUST BLOCKING

A. Refer to Indiana American Water Company Standard Detail Drawings for additional thrust blocking requirements. Notify the Engineer whenever field conditions are more restrictive than the thrust block design data included on Standard Detail Drawings.

B. Construct blocking against the vertical face of undisturbed earth or sheeting left in place. Prevent the concrete from enclosing more than half the circumference of the pipe unless it is a straddle block. Keep the concrete away from joints and bolts in the piping.

C. If thrust blocks are employed at fire hydrants, place thrust blocking to allow the hydrant to drain.

END OF SECTION

SECTION 03310

CAST-IN-PLACE CONCRETE FOR PAVING, DRIVEWAYS, SIDEWALKS, CURBS, AND PAVED DITCHES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required for the placing, finishing and curing of all cast-in-place concrete for paving, driveways, parking lots, sidewalks, curbs and paved ditches as indicated on the Drawings and as specified within this section. Cast-in-place concrete may be used as slope protection where specifically approved by the Engineer. Section 03305 specifies cast-in-place concrete for thrust blocking, pipe encasement, anchor collars, earth retaining walls, manhole bases and other below-grade cast-in-place concrete

B. The Drawings shall indicate the extent of new or replacement concrete work required. In addition, the Contractor shall replace all other curbs, driveways, parking lots and sidewalks damaged or removed incidental to water main construction. The Contractor shall be responsible to verify current ADA standards and requirements of local municipalities and other authorities for concrete requirements prior to submitting bids. Adhere to the most stringent requirements between local requirements and this Specification. Current ADA standards for width and grade shall supersede conflicting requirements herein, and existing sidewalks shall be installed in compliance with current ADA standards.

C. All permanent restoration of driveways and parking lots shall conform to the construction as originally placed and to the original lines and grades, unless otherwise directed by the Engineer or required by local requirements. However, in no case shall the thickness be less than four inches (4”) for residential driveways or six inches (6”) for commercial and industrial driveway and parking lots—both with at least 6x6x6/6 woven wire mesh.

D. All permanent restoration of sidewalks shall conform to the manner of construction as originally constructed and placed (brick, block or stone) and shall be of the same width and thickness as the original sidewalk if not otherwise required. However, in no case shall the thickness be less than four inches (4”), with 6x6x10/10 wire mesh. Replacement sidewalks shall match the existing lines and grades. All new sidewalks (including where the entire sidewalk is replaced) shall slope ¼ inch per foot across the width of the walk toward the street. Sidewalks shall receive a broom finish at right angles to the walkway.

E. All replacement curb (and gutter) shall be of the same type and thickness as the curb (and gutter) which it abuts. The grade of the restored curb (and gutter) shall conform with the grade of the existing adjacent curb (and gutter), unless

otherwise authorized by the Engineer, and shall be installed to insure no ponding of water occurs.

F. All permanent restoration of paved ditch areas shall conform to the construction as originally placed and to the original lines and grades in accordance with the current appropriate state transportation department guidelines.

1.02 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, certifications and other required submittals for the products furnished under this section as follows and as required by Section 01300 for the products specified in this section.

A. Concrete Mix Designs: Submit a mix design for each class of concrete required for the project including:

1. Mix proportions by weight, water/cement ratio, slump range and air content.
2. Sieve analysis of fine and coarse aggregate.
3. Documentation of average compressive strength.
4. Complete list of materials specified in Paragraph 2.01 with product information verifying compliance with all specified requirements.

B. Certificate of Conformance for Concrete Production Facilities: Submit certificate for each ready-mixed concrete batch plant which will supply concrete for the project.

C. Shop Drawings: Submit Shop Drawings indicating locations of construction joints, control joints, and embedded items.

D. Admixtures: Manufacturer's data on all admixtures and curing compounds stating compliance with the required standard.

E. Product Information: Submit product information for materials specified in Paragraph 2.02 verifying compliance with all specified requirements.

F. Concrete Placement Records: Submit at the completion of project.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 304.

B. Ready mixed concrete shall be furnished from a production facility with a current, valid NRMCA "Certificate of Conformance for Concrete Production Facilities".

1.04 WEATHER REQUIREMENTS

A. Concrete shall not be placed during rain, sleet or snow.

B. Hot weather: Refer to Paragraph 3.11.

C. Cold weather: Refer to Paragraph 3.12.

1.05 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 02025 Existing Utilities and Structures

G. Section 02210 Trenching, Backfilling and Compacting

H. Section 02540 Erosion and Sedimentation Control

I. Section 02610 Roadway Paving and Surfacing

J. Section 02820 Lawn Restoration and Landscaping

K. Section 03305 Cast-In-Place Concrete for Pipe Work

1.06 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. AASHTO M148 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

B. ACI 301 – Specifications for Structural Concrete

C. ACI 304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete

D. ACI 305 – Hot Weather Concreting

E. ACI 306 – Cold Weather Concreting

F. ACI 308 – Guide to Curing Concrete

G. ASTM C31: Standard Practice for Making and Curing Concrete Test Specimens in the Field

H. ASTM C33: Standard Specification for Concrete Aggregates

I. ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

J. ASTM C94: Standard Specification for Ready-Mixed Concrete

K. ASTM C138: Standard Test Method for Density, Yield, and Air Content of Concrete

L. ASTM C143: Standard Test Method for Slump of Hydraulic Cement Concrete

M. ASTM C150: Standard Specification for Portland Cement

N. ASTM C171: Standard Specification for Sheet Materials for Curing Concrete

O. ASTM C172: Standard Practice for Sampling Freshly Mixed Concrete

P. ASTM C173: Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

Q. ASTM C231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

R. ASTM C260: Standard Specification for Air-Entraining Admixtures for Concrete

S. ASTM C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

T. ASTM C494: Standard Specifications for Chemical Admixtures for Concrete

U. ASTM C618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

V. ASTM C989: Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

W. ASTM C1064: Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete

X. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete

Y. ASTM C1602: Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

Z. NRMCA: National Ready Mixed Concrete Association

PART 2: PRODUCTS

2.01 CONCRETE MATERIALS

All concrete shall conform to ASTM C150 and the following requirements:

A. Portland Cement: ASTM C150, Type I or Type II.

B. Fly Ash: ASTM C618, Type C or Type F

C. Slag (GGBFS): ASTM C989

D. Fine Aggregate: ASTM C33, Natural sand: clean, hard, durable particles.

E. Coarse Aggregate: ASTM C33, Washed gravel and/or crushed stone: clean, hard, durable particles, uniformly graded with a maximum size of 1 inch.

F. Water: ASTM C1602.

G. Synthetic Fibers: ASTM C1116

H. Air Entraining Admixture: ASTM C260.

I. Water-Reducing Admixture: ASTM C494, Type A.

J. Retarding Admixture: ASTM C494, Type B

K. Accelerating Admixture: ASTM C494, Type C.

L. High-Range Water-Reducing Admixture: ASTM C494, Type F.

2.02 RELATED MATERIALS

A. Curing Materials:

1. Cotton Mats
2. Sheet Material: ASTM C171
   a. Polyethylene film
3. Curing Compound: ASTM C309
   a. Non-staining acrylic type
   b. Curing compounds shall not be used on water-retention structures.
4. Curing compound shall conform to AASHTO M148, Type II, clear, and shall consist of a practically colorless impervious liquid that will thoroughly seal the concrete surface and will not impart a slippery surface thereto. The quality and quantity to be used shall be approved by the Engineer. The use of material that would impart a slippery surface to the concrete or alter its natural color will not be permitted. The colorless, impervious compound shall contain not less than twenty-five percent (25%) solids.

B. Preformed Joint Filler: ASTM D1752, Type III

C. Patching Grout: Use to repair honeycombed and other defective concrete.

2.03 CONCRETE MIXES

A. Proportion concrete mixes to produce homogeneous mixes with the required average strength based on the appropriate amount of overdesign as required by ACI 301 Section 4.2.

B. Proportion concrete mixes to provide workability and consistency to allow concrete to be easily worked into corners of the forms and around reinforcement without segregation or excessive bleeding.

C. Mix designs shall be based on saturated surface dry aggregates. Adjust the amount of mixing water for the moisture condition of the aggregates.

D. Fly ash or slag shall be used as a cement replacement with a maximum substitution rate as listed in ACI 301 Table 4.2.2.7.b.2. In mixes containing fly ash and/or slag, the water/cement (w/c) ratio shall be computed as the water/cementitious material (w/cm) ratio, where cementitious material is the sum of the weights of Portland cement, fly ash and slag.

E. Slump shall be 5 to 8 inches for all mixes containing a high-range water-reducing admixture and 3 to 5 inches for all mixes not containing a high-range water-reducing admixture.

F. Concrete Mix Classes: Fly ash and/or slag required for all mixes.

1. Class E concrete:
   a. Minimum compressive strength at 28 days: 4,500 psi
   b. Maximum water-cementitious material ratio: 0.45
   c. Air content: 6% ± 1½%
   d. Retarding admixture required, except during cold weather periods
   e. Water-reducing admixture required

2.04 REINFORCING STEEL

A. Welded wire fabric reinforcing shall conform to the requirements of ASTM A 1064 and the details shown on the Drawings.

B. Bar reinforcing shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel reinforcing. All reinforcing steel shall be from domestic mills and shall have the manufacturer's mill marking rolled into the bar which shall indicate the producer, size, type and grade. All reinforcing bars shall be deformed bars. Smooth reinforcing bars shall not be used unless specifically called for on Drawings.

C. Where shown on the Drawings, reinforcing bars anchored into hardened concrete with a dowel adhesive system shall use a two-component adhesive mix which shall be injected with a static mixing nozzle following manufacturer's instructions.

1. The adhesive system shall be IBC compliant for use in both cracked and uncracked concrete in all Seismic Design Categories and shall be "Epcon C6+ Adhesive Anchoring System" as manufactured by ITW Redhead, " HIT-HY 200 Adhesive Anchoring System" as manufactured by Hilti, Inc. “SET-XP Epoxy Adhesive Anchors” as manufactured by Simpson Strong-Tie Co. or “PE-1000+ Epoxy Adhesive Anchor System” by Powers Fasteners. Fast-set epoxy formulations shall not be acceptable. No or equal products will be considered, unless pre-qualified and approved.
2. All holes shall be drilled in accordance with the manufacturer’s instructions. Thoroughly clean drill holes of all debris, drill dust, and water in accordance with manufacturer’s instructions with compressed air and a wire brush prior to installation of adhesive and reinforcing bar.
3. The embedment depth of the bar shall be as shown on the Drawings. Where the embedment depth is not shown on the Drawings, the embedment depth shall be determined to provide the minimum allowable bond strength equal to the tensile strength of the rebar according to the manufacturer’s ICC-ES ESR.

PART 3: EXECUTION

3.01 PREPARATION

A. All base and subbase material as approved by local building code/requirements shall be thoroughly compacted and leveled to support the new and replacement installations without settlement.

B. Where water mains are installed (perpendicularly) through concrete driveways, parking lots, sidewalks, curbs and paved ditches, new concrete shall extend laterally a distance of at least 1 foot beyond the trench wall on each side of the trench to provide a bearing shelf onto native/undisturbed soils.

C. Remove debris from forms and other areas in which concrete will be placed.

D. Provide reinforcing bars anchored into hardened concrete with a dowel adhesive system as required by the Drawings.

E. No patching of concrete sidewalks, driveway, parking lot areas or paved ditches will be allowed between existing joints or control joints.

3.02 BATCHING AND MIXING

A. Batch and mix concrete in accordance with ASTM C94. Mix concrete until a uniform distribution of materials is achieved.

3.03 PLACING REINFORCING STEEL

A. Welded wire fabric shall be supported on slab bolsters spaced not less than 30 inches on centers, extending continuously across the entire width of the reinforcing mat and supporting the reinforcing mat in the plane shown on the Drawings.

B. Lap welded wire mesh at least 1/2 mesh plus end extension of wires but not less than six (6) inches in slabs on the ground.

C. The length of lap for reinforcing bars and dowels shall be as shown on the Drawings.

3.04 FIELD QUALITY CONTROL

A. The Resident Project Representative or an independent Testing Agency employed by the Owner will perform field testing at the Owner's direction. The Resident Project Representative shall have the authority to reject concrete due to delays in placement or failed tests of slump, air content, or temperature.

3.05 PLACING

A. Where water mains are installed (perpendicularly) through concrete driveways, parking lots, sidewalks, curbs and paved ditches, new concrete shall extend laterally a distance of at least 1 foot beyond the trench wall on each side of the trench to provide a bearing shelf onto native/undisturbed soils.

B. No water shall be added to the concrete during transport. The addition of water to the concrete at the site shall be in accordance with ASTM C94, Paragraph 11.7 and have the approval of the Resident Project Representative.

C. Provide one copy of concrete delivery ticket to the Resident Project Representative immediately upon arrival to the site. The delivery ticket shall list the quantity of concrete in the load, the concrete class, the design strength and all admixtures.

D. Place concrete at a rate such that the concrete is at all times plastic and flows easily between reinforcement and into corners of forms without segregation. Limit vertical drop of concrete to 4 feet, unless appropriate equipment is used to prevent segregation.

E. The concrete may be pumped into the structure. Use pumping equipment with appropriate design and capacity to provide a continuous flow of concrete without segregation. Do not add water to facilitate pumping. The concrete mix design for pumped concrete shall be submitted and approved prior to placement.

F. All concrete shall be placed in the structure within 90 minutes after batching per ASTM C94. Do not place concrete which has partially hardened or been contaminated by debris.

G. Thoroughly consolidate concrete with high frequency vibrators working the concrete thoroughly around reinforcement and into the corner of the forms. Do

not use vibrators to transport concrete within the forms. Provide at least one standby vibrator on site.

H. Place and consolidate concrete as directed by the Resident Project Representative.

3.06 FINISHING SLABS

A. Slab tolerance shall be ½ inch in 10 feet.

B. Screeding: Immediately after placing, strike off excess concrete with a straightedge to bring the concrete surface to the proper elevation and contour. Complete screeding before any bleed water is present on the surface.

C. Bull Floating: Immediately after screeding, bull float the concrete surface, eliminating high and low spots, smoothing the surface and embedding the coarse aggregate. Avoid overworking the concrete. Do not seal the concrete surface. Complete bull floating before any excess bleed water is present on the surface.

D. Floating:

1. Begin floating operations when bleed water has disappeared from the concrete surface and when the concrete has hardened sufficiently to support the operation. Do not use dry cement, sand or other material to absorb bleed water.
2. Hand or power float the concrete surface, removing slight imperfections and producing an even surface with a uniform texture. Avoid overworking the concrete. Do not seal the concrete surface.

E. Final Finishing:

1. Broom Finish: Slip-resistant surfaces.
   a. Immediately after floating, use a broom to produce a slip resistant surface.
   b. Edge Finish: Immediately after surface finishing, provide perimeter edging finish to match existing surfaces.

3.07 FINISHING FORMED SURFACES

A. Rough Form Finish: All surfaces unless otherwise specified.

1. Chip off fins and projections exceeding 1/4 inch in projection.
2. After being cleaned and dampened, fill tie holes solid with patching mortar.

3.08 JOINTS

A. Minimum control/construction joint width spacing shall be 3 feet as measured from the new construction joint to the existing driveway/sidewalk construction/control joint. Contractor shall align new joints with existing joints

and concrete corners to minimize development of stress cracking. Contractor shall remove existing slabs less than 3 feet width and place new concrete “cold joint” against the existing slab.

B. Construction Joints: Locate construction joints at 40 feet” maximum so as not to impair the strength of the structure or as shown on the Drawings. Thoroughly clean the concrete surface at construction joints and remove laitance before placing adjoining concrete.

C. Control Joints: Locate control joints as shown on the Drawings. Control joints shall be sawcut or hand-tooled. Maximum spacing of joints is 20 feet for pavement. For pavement less than 15 feet in width, joints shall be spaced at a distance no greater than the width of the pavement. Maximum spacing of joints is 6 feet for 3-ft. wide sidewalks and 8 feet for 4-ft. wide sidewalks.

   1. Sawcut joints as soon as possible after the concrete hardens. Complete saw cutting before shrinkage stresses become sufficient to produce cracking. Joints must be sawcut the same day concrete is placed. Sawcut joints in straight lines.
   2. Hand-tool joints with hand groovers in straight lines.

D. Expansion joints: Locate expansion joints for driveways at a maximum spacing of 40 feet. Maximum spacing of expansion joints for curbs is 12 feet.

3.09 CURING

A. Perform work in accordance with ACI 308.

B. Maintain concrete in a moist condition for a minimum of 3 days, except as modified by the provisions of Paragraph 3.12.

C. Place mats, sheet material or curing compound on concrete slab surfaces immediately after final finishing.

D. Formed surfaces may be cured by leaving forms in place. When forms are removed before the end of the curing period, place cotton mats, sheet material or curing compound on concrete surfaces.

E. If a curing compound is employed, it shall be applied per the manufacturer's direction and recommended rate of application. Surfaces damaged by construction operations during curing shall be resprayed at the same rate.

3.10 REPAIR OF DEFECTIVE AREAS

A. Repair honeycombed and other defective concrete. Remove defective concrete to sound concrete. Cut and chip edges perpendicular to the surface or slightly undercut.

B. Dampen areas to be patched. Patch with patching material in accordance with manufacturer’s instructions.

C. Consolidate the patching material and strike off leaving the patched area slightly higher than the surrounding surface. After initial shrinkage has occurred, strike off and finish to match the surrounding surface.

D. Provide curing to the patched areas and maintain for 48 hours minimum.

3.11 HOT WEATHER CONCRETING

A. Follow the provisions of ACI 305, ACI 308, and Paragraph 3.09 when the rate of evaporation of surface moisture from the concrete exceeds 0.2 lb/ft2/hr (ACI 308, Fig.1).

B. Before placing concrete, spray the subgrade, forms and reinforcement with water to cool them and to prevent absorption of water from the concrete.

C. Transport, place and finish concrete as quickly as practicable.

D. Maximum temperature of concrete during placing is 90°F. Ice or liquid nitrogen may be added to the concrete at the batch plant.

3.12 COLD WEATHER CONCRETING

A. Follow the provisions of ACI 306, ACI 308 and Paragraph 3.09 when the ambient temperature is less than 40°F at time of placement or expected to be less than 40°F during the curing period.

B. Retarding admixture may be eliminated from the mix design. Control concrete setting time with the use of accelerating admixtures as required to facilitate placing and finishing operations. Do not use calcium chloride in the concrete.

C. Subgrade, formwork and reinforcing shall be warmer than 35°F prior to placement of concrete.

D. The temperature of the concrete during placing shall be between 55°F and 75°F. Maintain the temperature of the concrete between 55°F and 75°F for a minimum of 3 days by providing insulating blankets, heated enclosures, or other methods of thermal protection. Provide proper curing for a minimum of 3 days.

E. Protect all earth supported concrete from damage due to frost heave.

3.13 TESTING

A. The Owner will employ a Testing Agency for concrete testing at its discretion. Contractor shall notify Resident Project Representative prior to all concrete placement. The Contractor shall cooperate with the Resident Project Representative and Testing Agency by providing the following:

1. 24-hour notification of concrete placements.
2. Assistance in obtaining fresh concrete samples.

3. Identifying an acceptable designated area for storing concrete test cylinders during the initial curing period and for field-cured concrete test cylinders.
4. Assistance in retrieval of concrete test cylinders.

B. Field tests shall be performed by certified ACI Field Testing Technicians, Grade I. Field tests shall include these tests and/or other tests requested by the Owner.

1. Temperature test: ASTM C1064
2. Slump test: ASTM C143
3. Air content test: ASTM C173 or ASTM C231
4. Unit Weight test: ASTM C138

C. Concrete test samples shall be obtained for each day's placement for each concrete mix supplied. Obtain one test sample for each placement under 50 cu. yd., plus one test sample for each additional 100 cu. yd. or fraction thereof. Concrete shall be sampled in accordance with ASTM C172.

D. Concrete test specimens shall be made and cured in accordance with ASTM C31 and tested in accordance with ASTM C39.

E. For acceptance testing for specified compressive strength, cylinders shall be 6" X 12" or 4" X 8".

F. Six 6" X 12" cylinders or seven 4" X 8" cylinders shall be made from each test sample. Compressive strength tests shall be performed as follows:

1. One field-cured cylinder at 7-days
2. One lab-cured cylinder at 7 days
3. Two field-cured cylinders at 28-days
4. Two 6" X 12" or three 4" X 8" lab-cured cylinders at 28-days

Additional cylinders may be required by the Owner or requested by the Contractor for early-age strength verification for formwork removal or opening to traffic.

G. Test results shall be reported in writing to Owner, Contractor and ready-mixed concrete producer.

3.14 PROTECTION

A. All concrete work shall be protected by barricades, lights, etc. to protect the concrete during the curing period until adequate strength is achieved.

END OF SECTION

SECTION 03450

PRECAST CONCRETE STRUCTURES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to construct precast concrete manholes, vaults, meter boxes, and other below-ground precast concrete structures as indicated on the Drawings and as specified within this section and related sections of the Specifications.

1.02 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, Operating and Maintenance Manuals, certifications and other submittals as follows and as required by Section 01300 for the products specified in this section.

A. Complete layout and installation Drawings and schedules with clearly marked dimensions.

B. Material certificates on all piping materials.

C. Structural design calculations sealed by a Professional Engineer in the State of Indiana for all precast structures of vertical depth greater than 5 feet. Design calculations for precast manholes, vaults, and other below ground structures of vertical depth 5 feet or greater shall include confirmation of structure adequately to resist flotation/buoyancy at the condition whereas structure is totally empty and subjected to groundwater submergence at full height of structure.

D. Results of leakage test.

1.03 QUALITY ASSURANCE

A. All manufactured precast concrete units shall be produced by an experienced manufacturer regularly engaged in the production of such items. All manufactured precast concrete and site-cast units shall be free of defects, spalls, and cracks. Care shall be taken in the mixing of materials, casting, curing and shipping to avoid any of the above. The Engineer may elect to examine the units at the casting yard or upon arrival of the same at the site. The Engineer shall have the option of rejecting any or all of the precast work if it does not meet with the requirements specified herein or on the Drawings. All rejected work shall be replaced at no additional cost to the Owner.

B. Connections that require welding shall be performed by welders certified in accordance with AWS D1.1. Certifications of field welders shall be submitted prior to performing any field welds.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 15000 Piping – General Provisions

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASTM A 123 - Zinc (Hot Galvanized) Coatings on Iron and Steel Products

B. ASTM C478 - Precast Reinforced Concrete Manhole Sections

C. ASTM C857 - Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

E. ASTM C990 - Joints in Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

PART 2: PRODUCTS

2.01 PRECAST MANHOLES, VAULTS, AND METER BOXES

A. Precast utility structures shall be furnished with waterstops, sleeves and openings as noted on the Drawings. Box out for wall pipes shall conform accurately to the sizes and elevations of the adjoining pipes. Precast utility structures shall be watertight and conform to the requirements of ASTM C 478 and ASTM C857 with the following modifications there to:

1. Structures shall meet the following:
   a. Each precast wall section shall have an internal diameter of 4'-0", unless noted otherwise.
   b. Minimum wall thicknesses shall be 5 inches for 4 foot and 5 foot diameter structures, 6 inches for 6 foot diameter structures and 7 inches for 7 foot diameter structures.
   c. Manholes and other utility structures shall include ballast concrete and/or other means necessary to insure structures resist flotation when empty and subjected to groundwater full height of structure.
2. The date and name of manufacturer shall be marked inside each precast section.
3. No more than two lift holes may be cast or drilled in each section.
4. Dimensions shall be as shown on the Drawings.
5. Covers and frames shall be as specified in article 2.09.
6. Mechanical Details such as piping, electrical, and other details shall be as shown on the Drawings.

B. Joints between manhole and utility structures riser sections and at base slabs shall be groove type.

2.02 CONCRETE

A. Concrete materials including Portland Cement, aggregates, water, and admixtures shall conform to Section 03305, Cast-in-Place Concrete for Pipe Work.

B. For non-prestressed concrete items, minimum compressive strength of concrete at 28 days shall be 4000 psi, unless otherwise specified.

C. Prestressed concrete items shall not be used without the approval of the Engineer.

2.03 GROUT

A. Cement grout shall be composed of Portland Cement and sand in the proportion specified in the Contract Documents and the minimum amount of water necessary to obtain the desired consistency. If no proportion is indicated,

cement grout shall consist of one part Portland Cement to three parts sand. Water amount shall be as required to achieve desired consistency without compromising strength requirements. White Portland Cement shall be mixed with the Portland Cement as required to match color of adjacent concrete.

B. Grout for joints between panels shall be cement grout with a minimum compressive strength at 7 days of 3,000 psi. All other grout shall be cement grout with minimum compressive strength at 28 days of 4,000 psi.

2.04 REINFORCING STEEL

A. Reinforcing bars shall be billet steel grade (60,000 psi minimum yield) conforming to the requirements of ASTM A615, Grade 60. Reinforcing bars shall be new stock, free from rust, scale, or other coatings that tend to destroy or reduce bonding.

2.05 PRESTRESSING STRANDS

A. Prestressing strands are not be used without the approval of the Engineer.

2.06 MANHOLE SECTIONS

A. Manhole riser sections shall be designed, manufactured, tested, finished and marked in accordance with the Drawings and ASTM C478, "Precast Reinforced Concrete Manhole Sections".

2.07 BRICK

A. Brick used to bring manholes or other structures to grade shall comply with ASTM C62, Grade SW.

2.08 LADDER / STEPS

A. Manholes and other structures indicated on the Drawings and/or that require personnel access for any reason shall be provided with a polypropylene vault ladder that meets ASTM C497 load requirements and is in accordance with OSHA regulations, including 1910.26 and 1910.27 specifications, . Rungs shall be 12-inches on center steel reinforced copolymer polypropylene with 10-inch clear tread width, 1-5/8 inch by 1-1/4 inch with molded finger grips, and drop front design. Rails shall be 1-3/4 inch square aluminum reinforced copolymer polypropylene. Polypropylene shall conform to ASTM D4101. Ladders shall be provided with appropriate adjustable mounting bracket and a pull-up handrail that extends to 42-inch height above the top of structure. Ladders shall be manufactured by Lane International Corporation.

B. If approved by the Owner for locations requiring infrequent personnel access, individual manhole steps conforming to ASTM C478 and AASHTO No. M-199-811 may be provided in lieu of ladders. Rungs shall be polypropylene coated ½

or 5/8 inch grade 60 deformed rebar with 11-inch clear tread width conforming to ASTM A615 and D4101. Each step shall have a minimum load resistance of 800 pounds and a minimum pull-out resistance of 400 pounds. Manhole steps shall be by Lane International Corporation, PS1-PF by M.A. Industries. Rungs shall be installed into preformed holes in cured concrete (at least 3,000 psi) at 16-inch vertical spacing, center-to-center.

C. Where individual manhole steps are allowed in lieu of a ladder, a Type 304 stainless steel telescoping safety post with 42-inch extension shall be provided. Post shall be tubular and shall automatically lock in position when fully extended. Acceptable manufacturers are The Bilco Company (Ladder-up model LU-3), Halliday Products (Series L1E, Model A Safety Extension). Contractor shall confirm compatibility of safety post and mounting hardware with manhole steps.

D. All hardware shall be Type 316 stainless steel.

2.09 FRAME AND COVER

A. Manholes and other structures shall be provided with flush mount covers unless otherwise indicated on the Drawings or specified in Section 01011.

B. For installations in roadways, locations subject to potentially fast-moving traffic and/or routinely subject to vehicular traffic, or where indicated on the Drawings, a heavy duty manhole frame with vented lid shall be installed such as Neenah Foundry Company's R-1752 Series Heavy Duty (36” round).

C. For locations with limited vehicular traffic (i.e. infrequent and slow-moving), a 36”X36” square H20-rated aluminum floor, vault and sidewalk door (hatch) shall be installed.

D. Installations in non-traffic areas shall be mounted 8 – 12” above the surrounding surface and shall be provided with a 36”X36” square aluminum floor, vault and sidewalk door (hatch) rated for 300 pounds per square foot.

E. Aluminum hatches shall meet the following requirements:

1. Mill finished aluminum covers of checkered or diamond plate or other approved non-slip suface, with channel frames for drainage.
2. Frames and doors shall be at least ¼-inch thick.
3. Comply with applicable provisions of ASTM A123.
4. Door shall pivot open so that no part of the cover protrudes beyond the channel frame into the opening. A full, unobstructed 36”X36” opening shall be provided.
5. All hardware shall be Type 316 stainless steel.
6. Door cover shall have torsion bars, springs or other approved means for counter-balanced operation.
7. Cover shall be equipped with Type 316 stainless steel hold-open devices fastened to the frame with ½-inch bolts.

8. Cover shall be provided with a recessed hasp, designed to receive a padlock, covered by a hinged lid flush with cover surface.

9. Warranty: Hatches shall operate properly and be free of defects in material and workmanship for a period of five years from date of purchase. Should any part break or fail to function in normal use during this period, Manufacturer shall furnish replacement parts at no charge to Owner.

10. Acceptable Manufacturers:
    a. H20-rated hatches shall be JAL-H20 Series by The Bilco Company, Type H1C by Halliday Products.
    b Non-traffic rated hatches shall be JAL Series by The Bilco Company, Type W1C by Halliday Products.

2.10 PIPE CONNECTIONS

The connection may be made with any of the following types:

A. Unless otherwise indicated on the Drawings, openings in structures for pipe connections shall be circular with flexible and watertight seals. “Dog-house” or “mouse-hole” pipe openings shall not be used unless shown on the Drawings or approved by the Engineer.

B. Pipe shall be sealed in the wall opening with a resilient connector meeting the requirements of ASTM C923. Connector shall consist of a rubber sleeve with Type 304 stainless steel banding and shall be one of the following products:

1. KOR-N-SEAL 106-406 Series as manufactured by Trellebor
2. Lockjoint Flexible Manhole Sleeve as manufactured by Interpace Corporation
3. PSX Direct Drive Manhole Connector by Press-Seal Gasket Corporation
4. Z-Lok Cast In Boot Connector by A-LOK Products, Inc.

C. Resilient connector shall either be cast integrally into the wall of the manhole section at time of manufacturer or shall be installed by mechanical means in openings cut into manhole wall per ASTM C923.

D. Each seal shall be of a size specifically designed for the opening size, pipe outside diameter and pipe material.

E. Flexible seals shall allow for up to fifteen degrees (15°) deflection in pipe alignment.

F. No mortar shall be placed around the connector on the inside or outside of the structures unless directed by the Resident Project Representative.

G. Where required on the Drawings, pipe connections shall be sealed with mechanical link-type seals suitable for 20 psi working pressure and corrosive service. Mechanical seals shall be provided with EPDM seal element, Delrin pressure plate, and Type 316 stainless steel bolts and nuts. Mechanical seals shall be accessible from one side. Mechanical seals shall be Link-Seal by Thunderline Corporation.

2.11 ACCESSORIES

A. Connecting and Supporting Devices: ASTM A 36 carbon steel plates, angles, items cast into concrete.

1. Steel devices outside building walls or exposed to weather shall be hot-dip galvanized in accordance with ASTM A153.
2. All connection plates and devices on the interior of the building and not exposed to view may be unfinished steel and no primer or paint is required.

B. Bearing Pads: A homogeneous blend of ozone-resistant rubber elastomer and high strength random synthetic fiber cords, cured together to form a pad with uniform behavior in all directions. Provide where indicated or required by the member design.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:
   a. JVI Inc.
   b. Voss Engineering, Inc.
   c. Alert Manufacturing

C. Bearing Strips: Tempered hardboard, smooth both sides, or minimum compression plastic, as shown on approved Shop Drawings.

D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations. For exposed to view concrete surfaces and for all units used in exterior construction, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI Class 1) or stainless steel protected (CRSI Class 2).

E. Provide connection plates between precast members where indicated on the Drawings, or where required by manufacturer's calculations for overall stability.

PART 3: EXECUTION

3.01 HANDLING

A. Precast members shall not be transported away from the casting yard until the concrete has reached the minimum required 28 day compressive strength and a period of at least 5 days has elapsed since casting, unless otherwise permitted by the Engineer.

B. No precast member shall be transported from the plant to the job site prior to approval of that member by the plant inspector. This approval will be stamped on the member by the plant inspector.

C. Lift and move all precast concrete components using suitable lifting slings and plugs that will not damage the precast lip.

D. Thoroughly repair all damage to precast sections in the presence of the Engineer. Repair and patch minor breaks by chipping and scarifying the defective area before applying grout. Allow sufficient curing time before the precast sections are put together. Form and key concrete cast-in-place bases specially to accommodate the bottom precast section.

3.02 INSTALLATION

A. Compaction shall be accomplished in accordance with Section 02210.

B. Unless otherwise noted on the Drawings, support bases uniformly on a 6-inch mat of compacted crushed stone or gravel placed over a base of sound, level, undisturbed earth.

C. Place concrete base and wall sections so that all pipes are at proper grade and alignment.

D. Clean the exterior of the pipe thoroughly before installing through the wall opening. Set the pipes securely in the wall opening and complete seal per the seal manufacturer's instructions at the correct line and grade. Provide clearance between the outside of the pipe and the manhole opening in accordance with the seal manufacturer's recommendations and properly tighten the seal. Do not grout the opening unless directed by the seal manufacturer.

E. Bring the top of all precast structures to proper grade for receiving manhole frames or other required covers/hatches. If proposed structure top grade is to be flush to ground surface grade, the top of the manhole ring and cover (or other lids/hatches) shall be within one inch (1") of surrounding grade. If proposed structure top grade is to be above ground surface grade, the top of the manhole ring and cover (or other lids/hatches) shall be between 8 and 12 inches above surrounding grade unless otherwise indicated on the Drawings.

F. Install ladders, hatches, and other devices in full conformance with the manufacturer's instructions.

END OF SECTION

SECTION 15000

PIPING - GENERAL PROVISIONS

PART 1: GENERAL

1.01 SCOPE OF WORK

The Work under this section consists of providing all labor, materials, tools, equipment, and services required to perform piping work as indicated on the Drawings and as specified within this section and related sections of the Specifications. Performance of Work specified under this section is integral to Work specified throughout the Specifications.

1.02 DRAWINGS

Dimensions shown on Drawings are approximate only. Verify all piping geometry in the field to ensure proper alignment and fit of all piping consistent with the intent of the Drawings. Submit field layout drawings when required for approval.

1.03 GENERAL REQUIREMENTS

A. The Contractor shall comply with American Water safety monitoring system for Contractor Safety requirements. The Contractor shall provide protection for the general safety of workers, pedestrians, the traveling public and others within the Work area throughout this project. Existing surface improvements and underground facilities and utilities shall also be protected. Damage caused by the Contractor shall be repaired at his own expense. Protection to be provided includes, at a minimum:

1. Provide adequate barricades, warning lights, signs, and other warning devices appropriate for the conditions for excavations and obstructions.
2. Contractor is solely responsible for trench support and safety of the work area and all construction activities.
3. All other protections required by the Drawings and/or other sections of the Specifications.
4. Comply with all requirements of federal, state, and local authorities with jurisdiction over the Work area.

B. Replacement of and/or connection to existing pipelines may require shutdown(s) of Owner facilities and may require that Work be performed during one or more shutdown periods, which may have associated time constraints and/or other special requirements and limitations (e.g. shutdowns only on certain days, only during certain hours, and/or only when a tank is above an allowable minimum level). Contractor shall closely coordinate construction work and connections with the Engineer and Owner, and shall make all required connections at such times as directed by the Owner at the Contract prices with no claim for premium time or other additional costs. The Owner has the final determination in regard to

all interruptions of the existing water system. The Contractor shall perform all related coordination in accordance with this section; Sections 01000, 01011, 01500; and all other applicable requirements of the Contract Documents.

1.04 COORDINATION OF WORK

A. Closely coordinate construction work, all interruptions and connections with the Owner through the Engineer as specified herein. The Engineer, in consultation with the Owner, may select the day(s) and time(s) for pipe bursting (if applicable) and/or connection to existing pipelines, which will, in the opinion of the Engineer, cause the least inconvenience to the Owner and/or its customers. This may require work by the Contractor during evenings, nights, Saturdays, Sundays, and/or holidays. Contractor shall perform all pipe bursting (if applicable), all interruptions, and make all connections at such times as may be directed by the Owner through the Engineer at the Contract prices, with no claim for premium time or additional costs.

B. Contractor shall schedule the Work so that the existing water system is maintained in continuous operation during the construction period except during Owner-approved interruptions as specified herein. All short-term shutdowns and diversions shall be approved by the Owner. Long-term shutdowns and diversions shall conform to the requirements hereinafter specified and shall be minimized by the Contractor as much as possible. If in the judgment of the Owner a requested shutdown is not required for the Contractor to perform the Work, the Contractor shall utilize approved alternative methods to accomplish the Work. All shutdowns shall be coordinated with and scheduled at times suitable to the Owner. Shutdowns shall not begin until all required materials are on hand and ready for installation. Each shutdown period shall commence at a time approved by the Owner, and the Contractor shall proceed with the Work continuously, start to finish, until the Work is completed and normal operation is restored. If the Contractor completes all required Work before the specified shutdown period has ended, the Owner may immediately place the existing system back into service.

C. Contractor shall schedule short-term and long-term shutdowns in advance and shall present all desired shutdowns in the Construction Schedule (see Section 01300). Shutdowns shall be fully coordinated with the Owner at least 48 hours before the scheduled shutdown. Owner personnel shall operate Owner's facilities involved in the short-term and long-term shutdowns and diversions.

D. Short-term shutdowns will be allowed for tie-ins to existing facilities, installation of permanent caps (to abandon pipes), etc. as indicated on the Drawings or elsewhere in the Contract Documents. All such shutdowns shall be scheduled for low flow periods (which may require weekend or night work) and shall be limited to less than two (2) hours.

E. Any shutdown of two (2) hours or longer duration shall be defined as a long-term shutdown. For long-term shutdowns, Contractor may be required to provide appropriate temporary water supply and/or flow bypass facilities to be approved by the Owner at no additional cost to the Owner when critical water customers, critical fire protection needs, or other Owner requirements so dictate. Contractor

may be allowed additional time for short-term interruptions if no critical water needs exist. The schedule and duration of short-term shutdowns shall be at the discretion of the Owner.

F. Any temporary work, facilities, roads, walks, protection of existing structures, piping, blind flanges, valves, equipment, etc. that may be required within the Contractor's work limits to maintain continuous and dependable operation of the Owner's facilities shall be furnished by the Contractor at the direction of the Engineer at no extra cost to the Owner.

G. Owner shall have the authority to order Work stopped or prohibited Work that would, in his opinion, unreasonably result in interrupting necessary operations of the Owner's water system.

H. If the Contractor impairs performance or operation of the water system as a result of not complying with specified provisions for maintaining operations, then the Contractor shall immediately make all repairs or replacements and do all work necessary to restore the water system to operation to the satisfaction of the Engineer. Such work shall progress continuously to completion on a 24 hours per day, seven work days per week basis.

I. Contractor shall provide the services of emergency repair crews on call 24 hours per day to affect repairs to portions of the water system affected by the Contractor's operations.

J. Preparation Prior to Making Connections into Existing Piping Systems

1. Approximate locations for existing piping systems are shown on the Drawings. Prior to making connections into existing piping systems, the Contractor shall:
   a. Field verify location, size, piping material, and piping system of the existing pipe.
   b. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown on the Drawings.
   c. Have installed all temporary piping in accordance with established connection plans.
2. Have on hand necessary pipe stoppers, pancake flanges or other items which may be necessary should an existing valve or appurtenance fail to seal properly.
3. Unless otherwise approved by the Engineer in writing, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

K. Flow Bypass and Temporary Water Service

1. Potable water service and water for fire protection purposes shall be maintained in continuous service at all times during construction except for short term interruptions required for tie-ins and long-term interruptions shorter than eight (8) hours when approved by the Owner. For long-term shutdown periods greater than eight (8) hours duration (and for shorter long-term interruptions where required), temporary water shall be provided to all

impacted services. This can include the use of temporary waterlines that have been disinfected and flushed in accordance with State standards and regulations for potable water use.

2. A flow bypass and temporary water service plan shall be submitted to the Owner and Engineer for approval. The plan shall indicate location of temporary piping, temporary waterline sizes, street and driveway crossing methods, location of connection to water distribution system, type of connection used to connect temporary water piping to water system, location and type of temporary fire hydrants, and the water services served. All temporary outages shall be shown or listed in the project schedule provided to the Engineer.
3. All temporary water services shall allow for the water to pass through the customer's existing water meter. At no time shall a customer be provided unmetered water.
4. Traffic on roadways shall not be impeded by temporary water service piping, and Contractor shall maintain vehicular access to all driveways throughout the Work. Temporary water service piping shall be protected from traffic at driveways and road crossings with cross-over ramps or by other methods approved by the Engineer, Resident Project Representative and the agency with jurisdiction over the roadway. Contractor shall submit and provide acceptable methods at no additional cost to the Owner.
5. The Contractor shall also comply with requirements included in Section 02025.

1.05 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, certifications, and other required submittals for all piping products furnished in accordance with Section 01300. Submittals shall include the following:

A. Field layout drawings (when required)

B. Flow bypass and temporary water service plan, including products and methods for protecting temporary piping at road and driveway crossings without impeding traffic (when flow bypassing and/or temporary water service is required for the Work)

C. Calculations and details of temporary thrust blocking at temporary caps and other temporary deadends

D. If any main is flooded, submit a plan to correct the condition as required by article 3.04.

E. Contractor shall execute and submit the applicable documentation of compliance with American Water Pipe Cutting Policy prior to performing Work.

F. Contractor shall execute and submit the applicable documentation of compliance with American Water PICS Contractor Safety requirements prior to performing Work.

1.06 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01010 Drawing Index

C. Section 01011 Special Provisions

D. Section 01075 Basis of Payment

E. Section 01300 Submittals

F. Section 01500 Temporary Facilities

G. Section 01570 Traffic Regulation

H. Section 01600 Products

I. Section 01700 Project Closeout

J. Section 02020 Dewatering

K. Section 02025 Existing Utilities and Structures

L. Section 02105 Clearing and Grubbing

M. Section 02210 Trenching, Backfilling and Compacting

N. Section 02230 Stream Crossing

O. Section 02540 Erosion and Sedimentation Control

P. Section 02558 Identification/Location Guide

Q. Section 02610 Roadway Paving and Surfacing

R. Section 02620 Gravel Roads and Driveways

S. Section 02820 Lawn Restoration and Landscaping

T. Section 03305 Cast-In-Place Concrete for Pipe Work

U. Section 03310 Cast-in-Place Concrete for Paving, Driveways, Sidewalks, Curbs, and Paved Ditches

V. Section 15020 Disinfecting Pipelines

W. Section 15025 Flushing and Cleaning Pipelines

X. Section 15030 Pressure and Leakage Tests

Y. Section 15105 Ductile Iron Pipe and Fittings

Z. Section 15120 Polyvinyl Chloride (PVC) Pipe

AA. Section 15125 High Density Polyethylene (HDPE) Pipe

BB. Section 15130 Piping Specialties

CC. Section 15185 Abandonment of Mains and Hydrants

DD. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps

EE. Section 15200 Service Lines

1.07 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. NSF/ANSI 14 Plastics Piping System Components and Related Materials

B. NSF/ANSI 61 Drinking Water System Components – Health Effects

C. NSF/ANSI 372 Drinking Water System Components – Lead Content

D. Indiana Administrative Code Title 327 Water Pollution Control Division (327 IAC)

PART 2: PRODUCTS

2.01 REDUCTION OF LEAD IN DRINKING WATER ACT COMPLIANCE

All products shall comply with the requirements and standards of the Reduction of Lead in Drinking Water Act. Products shall be “lead free’ as required by that act and as enforced by agencies with jurisdiction. Contractor shall be responsible for ensuring full compliance with all applicable federal, state, and local laws, ordinances, codes, rules, and regulations governing the Reduction of Lead in Drinking Water Act.

2.02 DOMESTIC AND FOREIGN PRODUCTS

Except as specially allowed in the individual Sections, all products provided by the Contractor shall be produced solely in the United States; and no foreign-manufactured items shall be allowed.

2.03 RUBBERIZED-BITUMEN BASED SPRAY-ON UNDERCOATING

A. Where required by the Engineer, an aerosol applied rubberized coating corrosion protection for exposed buried metal (not for stainless steel, Xylan, or FluoroKote #1 hardware) shall be provided. The material shall be rapid dry and specifically designed for corrosion protection. 3M Rubberized Undercoating 08883 or equivalent rubberized-bitumen based spray-on undercoating may be used. Follow manufacturer's recommendations for storage and application.

2.04 BRIDGE CROSSING AND OTHER AERIAL PIPE

A. The pipe material to be used for bridge crossings shall be ductile iron as called out in the Drawings and approved by the Engineer.

B. For bridge crossings using ductile iron pipe, all ductile iron pipe to be fully restrained meeting requirements provided in Section 15105 as applicable. Only factory-fabricated push-on restrained joints are permitted for bridge crossing pipe or other aerial pipelines. Push-on restraining gaskets with integral stainless steel locking segments are not permitted for exposed pipe. Flanged joints are not permitted for aerial pipelines. All ductile iron pipe shall have factory-installed cement mortar lining coated with an asphaltic seal coating on the interior in accordance with AWWA C110 and factory-applied epoxy primer with field-applied finish coating on the exterior as specified in Section 01011 or otherwise required by the Engineer.

C. Bridge crossing and other aerial piping shall be insulated in accordance with Section 15130.

PART 3: EXECUTION

3.01 PACKAGING, HANDLING, DELIVERY, OFF-LOADING AND STORAGE

A. The manufacturer shall package the pipe and fittings in a manner designed to ensure that they arrive at the project neat, clean, intact, and without physical damage. The transportation carrier shall use appropriate methods and intermittent checks to assure that the pipe is properly supported, stacked, and restrained during transport such that the pipe is not cut, nicked, gouged, deformed, or otherwise physically damaged. Nesting of pipe shall not be permitted.

B. Each pipe shipment shall be checked for quantity and proper pipe size, color and type. Each pipe shipment shall be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify Owner or Engineer immediately if

more than insignificant damage is found. Any pipe damaged in shipment shall be replaced by the Contractor as directed by the Owner or Engineer.

C. Pipe shall be loaded, off-loaded, and otherwise handled in accordance with the pipe manufacturer's guidelines and the applicable standards referenced in the individual pipe sections of the Specifications.

D. Contractor shall inspect all pipe, fittings, and appurtenances (whether furnished by the Owner or Contractor) for defects prior to installation in the trench. Contractor shall set aside defective, damaged or unsound material and hold material for inspection by the Engineer.

E. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The pipe shall be handled in such a manner that it is not pulled over sharp objects or cut by chokers or lifting equipment.

F. Protection of Pipe: Contractor shall install all devices and other equipment required to protect the pipe from damage during installation. Lubrication shall may be used as recommended by the manufacturer and specified in the individual pipe material sections of the Specifications. Under no circumstances will the pipes be stressed beyond their elastic limit.

3.02 CONTRACTOR'S RESPONSIBILITY FOR MATERIAL

A. Examine all material carefully for defects. Do not install material which is known, or thought to be defective.

B. The Engineer reserves the right to inspect all material and to reject all defective material shipped to the job site or stored on the site. Failure of the Resident Project Representative, Engineer or Owner to detect damaged material shall not relieve the Contractor from any responsibility for the Work.

C. Lay all defective material aside for final inspection by the Engineer. The Engineer will determine if corrective repairs may be made, or if the material is rejected. The Engineer shall determine the extent of the repairs.

D. Classify defective pipe prior to Engineer's inspection as follows:

1. Damage to interior and/or exterior paint seal coatings (DI, steel).
2. Damage to interior cement-mortar or epoxy lining (DI,steel).
3. Piping that has received a blow that may have caused an incident fracture, even though no such fracture is visible (PVC). All such pipe shall be marked as rejected and removed from the job site immediately upon Engineer's inspection.
4. Insufficient interior cement-mortar lining or epoxy thickness.
5. Excessive pitting of pipe (DI, steel)
6. Poor quality exterior paint seal coat (DI, steel).

7. Pipe out of round (all pipe).
8. Pipe barrel area damaged to a point where pipe class thickness is reduced (all pipe).
9. Denting or gouges in plain end of pipe (all pipe).
10. Excessive slag on pipe affecting gasket seal (DI).
11. Any visible cracks, holes (PVC, HDPE).
12. Embedded foreign materials (PVC, HDPE).
13. Non-uniform color, density and other physical properties along the length of the pipe (PVC, HDPE).

E. Contractor shall be responsible for all material, equipment, fixtures, and devices furnished. These materials, equipment, fixtures and devices shall comply with the requirements and standards of all Federal, State, and local laws, ordinances, codes, rules, and regulations governing safety and health.

F. Contractor shall be solely responsible for the safe storage and handling of all material furnished to or by him (including material furnished by the Owner) until the material is incorporated in the completed project and accepted by the Engineer. If any material furnished by the Owner is damaged after its receipt by the Contractor, the Contractor shall replace or repair the item in a satisfactory manner (at the Engineer's discretion) at the Contractor's own expense. If any defective or damaged item is discovered after it has been installed, it shall be removed and replaced with an exact replacement item in a satisfactory manner by the Contractor at the Contractor's own expense.

G. Load and unload pipe, fittings, valves, hydrants and accessories by lifting with hoists or skidding to avoid shock or damage. Do not drop materials or damage interior/exterior. Pipe handled on skidways shall not be skidded or rolled against other pipe. Handle this material in accordance with AWWA C600, C605 or C906, and manufacturers' guidelines as applicable.

H. Drain, store, and protect fittings and valves in accordance with Section 01600.

3.03 INSTALLATION - GENERAL REQUIREMENTS

A. Lay and maintain all pipe to the required lines and depths. Minimum depth of cover shall be as indicated on the Drawings. Measure the depth from the final surface grade to the top of the pipe barrel. Do not deviate from the required alignment, depth or grade without the written consent of the Engineer.

B. Buried steel lugs, rods, brackets, and flanged joint nuts and bolts are not permitted unless specifically shown on the Drawings or approved in writing by the Engineer. When allowed, these items shall be as specified in Section 15130.

C. Bolts shall be carefully tightened in increments, with a final torque value not exceeding the manufacturer's recommendations. Contractor shall ensure that bolts are properly re-tightened where appropriate following a sufficient time for gaskets to undergo compression set.

D. Install fittings, valves and hydrants in strict accordance with the Specifications at the required locations with joints centered, spigots home, and all valve and hydrant stems plumb. Contractor shall install pipe in accordance with minimum cover requirements as indicated on Drawings.

E. If during the course of pipeline installation the Contractor identifies or suspects the presence of petroleum products or any unknown chemical substance in the native soil, Contractor shall stop installing piping in the area of suspected contamination and notify the Engineer immediately. Contractor shall not resume installing piping in the area of suspected contamination until direction is provided by the Engineer.

F. Do not lay pipe in a wet trench, on subgrade containing frost, or when trench conditions are unsuitable for such work. If all efforts fail to obtain a stable dry trench bottom and the Engineer determines that the trench bottom is unsuitable for such work, the Engineer will specify in writing the type of stabilization to be used. In all cases, water levels must be at least 6” below the bottom of the pipe during pipe joint installation. See Section 02020, Dewatering.

G. Lay pipe with the bell ends facing in the direction of work progress, unless otherwise shown on the Drawings or directed by the Engineer. Exercise care to ensure that each length abuts the next in such a manner that no shoulder or unevenness of any kind occurs in the pipe line.

H. Do not wedge or block the pipe during laying unless by written order of the Engineer.

I. Before joints are made, bed each section of pipe the full length of the barrel, at the required grade, and at the invert matching the previously laid pipe. Dig bell holes sufficiently large to permit proper joint making. Do not bring succeeding pipe into position until the preceding length is embedded and secure in place.

J. Remove and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying. Remove, such in-place pipe sections found to be defective and replace them with new pipe. Removal, installation, and replacement will be at the Contractor's expense.

K. Place enough backfill over the center sections of the pipe to prevent floating. Take all other necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench, or the collapse of the pipeline from any cause. Should floating or collapse occur, restoration will be at the Contractor's expense.

L. Bedding materials and concrete work for the pipe bedding and thrust restraint shall be as specified in Divisions 2, 3, and 15 as well as indicated on the Drawings.

M. Cutting of the pipe in the field shall be limited to only two pieces of pipe per pipeline; and this shall be for closure purposes only, unless otherwise approved by the Owner. Such cuts shall be made carefully in a neat workmanlike manner using approved methods to produce a clean square cut perpendicular to the longitudinal axis. Contractor shall propose method of cutting pipe, which shall be

subject to approval by the Owner. Contractor shall comply with American Water Pipe Cutting Policy. Re-mark the “home” line on the cut end spigot end per pipe manufacturer’s recommendations for the specific pipe material, size, and joint type.

1. When ductile iron pipe is cut in the field, the cut end shall be conditioned for use by filing or grinding a bevel at an angle of approximately 30 degrees with a heavy file or grinder to remove all sharp edges and shape the pipe for insertion into the adjacent pipe, valve or fitting; and coat all exposed metal to match pipe interior coating as specified.
2. When PVC pipe is cut in the field, the cut end shall be conditioned for use by filing a bevel at an angle recommended by the pipe manufacturer with a heavy file to remove all sharp edges and shape the pipe for insertion into the adjacent pipe.
3. When HDPE pipe is cut in the field, the cut end shall be conditions in accordance with the manufacturer’s recommendations.

N. In distributing material at the site of the Work, unload each joint as close as possible to where it is to be laid in the trench. If the pipe is to be strung out, do so in a straight line or in a line conforming to the curvature of the street. Block each length of pipe adequately to prevent movement. Block stockpiled pipe adequately to prevent movement. Do not place pipe, material, or any other object on private property, obstructing walkways or driveways, or in any manner that interferes with the normal flow of traffic.

O. Exercise special care to avoid damage to the bells, spigots or flanged ends of pipe during handling, temporary storage, and construction. Replace damaged pipe that cannot be repaired to the Engineer's satisfaction, at the Contractor's expense.

P. Remove all existing pipe, fittings, valves, pipe supports, blocking, and all other items in accordance with Section 15185 as necessary to provide space for making connections to existing pipe and installing all piping required under this Contract. Contractor shall make connections to existing pipeline(s) in such a manner so as to cause the least amount of disruption to water service to the Owner’s customers. Where existing pipe is corroded, deformed, or otherwise not acceptable for connection in the opinion of the Resident Project Representative, Engineer or Owner, the pipe shall be exposed and cut back until pipe in acceptable condition is exposed; and connection shall be made to existing pipe that is acceptable to the Resident Project Representative, Engineer and/or Owner.

Q. Maintain the minimum required distance between the water main and other utility lines in strict accordance with all Federal, State, and local requirements and all right of way limitations.

R. Provide and install polyethylene encasement for ductile iron pipe, fittings, valves, and other appurtenances per Section 15130. Contractor shall install polyethylene encasement on the pipe directly prior to the installation of the piece of pipe.

S. Use short lengths of pipe (minimum length 3 feet, no more than three short sections), when approved by the Engineer, to make curves that cannot be made with full length sections of pipe without exceeding the allowable deflection. Making these curves will be at no additional cost to the Owner. Joints in curves shall be restrained where required by the Drawings.

T. Furnish air valve assemblies in accordance with the Drawings, the Owner's Standard Detail Drawings for air valves and as specified in Section 15190. Any proposed deviation from these requirements that are proposed by the Contractor must be approved in writing by the Engineer.

U. Exercise particular care so that no high points are established where air can accumulate. If the Engineer determines that unforeseen field conditions necessitate a change in the pipe profile that requires the installation of an air valve and concrete structure, then an air valve and concrete structure will be provided at the unit price bid. If no applicable unit price was established in the Contract then this will be added as Extra Work in accordance with the Contract Documents. If the Contractor requests a change in the pipe profile solely for ease of construction, and the requested change requires the installation of an air valve and concrete structure as determined by the Engineer, the cost of furnishing and installing the air valve and concrete structure will be at the expense of the Contractor.

3.04 CONSTRUCTION METHODS TO AVOID CONTAMINATION

A. String pipe delivered for construction so as to keep foreign material out of the pipe.

B. Remove all dirt and foreign matter from pipe before lowering it into the trench. Do not place debris, hand tools, clothing or other materials in the pipe. Thoroughly clean the pipes, fittings and valves before they are installed; and keep these materials clean. Clean the sealing surface of the spigot end, the pipe bell, the coupler or fitting, and the elastomeric gaskets immediately before assembly.

C. Do not roll, drop or dump pipe or appurtenances into the trench.

D. Keep pipe clean during and after laying. Take precautions to protect the interior of pipes, fittings, and valves against soil, debris, runoff and other foreign materials entering the pipe and other contamination during installation. Do not place debris, tools, clothing, or other materials in the pipe during laying operations. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons such as rest breaks or meal periods when the exposed pipe will be unattended. If approved by the Owner, use rodent-proof plugs approved by Engineer where watertight plugs are not practical and where thorough flushing or cleaning will be performed. If water, soil, backfill material, or other debris accumulates in the trench, keep the plugs in place until the trench is dry and the pipe end has been completely uncovered.

E. Handle sealing material and gaskets in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be NSF-certified for use in potable water line and in accordance with pipe manufacturer's recommendations. Lubricant shall be stored, handled, and applied as recommended by the pipe manufacturer. Avoid using too much lubricant. Excessive lubricant use can make disinfection more difficult and cause taste and odor problems when the line is placed in service.

F. If dirt enters the pipe, and in the opinion of the Engineer the dirt will not be removed by the flushing operation, clean the interior of the pipe by mechanical means, then swab with a 1% hypochlorite disinfecting solution. Clean using a pig, swab, or "go-devil" only when approved by the Engineer and Owner.

G. If the main is flooded during construction, the flooded section must be isolated from the remainder of the installation as soon as practical. Contractor shall submit a plan to the Engineer to correct the condition and shall not proceed until authorized by the Engineer. Any required replacement of pipe, cleaning and disinfection required shall be at no additional cost to the Owner.

3.05 TRACER WIRE

A. Contractor shall install tracer wire and test connection points along all buried piping (water mains, hydrant branches, and services), regardless of pipe material or installation method, in accordance with Sections 02458, 02558 and 15130, as applicable.

3.06 THRUST RESTRAINT

A. Provide all plugs, caps, tees, and bends (both horizontal and vertical) with concrete thrust blocking and/or restrained joint pipe and fittings as indicated on the Drawings, or specified in the Specifications.

B. Place concrete thrust blocking between undisturbed solid ground and the fitting to be anchored. Install the concrete thrust blocking in accordance with Section 03305 and Owner's Standard Detail Drawing for thrust blocking. Ensure proper placement of polyethylene encasement where specified prior to pouring concrete for thrust blocking; and locate the thrust blocking to contain the resultant thrust force while keeping the pipe and fitting joints accessible for repair, unless otherwise shown or directed.

C. Provide temporary thrust restraint at temporary caps and plugs. Submit calculations and details of temporary restraint to the Engineer for review.

3.07 BRIDGE CROSSINGS

A. Supply cement-lined ductile iron pipe, related hardware, equipment, and labor to install water main in a dedicated utility bay beneath the bridge deck. Supply and install all required bends from bridge utility bay to meet required alignments to proposed buried DIP.

B. For ductile iron pipe installation, provide at least one support per length of pipe Provide proper lateral and vertical support as needed to prevent “snaking.”

C. Size, supply, and install all required pipe roller supports for attachment to bridge. (Maximum spacing between supports is 10 feet.) Submit Shop Drawings to Owner for approval.

D. If construction of bridge is proposed at the same time as main installation, coordinate all activities with Bridge Contractor and Governing Agency, including supplying and installation of steel sleeve, pipe roller supports and all appurtenant items required for water main installation.

END OF SECTION

SECTION 15020

DISINFECTING PIPELINES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Work under this section consists of providing all labor, materials, tools, equipment, and services required to disinfect all piping, valves, and appurtenances installed under these Contract Documents as specified in this section. This includes the operation of valves, hydrants, and blow-off assemblies on the new pipeline during the disinfection process except as otherwise specified.

B. Contractor shall provide all taps required for testing, disinfection, and sampling as required herein and in Sections 15025, 15030, and 15190, and shall remove and plug all such taps as required by Sections 15185 and 15190 unless otherwise directed by the Owner.

C. All disinfection activities will be performed under the supervision of the Owner.

D. Contractor shall identify appropriate disposal locations for flushed water and secure all required approvals and permits. All disposal locations shall be authorized by the appropriate stormwater governance authority. Contractor assumes all responsibility for any permit violations, erosion, flooding, fish kills, and other damage or injury resulting from flushing activities.

E. When pre-chlorination is proposed for HDPE pipe to be installed by pipe bursting method, Contractor shall comply with the additional requirements and procedures specified in Section 02350.

1.02 WORK BY OWNER

A. Owner reserves the option to furnish the dechlorination equipment, which the Contractor shall use at no additional cost. Owner will furnish water for testing, flushing, and disinfecting pipelines in accordance with Section 01500 up to ten (10) times the volume of the new pipeline(s). If additional water is needed, then the Owner will furnish the water and may charge the Contractor for the additional water as specified in Section 01500. Unless otherwise indicated in Sections 01000 and/or 01011, the Owner will collect all water samples required for water quality and disinfection testing and perform all bacteriological testing required. The Owner will provide the Contractor a written report with the test results within 24 hours of the Owner completing the test.

1.03 COORDINATION OF WORK

A. Coordinate disinfection activities with flushing and cleaning activities and comply with Section 15025. Coordinate disposal of chlorinated water as required in

article 3.04 below and Section 15025. Contractor shall coordinate with the local storm sewer and/or sanitary sewer department as required in Section 15025.

B. Contractor shall secure all approvals as required in this section and in Section 15025.

C. Contractor shall schedule the disinfection activities with the Owner and Resident Project Representative at least 48 hours in advance for a mutually-acceptable time. Contractor shall coordinate disinfection activities and associated sampling requirements with the Owner. Owner reserves the right to require that all sampling occur during the Owner's normal business hours, in which case Contractor shall schedule disinfection activities to accommodate such requirement.

1.04 SUBMITTALS

Contractor shall submit the following in accordance with Section 01300:

A. Contractor shall submit to the Owner for approval the proposed method of disinfection (from the options specified herein),

B. Contractor shall submit to the Owner for approval the proposed method of dechlorination and a plan for disposal of flushed water.

C. Contractor shall submit results of all chlorine residual tests.

1.05 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 01500 Temporary Facilities

G. Section 15000 Piping – General Provisions

H. Section 15025 Flushing and Cleaning Pipelines

I. Section 15030 Pressure and Leakage Tests

J. Section 15170 Tapping Sleeves, Saddles and Valves

K. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps

L. Section 15200 Service Lines

1.06 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ANSI/AWWA B300 Hypochlorites

B. ANSI/AWWA B301 Liquid Chlorine

C. ANSI/AWWA C651 Standard for Disinfecting Water Mains

D. ANSI/AWWA C655 Field Dechlorination

E. AWWA Manual M12 Simplified Procedures for Water Examination

F. Indiana Administrative Code Title 327 Water Pollution Control Division (327 IAC)

G. Standard Methods for the Examination of Water and Wastewater

PART 2: PRODUCTS

2.01 MATERIALS

A. Furnish liquid chlorine (gas) and injection equipment and/or calcium hypochlorite (HTH) as needed to disinfect all pipelines and appurtenances.

B. Liquid chlorine (gas) contains 100% available chlorine and is packaged in steel containers, usually of 100 lb, 150 lb, or 1 ton net chlorine weight. Liquid chlorine (gas) shall be furnished in accordance with AWWA B301.

C. Calcium hypochlorite shall be in granular form containing approximately 65% available chlorine by weight. The material shall be stored in a cool, dry, and dark environment to minimize its deterioration. Do not use calcium hypochlorite intended for swimming pool disinfection, as this material (containing trichloroisocyanuric acid) has been sequestered and is extremely difficult to eliminate from the pipe after the desired contact time has been achieved.

D. Calcium hypochlorite must conform to AWWA B300.

2.02 EQUIPMENT

A. A gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions shall be used for applying hypochlorite solution to the water

main. Feed lines shall be of such material and strength as to safely withstand the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. Check all connections for tightness before the solution is applied to the main.

B. If liquid chlorine (gas) in solution is proposed by the Contractor and permitted by the Engineer and Owner, the preferred equipment for the gas application employs a vacuum-operated, solution feed type chlorinator to mix the chlorine gas, in combination with a booster pump for injecting the chlorine gas solution water into the main to be disinfected. Direct feed chlorinators shall not be used. (A direct feed chlorinator is one which operates solely from the pressure in the chlorine cylinder.)

PART 3: EXECUTION

3.01 PROTECTION

A. Chlorine disinfection and dechlorination shall be under the direct supervision of someone familiar with the physiological, chemical, and physical properties of the form of chlorine used. They shall be trained and equipped to handle any emergency that may arise. All personnel involved shall observe appropriate safety practices to protect working personnel and the public.

B. The forwards of AWWA Standards B300 and B301 contain information and additional reference material regarding the safe handling of hypochlorites and liquid chlorine. Contractor shall familiarize himself with this information prior to performing any disinfection work.

C. All water with chlorine residual higher than 0.05 ppm (mg/L) shall be disposed of as required in article 3.04 below and Section 15025 in full conformance with 327 IAC 2-1-6 (including Table 6-1).

3.02 PREPARATION

A. Unless the Owner has approved in writing the slug method for chlorination, complete flushing and cleaning in accordance with Section 15025 and pressure and leakage testing in accordance with Section 15030 before commencing disinfection of pipeline. All pipelines shall be cleaned of debris and dirt, flushed, purged of air, and successfully pressure and leakage tested prior to application of the disinfectant.

B. Contractor shall install sampling tap assemblies with the components as required in Section 15190 and 15200 on the new pipeline within ten feet (10') of each proposed connection to the existing water main, at each dead end, and at intervals not exceeding 1,200 feet along the entire pipeline(s). These sampling taps shall be used as necessary for the purpose of introducing the disinfectant, checking the chlorine residual, and obtaining samples.

C. Observe the precautions described in Section 15000 to avoid contamination during installation of the pipeline.

3.03 APPLICATION OF DISINFECTANT FOR WATER MAINS

Method to be used for disinfection shall be one of the two (2) described below as detailed in AWWA C651 Disinfecting Water Mains. Contractor shall use the Continuous Feed Method unless an alternate method is proposed by the Contractor in writing and approved in writing by the Owner. Under no circumstance shall the other methods described in AWWA C651 (i.e. using tablets of hypochlorite or spray disinfection) be allowed. Otherwise, information in the forward of AWWA Standard C651 will be helpful in determining the best method to be used.

Continuous Feed Method:

A. Set up:

1. The continuous feed method consists of completely filling the main with highly chlorinated potable water after pressure and leakage testing has been completed per Section 15030. The potable water shall be chlorinated, so that after the specified holding period in the main, there must be a free chlorine residual of not less than 10 mg/L in all collected samples (i.e. at every sampling tap). Disinfectant shall be disbursed throughout the entire length of new main.
2. Chlorine can be applied in advance of flushing by swabbing joints with bleach or placing hypochlorite granules in the pipe in areas where contamination is suspected. All tie-ins between the new main and existing mains shall utilize this method of disinfection.
3. During filling, Contractor shall ensure that main is completely filled and all air pockets are eliminated.

B. Chlorinating the Main:

1. Flow water from the existing water main through a new line valve, through an approved temporary connection from the existing distribution system or from other approved source of supply at a constant, measured rate into the newly laid water main. In the absence of a meter, approximate the rate by placing a pitot gauge in the discharge or measuring the time to fill a container of known volume. Ensure that all air is eliminated from the pipe so that highly chlorinated water comes into contact with all surfaces.
2. At a point not more than ten (10) feet downstream from the beginning of the new main, dose the water entering the new main with chlorine fed at a constant rate such that the water will have not less than 25 mg/L free chlorine residual. Measure the chlorine concentration at regular intervals to ensure that this concentration is provided. Measure chlorine in accordance with the procedures described in the current edition of the AWWA Manual M12 or Standard Methods for the Examination of Water and Wastewater.
3. Table 1 below indicates the amount of chlorine required for each 100 feet of clean pipe of various diameters. Solutions of 1 percent chlorine may be

prepared with calcium hypochlorite. The solution requires 1 pound of calcium hypochlorite in 8 gallons of water. Contractor is responsible to ensure adequate chlorine is used to account for any contamination in the main.

TABLE 1
Chlorine Required to Produce 25 mg/L
Concentration in 100 feet of Pipe by Diameter

Diameter Inches	100% Chlorine lbs	1% Chlorine Solution gallons
4	0.013	0.16
6	0.030	0.36
8	0.054	0.65
10	0.085	1.02
12	0.120	1.44
16	0.217	2.60

4. Apply hypochlorite solution with approved equipment. Check all connections for tightness before the solution is applied to the main.
5. During the application of chlorine, utilize an approved backflow prevention valve so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Do not stop the chlorine application until the entire new main is filled with highly chlorinated water. Keep the chlorinated water in the new main for at least 24 hours, but not more than 72 hours unless approved in writing by the Engineer. During this holding time, operate all valves and hydrants in the section treated in order to disinfect the appurtenances. At the end of the 24-hour holding period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine as established by testing at every sampling station.
6. Apply liquid chlorine (gas) in solution with approved equipment.
7. Provide dechlorination of all discharged water as specified herein.

Slug Method:

A. Setup:

1. The slug method consists of placing calcium hypochlorite granules in the main during construction and slowly flowing a slug of water containing 100 mg/L of free chlorine through the main so that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours. During filling, Contractor shall ensure that main is completely filled and all air pockets are eliminated.

B. Chlorinating the main:

1. Place calcium hypochlorite granules in the main during construction. The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water especially to fill annular spaces in pipe joints.

Slowly fill the main at a controlled velocity not more than 1.00 foot per second. Velocity shall be slow enough to avoid pushing the granules along the pipe. Disinfectant shall be disbursed throughout the entire length of new main (to maintain the required 100 mg/L concentration for at least 3 hours in every part of the main) and shall not be more heavily-concentrated at the end of the main due to granules being pushed to the end as the main is filled. Ensure that all air is eliminated from the pipe so that highly chlorinated water comes into contact with all surfaces.

2. At a point not more than ten (10) feet downstream from the beginning of the new main, dose the water entering the new main with chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. During the chlorination process, utilize an approved backflow prevention valve so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Do not stop the chlorination process until the slug has moved through the entire new main.
3. Measure chlorine in accordance with the procedures described in the current edition of the AWWA Manual M12 or Standard Methods for the Examination of Water and Wastewater. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of highly chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours. Chlorine concentration shall be tested at a minimum at the beginning and end of the watermain to ensure uniform distribution of concentrated chlorine throughout the entire length of watermain.
4. The free chlorine residual shall be measured at each sampling tap in the water main as the slug moves through the main to ensure that this concentration is provided throughout the length of the pipeline for the required duration. If at any time the free chlorine residual drops below 50 mg/L in the slug, suspend the flow for not more than sixty (60) minutes, provide additional chlorination equipment at the head of the slug, and as flow is resumed, apply chlorine at a constant rate at the additional location to restore the free chlorine in the slug to not less than 100 mg/L while still applying chlorine at the beginning of the water main at the same rate as before.
5. As the highly chlorinated water flows past fittings and valves, operate related valves and hydrants so as to disinfect appurtenances and pipe branches.
6. The chlorinated water shall remain in the pipe for at least 24 hrs. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 hrs. A detectable free chlorine residual (≥0.2 mg/L) shall be measured at each sampling point after the 24- or 48-hr period.

C. Upon completion of chlorinating the main, Contractor shall perform flushing in accordance with Section 15025 (to remove particulates) and pressure and leakage testing in accordance with Section 15025. Provide dechlorination of all discharged water as specified herein.

3.04 DISPOSAL OF CHLORINATED WATER

A. Do not keep highly chlorinated water in contact with pipe for more than 24 hours after the applicable holding period (i.e. all highly chlorinated water shall be flushed out within 72 hours of filling the main with highly-chlorinated water). In order to prevent damage to the pipe lining, corrosion damage to the pipe itself, or damage to valves, flush the highly chlorinated water from the main, fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the existing distribution system and is acceptable for domestic use.

B. Discharge of any and all water from the water main for any purpose shall be in conformance with Section 15025 and this section. All water discharged from the water main for any purpose (including during cleaning, flushing, testing, and disinfection procedures) shall be discharged to either an approved sanitary sewer system or an alternative disposal site(s) authorized by the appropriate stormwater governance authority. Any alternative disposal sites on private property or that are tributary to a private lake or pond or livestock water source shall also be approved in writing by the property owner(s).

C. Take all steps necessary to dechlorinate water discharged to any location (except when chlorinated water is discharged to an approved sanitary sewer system with the written permission of the local sewer department). Under no conditions may highly-chlorinated or low-chlorinated water be disposed of to any location other than an approved sanitary sewer system without adequate dechlorination as specified herein. Neutralize the chlorine residual of the water being disposed of by treating with one of the neutralizing chemicals listed in Table 2. Apply the reducing agent to the chlorinated water to be wasted to completely neutralize the chlorine residual remaining in the water. Do not overdose neutralizing chemicals as this may result in adverse environmental impacts. Only dose the amount required to neutralize the amount of chlorine present.

Table 2

Pounds of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water.

Residual Chlorine mg/L	SulfurDioxide (SO_2)	Sodium Bisulfite ($NaHSO_3$)	Sodium Sulfite (Na_2SO_3)	Sodium Thiosulfate ($Na_2S_2O_35H_2O$)	Ascorbic Acid ($C_6O_8H_6$)
1	0.8	1.2	1.4	1.2	2.1
2	1.7	2.5	2.9	2.4	4.2
10	8.3	12.5	14.6	12	20.9
50	41.7	62.6	73	60	104

D. Test for chlorine residual throughout the disposal process to be sure that the chlorine is neutralized.

3.05 BACTERIOLOGICAL TESTING

A. After final flushing and before the water main is placed in service, the first of two consecutive sets of acceptable samples can be collected from the new main. The second set of samples shall be taken at least 24 hours after the first set of samples. The main shall not be flushed between collection of the first and second set of samples except to clear the sample site to collect the second sample. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from each end of the line and at least one set from each branch.

   1. Optional Method A: When approved by the Owner, the second set of samples shall be collected a minimum of 16 hours after the first set of samples.
   2. Optional Method B: When approved by the Owner, both sets of samples shall be collected a minimum of 15 minutes apart, with the first set collected after a minimum 16 hour rest period following completion of final flushing, during which rest period there shall be no water flow through the pipeline or water use from the pipeline. Sampling taps shall be left running continuously between the first and second set of samples.

B. Coordinate sample collection for testing of bacteriological (chemical and physical) quality with the Owner. Samples shall be collected by the Owner. Testing will be in accordance with Standard Methods of the Examination of Water and Wastewater. Samples shall show the absence of coliform organisms and the presence of a chlorine residual. Samples shall also be tested for turbidity, pH, and standard heterotrophic plate count (HPC). HPC levels must be consistent with levels normally found in the distribution system to which the new main will be connected.

C. Bacteriological tests of all samples must show complete absence of coliforms and acceptable HPCs. If tests show the presence of coliform or unacceptable HPCs, perform additional flushing and disinfection of the pipeline until acceptable tests are obtained, all at no cost to the Owner. Contractor will not be charged for the additional testing performed by the Owner but may be charged for any additional water used in accordance with Section 01500.

3.06 TESTING SOURCE WATER

A. At the time of initial flushing of the new main to remove material and test for air pockets, Contractor may, at its discretion, use the sampling tap installed near the feed point (i.e. within ten (10) feet of the beginning of the new main) to verify that the source water entering the new pipeline from the existing system contains a chlorine residual. This action will provide the Contractor assurance that the source water is chlorinated.

B. If the subsequent tests for bacteriological contamination conducted by the Contractor fail, the Contractor may again, at its discretion, use the same sampling tap installed near the feed point to verify that the source water entering the new pipeline from the existing system contains a chlorine residual. This action will provide the Contractor assurance that the source water is chlorinated for subsequent tests.

3.07 REMOVAL OF TEMPORARY TAPS

A. Upon successful completion of all flushing, testing, and disinfection, the Contractor shall remove temporary sampling taps and blow-off assemblies, including corporation stops, and plug the taps with brass plugs in accordance with Sections 15185 and 15190, and as approved by the Resident Project Representative. Any taps to remain permanently shall be completed in accordance with Section 15190.

END OF SECTION

SECTION 15025

FLUSHING AND CLEANING PIPELINES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to complete the following as specified for the piping, valves, and appurtenances installed under these Contract Documents as specified in this section.

B. Flush the pipelines to remove all particulate matter and air.

C. Clean the pipelines using foam pigs, swabs, or "go-devils", as described herein, whenever the specified flushing velocity cannot be achieved and/or normal flushing will not sufficiently remove dirt and debris that was introduced during construction.

D. Flushing and cleaning required by this section shall be completed prior to testing and disinfecting of the pipeline, except as modified when the slug method of disinfection is approved and followed.

E. Contractor shall identify appropriate disposal locations for flushed water and secure all required approvals and permits. All disposal locations shall be authorized by the appropriate stormwater governance authority. Contractor assumes all responsibility for any permit violations, erosion, flooding, fish kills, and other damage or injury resulting from flushing activities.

1.02 GENERAL REQUIREMENTS

A. New pipeline shall be connected to existing in-service water main at one end only in order to allow sufficient water flow rate to be introduced for successful completion of all required flushing, testing and disinfection. A new line valve (gate or butterfly) shall be installed at this connection point to isolate the new main from the existing water main during pressure testing and disinfection, unless otherwise authorized in writing by the Owner. At each other proposed connection to existing water main(s), Contractor shall provide a temporary plug or cap at the end of the new water main with adequate restraint and/or blocking to allow all flushing, testing, and disinfection to be completed prior to final connections to the existing main(s). Contractor shall also provide adequate temporary air release, blow-off assemblies, and sampling taps to accommodate filling, flushing, and disinfecting the pipeline(s) in accordance with Section 15190. Contractor shall take all possible precautions to prevent backflow into the existing water main during construction, filling, flushing, testing, and disinfection.

B. Flushing is no substitute for preventive measures during construction. Normal pipeline flushing is often inadequate to remove all the entrapped air, loose debris, and certain other contaminants, such as caked deposits, which resist flushing at

any feasible velocity. Contractor shall adhere to the requirements of Section 15000 to prevent contamination of the pipeline. In no case shall any objects be left in the main during installation.

C. In cases where, in the opinion of the Engineer, normal pipeline flushing is unable to remove all entrapped air and debris, Contractor shall use polyurethane foam pigs and/or polyurethane hard foam swabs to remove all foreign matter from the pipeline (i.e. "pig" the pipeline).

1.03 WORK BY OWNER

A. Owner will furnish water for testing and flushing, and disinfecting pipelines in accordance with Section 01500 up to ten (10) times the volume of the new pipeline(s). If additional water is needed, then the Owner will furnish the water and may charge the Contractor for the additional water as specified in Section 01500.

1.04 COORDINATION OF WORK

A. Coordinate with Engineer and Owner before flushing to ensure that an adequate volume of flushing water is available at sufficiently high pressure (to maintain at least 40 psi residual pressure unless otherwise approved by the water supply system's owner) and to determine any applicable time constraints or other special requirements. Owner may require flushing only during low demand hours and/or when the distribution system tower is above an allowable minimum level. Determine if the water can be disposed of safely and arrange disposal location(s) for chlorinated water per Section 15020. Notify the Owner, Engineer, Resident Project Representative, and the following prior to flushing or cleaning:

1. Local fire department
2. Other utilities, such as gas, electric and telephone companies, who may have underground facilities in the area.
3. Local storm sewer and sanitary sewer departments.
4. Customers who may be inconvenienced by reduced pressure or dirty water. Contractor shall coordinate with the Owner and Engineer to identify customers requiring notification.
5. Property owners where water will be disposed of to location(s) other than a sanitary sewer.

B. Coordinate with Owner, who shall operate any valves and/or hydrants on the operating distribution system. Close valves and hydrants sufficiently-slowly to prevent water hammer. Open each fire hydrant and blow-off valve slowly until the desired flow rate is obtained. When flushing from a dry barrel fire hydrant, open the hydrant valve fully to prevent water from escaping into the ground through the fire hydrant barrel drain and use the gate valve upstream of the hydrant for throttling purposes.

C. Contractor shall contact the local storm sewer and/or sanitary sewer department to obtain permission and coordinate disposal of water. Chlorinated water shall be discharged to a sanitary sewer system if available, if adequate capacity exists, and if approved by the sewer department. If an authorized sanitary sewer disposal location is not available, Contractor shall secure an authorized alternative disposal site(s).

D. Alternative disposal site(s) shall be a storm sewer system if available, if adequate capacity exists and if approved by the appropriate stormwater governance authority). Otherwise, alternative disposal site(s) shall be an adequately-sized waterway that is authorized by the appropriate stormwater governance authority and the property owner. In the event that no authorized discharge location with adequate capacity can be identified, Contractor shall obtain authorizations and construct a temporary ponding area of adequate size to detain the flushed water until it can be discharged to an authorized sewer or waterway or until it evaporates and percolates into the soil.

E. Any alternative disposal sites on private property or that are tributary to a private lake or pond or livestock water source shall also be approved in writing by the property owner(s). Contractor shall obtain permission and coordinate with affected property owners for disposal of all water discharged from water mains.

F. Contractor shall secure all approvals as required in this section and in Section 15020.

G. Coordinate flushing and cleaning activities with disinfection activities and comply with Section 15020.

1.05 PROTECTION DURING FLUSHING AND CLEANING

A. Protect the work staff and the public during operation of hydrants and valves. Keep children away from the flow of flushing water.

B. When needed to avoid damage to property (including soil erosion) and the flooding of streets or buildings, employ energy dissipators.

C. If flushed water is discharged into a sanitary or storm sewer, provide adequate barricades and warning devices around any open manhole lids or other safety hazards.

D. Proper dechlorination and disposal of flush water is the responsibility of the Contractor. All water with chlorine residual higher than 0.01 ppm (mg/L) shall be disposed of as required in Section 15020.

E. These safety considerations also apply to main cleaning, flushing, and disinfection activities specified in Section 15020. See General Conditions Article 6.

1.06 SUBMITTALS

Contractor shall submit the following in accordance with Section 01300:

A. Contractor shall submit the proposed temporary connection (when required) between existing water main and new pipeline for filling, flushing, and disinfection, including cut sheets for the proposed backflow preventer. The method to be used and backflow preventer must be approved by the Owner prior to filling the pipeline.

B. Before performing any cleaning activities, Contractor shall submit to the Engineer a proposed cleaning plan as required herein and cut sheets for any swabs and/or pigs proposed to be used.

C. Contractor shall submit copies of all written approvals obtained for disposal of flushed water.

1.07 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 15000 Piping – General Provisions (including construction methods to avoid contamination)

G. Section 15020 Disinfecting Pipelines

H. Section 15030 Pressure and Leakage Tests

I. Section 15170 Tapping Sleeves, Saddles and Valves

J. Section 15180 Fire Hydrants

K. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps

L. Section 15200 Service Lines

1.08 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other

standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. AWWA C651 Standard for Disinfecting Water Mains

B. ANSI/AWWA C655 Field Dechlorination

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

Provide the foam cleaning plugs (swabs or pigs) and other equipment as needed to clean pipelines as required and approved by the Engineer. Do not use pipe cleaning plugs which utilize bristles, wire brushes, carbide abrasives, steel studs, or any other type abrasive unless specifically approved by the Engineer in writing. Consult a manufacturer of pipe cleaning plugs, such as Knapp Polly Pig (Houston, Texas), to determine the type and size of cleaning plug best suited for the application. Two types of plugs may be considered and are described as follows:

A. Swabs:

1. Swabs used for cleaning mains shall be made of polyurethane foam. This foam has a density of 1 to 2 pounds per cubic feet. Swabs shall be purchased from commercial manufacturers of swabs for pipes. Both soft and hard grade foam swabs are available. New mains are typically cleaned with hard foam swabs.
2. Use swabs cut into cubes and cylinders slightly larger than the size of the pipe to be cleaned (typically up to one inch larger in width/diameter for pipe up to 12 inches diameter or up to 3 inches larger for pipe larger than 12 inches diameter). The swab width/diameter must be considered individually for each operation. Length of swabs shall be coordinated with the manufacturer. The Contractor is solely responsible for determining swab sizing and any consequences of using an inappropriately-sized swab.

B. Pigs

1. Alternatives such asa cleaning plug are available and are commonly referred to as a pig. Pipeline pigs, if used, shall be commercially manufactured for the specific purpose of cleaning pipes. They shall be made of polyurethane foam weighing 2 to 15 lb./cu.ft. Cleaning pigs are bullet shaped and come in various grades of flexibility and roughness. Cleaning pigs shall be sized for the specific pipe inside diameter and are typically 1/4 -inch to 1/2-inch larger in diameter than the pipe to be cleaned. The Contractor is solely responsible for ensuring that correctly-sized pigs are used and any consequences of using an inappropriately-sized cleaning pig.

PART 3: EXECUTION

3.01 FILLING AND FLUSHING

A. Prior to pressure and leakage testing or chlorination, Contractor shall fill the main to eliminate air pockets and flush the water main to remove particulates. Slowly fill each segregated section of pipeline with water at a velocity of approximately 1 foot per second ensuring that all air is expelled. Extreme care must be taken to ensure that all air is expelled from the pipeline during the filling of pipe prior to testing or disinfection.

B. The flushing velocity in the main shall be not less than 3.0 fps, unless insufficient water supply is available and/or, in the opinion of the Engineer, conditions do not permit the required flow to be discharged to waste. Unless otherwise approved by the Engineer, the required velocity must be achieved throughout the entire length of the pipeline, which may require installation of temporary taps or hydrant(s) at the end of the main. Table 1 shows the rates of flow required to produce a velocity of 3.0 fps in ductile iron pipes of various sizes up to 16-inch diameter. In mains of 24-inches or larger diameter, the main shall be broom-swept, carefully removing all sweepings prior to chlorinating the main. After sweeping, pipeline shall still be flushed at the flow rate indicated in Table 1. For other pipe materials and sizes, Contractor shall confirm required flushing rate to achieve 3.0 fps velocity with the Engineer.

C. Table 2 indicates the flow that can be achieved through each tap or 2½ inch hydrant outlet at 40 psi residual pressure. These should be used only as a guideline. The Contractor is responsible for determining the number of taps and/or hydrants that are needed to achieve the required flushing velocity and providing acceptable assurances to the Engineer that the required velocity is achieved.

TABLE 1
Required Flow to Flush Pipelines

Pipe Diameter (inches)	Flow required to produce 3.0 fps velocity in main (gpm)
2	30
3	90
4	120
6	260
8	470
10	730
12	1,060
16	1,880
20	3,200
24	4,600
30	7,100
36	10,200

1. This table is based on friction losses of ductile iron pipe. For PVC and HDPE, slightly lower flow rates will achieve the required velocity.
2. In mains of 24-inches or larger diameter, the main shall be broom-swept, carefully removing all sweepings prior to chlorinating the main. After sweeping, pipeline shall still be flushed at the indicated flow rate.

TABLE 2
Flow Produced Through Openings of Various Sizes

Opening Nominal Diameter (inches)	Flow (gpm)*
1 (open pipe)	40 †
1½ (open pipe)	80 †
2 (open pipe)	200 †
3 (open pipe)	300 †
4 (open pipe)	600 †
6 (open pipe)	2,100 †
8 (open pipe)	3,500 †
12 (open pipe)	7,000 †
2 (blow-off hydrant)	200
2½ (fire hydrant hose nozzle)	500
2-2½ (fire hydrant hose nozzles)	800
4½ (fire hydrant pumper nozzle)	1,200

* Based on 55 psi static pressure with a 40 psi residual pressure in the water main.

† Estimated allowable flowrates based on discharging through 5 feet of smooth, rigid pipe with two 90 degree elbows.

3.02 PRE-CLEANING PROCEDURES

A. Prepare a written cleaning plan for the Engineer's review,

B. Suggested pre-cleaning procedures include:

1. Identify mains to be cleaned on a map. Mark the location of the entry, water supply, exit points, any blow-offs to be used, valves to be closed, and the path of the swab or pig.
2. Under the Engineer's supervision and with Owner staff as required, inspect and operate all valves and hydrants to be used in the cleaning operation to ensure their correct operation and a tight shutdown.
3. Check location and type of hydrants, launch and exit location, and blow-offs to be used. Make blow-off tap connections, if necessary.
4. Determine the number and size of plugs to be used.

3.03 CLEANING PLUG INSTALLATION AND REMOVAL

A. Satisfactorily expose or install cleaning wyes, or other entry or exit points. Remove cleaning wye covers, etc., as required by the Engineer to insert the plug(s) into the pipeline(s).

B. If approved by the Engineer, stripped fire hydrants, air valves and blow-offs may serve as entry and exit points for smaller sized mains. The Engineer will examine these appurtenances and the connecting laterals to ensure that adequate openings exist through which a plug may be launched.

   1. If these appurtenances are used, a special launcher is required to ease the insertion and launching of the plug. If available, a pressurized water source such as a fire hydrant can be used to launch the plug. If water from the system is not available nearby, use a water truck with pump.

   2. If hydrants are used as entry and/or exit points, remove the internal mechanisms and plug the drains under the supervision of the Engineer. Insert the plug and replace the cap with a special flange with a 2-1/2-inch fitting. Connect the 2-1/2-inch fitting, with a pressure gauge and valve, to a pressurized water source. After closing the last valve isolating the section to be cleaned, open the hydrant supply valve. Propel the swab or pig into the main by opening the exit valve.

C. In mains greater than 8-inches nominal diameter, wyes shall be used at the entry and exit points. Fabricate the wye section one size larger than the main to ease the insertion and extraction of the plug. The use of wyes, as with the previously mentioned appurtenances, requires an outside source of pressurized water for launching. Cap the wye with a flange with a 2 to 6 inch fitting for connecting to the pressurized water source.

D. Many pigs are harder to insert into a pipe since they are less flexible than swabs. Other methods acceptable to insert pigs include:

   1. Winching with a double sling,

   2. Winching with a rope attached to the pig,

   3. Compression with a banding machine prior to insertion, and

   4. The use of a specially designed tapered steel pipe which is removed after use.

E. During swab or pig installation, leave as much water as possible in the main to be cleaned. The water suspends the material being removed from the pipe and minimizes the chance of the material forming a solid plug. Water in the pipe also keeps the swab or pig from traveling through the pipe at excessive rates. If swabs or pigs travel too fast, they will remove less material and wear more rapidly.

F. At the exit point or blow-off, install a wye long enough to house the swab or pig. Attach temporary piping to the end cap to allow the drainage of the water.

G. Take precautions to prevent backflow of purged water into the main when the cleaning plug exits through a dead end main. This can be accomplished by installing mechanical joint bends and pipe joints to provide a riser out of the trench. Additional excavation of the trench may serve the same purpose.

3.04 CLEANING PROCEDURE

Clean the pipeline using the following procedures and the Contractor's cleaning plan, as approved by the Engineer.

A. Swab Cleaning Procedures:

1. Open the water supply upstream of the swab. Throttle the flow in the main at the discharge (plug exit) point so that the swab passes through the main at a speed of 2 to 4 fps. (At this velocity, swabs will effectively clean pipes for distances of up to 4,000 feet before disintegrating to a size smaller than the main.) Use pitot gauges at the existing hydrant or blow-off to estimate the flow rate in the pipeline.
2. Note the time of entry of the swab into the main and estimate its time of exit. If the swab does not reach the exit point in 1.5 times the estimated time, then a blockage has probably occurred. Reverse the flow in the main, and note the time required for the swab to reach the original entry point. From the return travel time, estimate the location of the blockage. The Engineer may require the use of a swab containing a transmitter to accurately locate the blockage.
3. Swab repeatedly as needed. Stop swabbing when the water behind the swab emerging at the exit clears up within one minute. Ensure that all swabs inserted into the main are recovered and accounted for.
4. After the last swab has been recovered, flush the main to remove swab particles. This may require up to an hour of flushing.

B. Pig Cleaning Procedures:

1. Remove all air valves along the line. Ensure that each isolating valve to the air valve is completely closed. Operate system to prevent undesired buildup of air while air valves are out of service.
2. If the pig is inserted directly into the main, set it in motion by opening the temporary valved connection to the existing main and a downstream fire hydrant or blow-off valve (usually the valve on the capped end at the exit point). If the pig is launched from a wye, fire hydrant, or other appurtenance, use an external pressurized water source to inject the pig into the main as described in Paragraph 3.03 before using the temporary valved connection to the existing main to set it in motion.
3. Once the pig is launched, control its speed by throttling the discharge at a downstream fire hydrant or blow-off. Operate pigs at the typical speed of 1 ft./sec. This slow speed will help prevent pressure surges when the pig passes through undersized valves, enters smaller pipes, or turns through tees or crosses. Speeds of up to 2 ft./sec. can be used on straight runs with no restrictions or sharp turns.
4. Make sufficient passes of the pig to obtain thorough cleaning. Two pigs may be used in tandem to save time and water. Sufficient cleaning is established when the water discharging after the pig becomes clear within one minute.
5. Ensure that all pigs inserted into the main are recovered and accounted for.

3.05 POST CLEANING PROCEDURE

A. After successful cleaning; test, flush, and disinfect the main in accordance with requirements of this section and Sections 15020 and 15030.

3.06 DISPOSAL OF WATER

A. Discharge of any and all water from the water main for any purpose shall be in conformance with Section 15020 and this section. All water discharged from the water main for any purpose (including during cleaning, flushing, testing, and disinfection procedures) shall be discharged to either an approved sanitary sewer system or an alternative disposal site(s) authorized by the appropriate stormwater governance authority. Any alternative disposal sites on private property or that are tributary to a private lake or pond or livestock water source shall also be approved in writing by the property owner(s).

B. Dechlorinate discharged water in conformance with Section 15020. Under no conditions may highly-chlorinated or low-chlorinated water be disposed of to any location other than an approved sanitary sewer system without dechlorination as required by Section 15020.

END OF SECTION

SECTION 15030

PRESSURE AND LEAKAGE TESTS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Work under this section consists of providing all labor, materials, tools, equipment, and services required to test all piping, valves, and appurtenances installed under these Contract Documents as specified in this section.

B. Contractor shall provide the pump, pipe connections, and all necessary apparatus for the pressure and leakage tests including gauges and metering devices and all other required components. However, the Owner reserves the option to furnish the gauges and metering devices for the tests.

1.02 COORDINATION OF WORK

Contractor shall coordinate witnessing of the pressure testing procedure with the Resident Project Representative a minimum of two (2) full working days prior to the pressure testing.

1.03 SUBMITTALS

Contractor shall prepare and submit schedules and procedures to the Engineer for testing of all parts of the water main installed as part of the Work in accordance with Section 01300 and these Contract Documents. Submit the schedule at least seven days prior to any testing.

1.04 RELATED WORK

A. 01000 - Summary of Work

B. 01010 - Drawing Index

C. 01011 - Special Provisions

D. 01075 - Basis of Payment

E. 01300 - Submittals

F. 01500 - Temporary Facilities

G. 02540 - Erosion and Sedimentation Control

H. Section 15000 Piping – General Provisions

I. Section 15020 Disinfecting Pipelines

J. Section 15025 Flushing and Cleaning Pipelines

K. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps

L. Section 15200 Service Lines

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

B. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

C. AWWA Manual M23 - PVC Pipe - Design and Installation

D. AWWA Manual M55 - PE Pipe Design and Installation

E. ASTM F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems using Hydrostatic Pressure

PART 2: PRODUCTS

2.01 EQUIPMENT

Positive displacement pump capable of exceeding the specified test pressure. Volumetrically calibrated container/reservoir to sufficiently determine the volume of water added throughout the pressure testing.

Liquid filled pressure gauges, 0 to 300 psi, 4-inch diameter face.

PART 3: EXECUTION

3.01 GENERAL

A. Under no circumstances shall pneumatic (air) testing of water mains be permitted. As described herein, extreme care shall be taken to ensure that all air is expelled from the pipeline prior to pressure testing.

B. Perform hydrostatic pressure and leak tests in accordance with AWWA C600 Section 5.2 - Hydrostatic Testing (ductile iron pipe), AWWA C605 Section 10.3 – Hydrostatic Testing (PVC pipe) or ASTM F2164 and AWWA Manual M55 (Leak Testing: Testing Inside the Trench) (HDPE pipe), after the pipe or section of pipe has been laid, concrete thrust blocking has cured a minimum of 5 days (unless high-early strength concrete is used and a shorter cure time is authorized by the Engineer), the trench is completely or partially backfilled, and flushing has been completed as required in Section 15025. When the slug method of chlorination is used as described in Section 15020, pressure and leakage testing shall be performed after chlorination. Pressure and leakage testing shall be performed prior to disinfection activities when all other methods of chlorination are used. Pressure testing of the new pipeline shall be performed fully isolated from the active distribution system unless otherwise approved by the Engineer and Owner.

C. The Contractor may, at his option, completely backfill the trench or partially backfill the trench over the center portion of each pipe section to be tested. However, the Engineer may direct the Contractor to completely backfill the trench if local conditions require. Also, portions of the pipeline designed and installed with restrained joints shall be backfilled to the design depth to prevent movement of the pipe during pressurization of the pipeline.

D. Perform the hydrostatic test at a pressure of no less than 1.25 times the stated operating pressure of the pipeline measured at the highest elevation along the test section and not less than 1.5 times the stated operating pressure at the lowest elevation of the test section without exceeding the thrust restraint design pressures or 1.5 times the manufacturer’s specified pressure rating of the pipe (1.5 times the standard pressure class for HDPE pipe), joints, or appurtenances, whichever is less. In no case shall the test pressure at any point in the tested portion of the pipeline be less than 150 psi. Test pipeline in shorter sections if necessary to meet all these criteria.

E. The test pressure shall not exceed the rated working pressure or differential pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

F. A test pressure greater than the rated valve working pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests exceeding the rated valve working pressure, the test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve working pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or the valve can be fully opened if approved in writing by the Engineer.

G. Valves shall not be operated in either direction at a differential pressure exceeding the valve’s rated working pressure or differential pressure.

H. Prior to hydrostatic pressure testing specified herein, Contractor shall make each valve tight under its working pressure. Any defective parts shall be replaced at the Contractor's expense.

I. When installing a tapping sleeve and valve assembly to the main, pressure test the assembly prior to making the tap. The required test pressure shall be determined in the same manner as for pipe. The pressure test is acceptable if there is zero pressure drop in 15 minutes at test pressure.

3.02 TESTING (DUCTILE IRON AND PVC)

A. Prior to pressure and leakage testing or chlorination, Contractor shall fill the main to eliminate air pockets. Slowly fill each segregated section of pipeline with water at a velocity of approximately 1 foot per second ensuring that all air is expelled. Extreme care must be taken to ensure that all air is expelled from the pipeline during the filling of pipe prior to pressure testing. The line shall stand full of water for at least twenty-four hours after initial filling prior to testing to allow all air to escape and to saturate the cement mortar lining of any ductile iron pipe used. If necessary, tap the main at points of highest elevation in accordance with the requirements of Section 15190 to expel air as the pipe is filled.

B. Apply the specified test pressure using a pump connected to the pipe in a manner satisfactory to the Engineer. The hydrostatic test shall be of at least a two hours duration, during which the test pressure shall not vary by more than ± 5 psi. Test pressure shall be maintained within this tolerance by adding makeup water into the pipeline through the pressure pump as necessary. The amount of makeup water added shall be accurately measured (in gallons per hour) using a calibrated container or meter.

C. Leakage is defined as the maximum hourly volume of makeup water that must be added into the pipeline during the hydrostatic test to maintain pressure within ± 5 psi of the required test pressure throughout the test duration (after it is filled and purged of air).

D. No pipeline installation will be accepted if the leakage is greater than that shown in the following table or as allowed by Equation 1 in AWWA C600 5.2.1.4 (also AWWA C605 10.3.6).

Allowable Leakage per 1000 ft. of Pipeline*---gallons / hour

	Nominal Pipe Diameter - inches										
Avg. Test Pressure (psi)	4	6	8	12	16	20	24	30	36	42	48
100	0.27	0.41	0.54	0.81	1.08	1.35	1.62	2.03	2.43	2.84	3.24
125	0.30	0.45	0.60	0.91	1.21	1.51	1.81	2.27	2.72	3.17	3.63
150	0.33	0.50	0.66	0.99	1.32	1.66	1.99	2.48	2.98	3.48	3.97
175	0.36	0.54	0.72	1.07	1.43	1.79	2.15	2.68	3.22	3.75	4.29
200	0.38	0.57	0.76	1.15	1.53	1.91	2.29	2.87	3.44	4.01	4.59
225	0.41	0.61	0.81	1.22	1.62	2.03	2.43	3.04	3.65	4.26	4.86
250	0.43	0.64	0.85	1.28	1.71	2.14	2.56	3.21	3.85	4.49	5.13
275	0.45	0.67	0.90	1.34	1.79	2.24	2.69	3.36	4.03	4.71	5.38
300	0.47	0.70	0.94	1.40	1.87	2.34	2.81	3.51	4.21	4.92	5.62

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size. The table has been generated from the formula: $L = (S*D*P^{1/2} / 148{,}000)$ where L is the allowable leakage in gallons per hour, S is the length of pipe in feet, D is the nominal pipe diameter in inches, and P is the test pressure in psig.

E. All exposed pipe, fittings, valves, hydrants, and other appurtenances shall be carefully examined during the pressure test. Should any test disclose damaged or defective materials (pipe, fittings, valves, hydrants, other appurtenances, or joints), visible leaks, or leakage greater than that permitted, the Contractor shall, at Contractor's expense, locate and correct the problem to the satisfaction of the Engineer. All visible leaks shall be properly repaired by the Contractor. Contractor shall replace any damaged or defective materials with new materials in compliance with the Specifications, except that, if approved in writing by the Engineer and manufacturer, repairs may be made by approved methods. Materials used for repairs must be approved by the Engineer and comply with the Specifications.

F. Repeat the pressure and leakage testing until no visible leaks occur and the leakage is within the permitted allowance to the satisfaction of the Engineer.

3.03 TESTING (HDPE)

A. Prior to pressure and leakage testing or chlorination, Contractor shall fill the main to eliminate air pockets. Slowly fill each segregated section of pipeline with water at a velocity of approximately 1 foot per second ensuring that all air is expelled. Extreme care must be taken to ensure that all air is expelled from the pipeline during the filling of pipe prior to pressure testing. The line shall stand full of water for at least twenty-four hours after initial filling prior to testing to allow all air to escape stabilize the temperature. If necessary, tap the main at points of highest elevation in accordance with the requirements of Section 15190 to expel air as the pipe is filled.

B. When the test section is completely filled, purged of air, and stabilized, gradually increase the pressure in the test section to the required test pressure. If the test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, there may be faults such as excessive leakage, entrapped air, or open valving, or the pressurizing equipment may be inadequate for the size of the test section. If such faults exist, discontinue pressurizing, and correct them before continuing.

C. Add make-up water as necessary to maintain maximum test pressure for four (4) hours.

D. Test Phase: Reduce the pressure by 10 psi and monitor pressure for one (1) hour. Do not increase pressure or add make-up water.

E. If no visual leakage is observed, and pressure during the test phase remains steady (within 5% of the test phase pressure) for the one hour test phase period, a passing test is indicated.

F. If retesting is necessary, depressurize the test section before attempting to correct any faults or leaks. The test section must be allowed to “relax” for at least eight (8) hours prior to re-pressurizing.

G. Under no circumstances shall HDPE pipe be pressure tested when the temperature of the pipe is above 80 degrees F.

H. When pre-chlorination is proposed for HDPE pipe to be installed by pipe bursting method, Contractor shall comply with the additional requirements and procedures specified in Section 02350, which shall supersede any conflicting requirements specified in this section. Nonetheless, this section shall apply in its entirety where not in conflict with Section 02350.

END OF SECTION

SECTION 15105

DUCTILE IRON PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE OF WORK

The work under this section consists of providing all labor, materials, tools, equipment, and services required to install and test all ductile iron (DI) pipe and fittings (4 inch through 48 inch nominal diameter) for water distribution and transmission as indicated on the Drawings and as specified within this section and related sections of the Specification. Contractor shall furnish and install all required pipe restraint components and other related components that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

1.02 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, and certifications for all products furnished under this section in accordance with Section 01300.

B. Required certifications include those specified under Quality Assurance below.

1.03 QUALITY ASSURANCE

A. Ductile iron pipe and fittings shall meet the minimum quality requirements by conforming to the below-referenced AWWA/ANSI standards as modified herein. Ductile iron pipe and fittings will be accepted on the basis of the Manufacturer’s certification that the materials conform to this section.

B. The certification for ductile iron fittings shall list a fitting description, quantity, bare fitting weight, source, and applicable AWWA standard (C110 or C153). The certification shall accompany each delivery of the material to the project site.

C. Owner reserves the right to sample and test these materials subsequent to delivery at the project site.

D. Bolt manufacturer’s certification of compliance must accompany each shipment.

E. If foreign-manufactured fittings are furnished, Contractor shall notify the Engineer in the Shop Drawing submittal and provide the necessary documentation to satisfy the Engineer and the Owner that the materials furnished meet the specified AWWA standards and, among other documentation that may be required, provide certificates of compliance on the components supplied.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 02558 Identification/Location Guide

H. Section 15000 Piping - General Provisions

I. Section 15020 Disinfecting Pipelines

J. Section 15025 Flushing and Cleaning Pipelines

K. Section 15030 Pressure and Leakage Tests

L. Section 15130 Piping Specialties

M. Section 15150 Gate Valves

N. Section 15155 Butterfly Valves

O. Section 15170 Tapping Sleeves, Saddles, and Valves

P. Section 15180 Fire Hydrants

Q. Section 15185 Abandonment of Mains and Hydrants

R. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps

S. Section 15200 Service Lines

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASME / ANSI B1.1 - Unified Inch Screw Threads

B. ASME / ANSI B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300

C. ASME / ANSI B18.2 - Square and Hex Bolts and Screws (Inch Series)

D. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength

E. ASTM A536 – Standard Specification for Ductile Iron Castings

F. AWWA C104 / ANSI A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

G. AWWA C105 / ANSI A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems

H. AWWA C110 / ANSI A21.10 - Ductile-Iron and Gray-Iron Fittings

I. AWWA C111 / ANSI A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

J. AWWA C115 / ANSI A21.15 - Flanged Ductile-Iron Pipe with Threaded Flanges

K. AWWA C116 / ANSI A21.16 - Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

L. AWWA C150 / ANSI A21.50 - Thickness Design of Ductile-Iron Pipe

M. AWWA C151 / ANSI A21.51 - Ductile-Iron Pipe, Centrifugally Cast

N. AWWA C153 / ANSI A21.53 - Ductile-Iron Compact Fittings

O. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

P. NSF/ANSI 61 Drinking Water System Components – Health Effects

PART 2: PRODUCTS

2.01 GENERAL

A. No foreign-manufactured pipe or appurtenances, except for ductile iron fittings, shall be allowed. All pipe and restraints shall be produced solely in the United States.

B. All materials that come in contact with potable water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

2.02 DUCTILE IRON PIPE

A. Ductile iron pipe shall conform to the latest specifications as adopted by the American National Standards Institute, Inc., (ANSI) and the American Water Works Association (AWWA). Specifically, ductile iron pipe shall conform to AWWA C151 in standard supplied sizes, except as modified herein. Pipe shall be supplied in 18 or 20 foot nominal lengths or as required to meet the requirements of the Drawings.

B. The pipe exterior shall be coated with an asphaltic coating in accordance with AWWA C151. The pipe interior shall be cement mortar lined and asphaltic seal coated in compliance with the latest revision of AWWA C104.

C. Pipe Class: Pipe wall thickness shall be the required thickness class based on the design conditions in accordance with AWWA C150. The thickness class of pipe to be furnished shall be as required on the Drawings and/or as specified in Section 01011 but shall not be less than recommended by the pipe manufacturer or less than the minimum requirements indicated in Table 1.

Table 1

MINIMUM RATED WORKING PRESSURE FOR DUCTILE IRON PIPE MANUFACTURED IN ACCORDANCE WITH AWWA STANDARD C151

Pipe Nominal Size (Inches)	Thickness Class
12 and smaller	52 (See Note 2)
16 – 20	54
24 and larger	54

Note:

1. The noted thickness class is adequate to support 3/4 and 1-inch corporation stops by direct tapping. Provide a full tapping sleeve or saddle in accordance with Section 15170 and/or 15200 (as appropriate) for taps larger than 1-inch due to limited wall thickness.
2. 12-inch and smaller pipe: Engineer to determine Thickness Class increase to Thickness Class 54 to meet critical parameters due to operating pressures greater than 100 psi, high system criticality, high consequence of failure and accessibility for repair of the pipe.

D. Plain ends shall be suitably beveled to permit easy entry into the bell and shall have home marks to indicate when the spigot it fully seated in the bell.

E. All non-restrained joints for pipe to pipe connections shall be standard push-on joints recommended by the pipe manufacturer and conforming to AWWA C151 and C111. Mechanical joints are not allowed for pipe to pipe connections. Push-on joints shall be of a type which employs a single elongated groove gasket to effect the joint seal.

F. Restrained Joint Pipe (12-inch and smaller): Unless otherwise indicated on the Drawings or in Section 01011 or furnished by the Owner, restrained joints for

pipe to pipe connections 12-inch nominal size and smaller shall use push-on restraining gaskets with integral stainless steel locking segments recommended by the pipe manufacturer and conforming to AWWA C111. Restraint system shall be UL-listed and rated for a working pressure of 350 psi. Restraining gaskets shall not be used on connections to valves or fittings or for connections to pipe materials other than ductile iron (e.g. gray cast iron). If required by the Drawings or Section 01011 and/or if furnished by the Owner, restrained-joint pipe such as specified below for 16-inch and larger pipe shall be used for 12-inch and smaller piping.

G. Restrained Joint Pipe (16-inch and larger): Restrained joints for pipe to pipe connections (16-inch and larger) shall consist of factory-welded retainer bead or ring on the pipe spigot, and either factory manufactured bolted retainer rings, ductile iron locking segments held in place by rubber retainers, or ductile iron retaining rings that lock over the bell of the joint and are secured to prevent rotation. All components of the bolted or snap rings assemblies shall be constructed of corrosion-resistant, high-strength, low-allow steel and shall conform to AWWA C111 as applicable. Restrained joint pipe shall be U.S. Pipe TR Flex, Bolt-Lok, or HP LOK; Clow TR Flex or Super Lock; American Flex-Ring or Lok-Ring. Restrained system shall be suitable for the following minimum working pressures:

Size (Inch)	Pressure (psi)
12 and smaller	52(See Note 2, Table 1)
20	54
24	54
30 - 48	54

Gaskets utilizing integral locking segments such as Field Lok gaskets are not permitted for restraint of pipe 16-inch or larger. Restrained joint pipe per this article shall not be acceptable where ball and socket pipe is required by the Drawings, Section 01000, and/or Section 01011. Restrained joint ductile iron pipe installed by horizontal directional drill method shall also comply with Section 02458.

H. Ball and Socket Pipe:

Ball and socket pipe shall comply with AWWA C150 and C151 and shall be U.S. Pipe USIFLEX Boltless Flexible Joint Pipe, American Flex-Lok Ball Joint Pipe, McWane Ball and Socket Joint Pipe.

I. Flanged piping shall be Thickness Class 53 ductile iron unless otherwise required by the Drawings or Section 01011.

J. Acceptable ductile iron pipe manufacturers are:

1. United States Pipe & Foundry Co. (including Griffin Pipe)
2. McWane Family of Companies (Clow, Atlantic States, etc.)
3. American Cast Iron Pipe Company.

2.03 FITTINGS

A. Ductile Iron Fittings: Standard fittings shall be ductile iron conforming to AWWA C110. Compact ductile iron fittings shall meet the requirements of AWWA C153. Fittings shall be suitable for the following working pressures unless otherwise noted in AWWA C110 or C153. **No gray cast iron fittings are permitted.**

	Working Pressure Rating (psi)	
Size (inch)	MJ Fittings	Flanged Fittings
3 – 24	350	250
30 – 48	250	250

B. Coating and Lining: The fittings shall be coated on the outside with either asphaltic coating in accordance with AWWA C110 or fusion-bonded epoxy in accordance with AWWA C116, and the fittings shall be lined inside with either cement-mortar and asphaltic seal coating in accordance with AWWA C104 or fusion-bonded epoxy in accordance with AWWA C116.

C. All fittings shall have mechanical joint bell ends conforming to AWWA C111 unless otherwise shown on the Drawings. However, for pipe 16-inch and larger, fittings with restrained bell joints compatible with the restrained joint pipe used will be permitted when authorized by the Engineer or Owner.

D. Restrained MJ Joints (all sizes): Restrained joints shall be used for all connections to valves and fittings, and all such connections shall be restrained mechanical joint type using retainer glands as specified in Section 15130. However, when restrained joint pipe (with factory-welded retainer bead or ring on the pipe spigot) is used, fittings manufactured with restrained joints compatible with the restrained joint pipe may be used in lieu of fittings with restrained mechanical joints. Restraining gaskets with integral stainless steel locking segments (including MJ Field-Lok gaskets) are not permitted on valves or fittings.

E. Non-restrained mechanical and push-on joints are not allowed for connections to valves, hydrants, or fittings.

F. Acceptable ductile iron fittings manufacturers are:

1. Sigma through United States Pipe & Foundry Co. (domestic or foreign)
2. McWane Cast Iron Pipe Co. (Tyler Union domestic only)
3. Star Pipe Products (domestic or foreign)
4. Metalfit, through United States Pipe & Foundry Co. or American Cast Iron Pipe Company.

2.04 JOINTS – ADDITIONAL REQUIREMENTS

A. All gaskets for buried pipe and fittings shall be of styrene butadiene rubber (SBR), unless otherwise required by the Drawings, Section 01011, or as directed by the Engineer.

B. Anti-rotation T-bolts shall be used on mechanical joints, except where special bolts are supplied with the approved restraint device, and shall be of domestic origin meeting the current provisions of AWWA C111. T-bolts and nuts shall be high-strength, corrosion-resistant low-alloy steel with the characteristics listed in Table 6 of AWWA C111. T-bolts shall be Xylan or FluoroKote #1 (corrosion resistant).

C. Retainer glands of any style are not acceptable for pipe to pipe joints.

D. Anchor Couplings: Anchor couplings for anchoring the hydrant valve to pipeline tee's branch and for anchoring the hydrant to the valve shall consist of a plain end mechanical joint pipe with a rotating follower gland, retained by a welded ring, on one or both ends. Anchor couplings shall be installed for each hydrant branch and other locations where shown on the Drawings. Anchor couplings shall be manufactured from Thickness Class 53 ductile iron and shall meet the applicable requirements for both ductile iron pipe and fittings as specified in this section. Standard MJ gaskets as specified herein shall be used with anchor couplings.

E. Flanged: Flanged joints shall conform to AWWA C110 (for fittings) or AWWA C115 (for pipe) and also to ANSI B16.42 Class 150. Unless otherwise noted on the Drawings (including bridge crossings), all exposed ductile iron pipe and fittings shall have flanged joints. Flanged joints are not permitted in underground installations except where exposed within structures or if allowed for tapping sleeves, saddles, and valves as specified in Sections 15150 and/or 15170.

   1. Gaskets for all flanged joints shall be 1/8-inch thick, styrene butadiene rubber (SBR) or EPDM gaskets. Paper flange gaskets are not permitted.

   2. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. Bolts and nuts hall be threaded in accordance with ASME/ANSI B1.1, Unified Inch Screw Threads (UN and UNR Thread Form) class 2A external and class 2B internal. Material for bolts and nuts shall conform to ASTM A307, 60,000 psi tensile strength, Grade B, unless otherwise specified in Section 01011. Xylan or FluoroKote #1 hex bolts (corrosion resistant) shall be used on any buried flange bolts used with ductile or gray cast iron flanges.

   3. Each flange shall be fully compatible with its mating flange.

F. Connections to existing piping shall comply with Section 15000. When connecting to existing ductile iron pipe, connection shall be made either as described in this section or using couplings in accordance with Section 15130. A restrained mechanical joint solid sleeve as specified above for ductile iron fittings may be used to connect an existing plain spigot end to a new pipe plain spigot end. When connection is to be made to an existing pipe with a joint type not

allowed within this section, the existing pipe shall be cut to a plain spigot end unless otherwise approved by the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

Installation of ductile iron pipe and appurtenances shall be in full accordance with AWWA C600 except as modified herein. Contractor shall follow the provisions of Sections 02210 and 15000, other sections as applicable (including related sections listed in Part 1 above), and all manufacturers' recommendations, in addition to the following requirements:

A. All Joint Types:

Immediately prior to assembly, thoroughly clean the surfaces that the gasket will contact using a bacteria-free solution (bleach, potable water or NSF-61 compliant material).

B. Non-restrained Push-On Joints:

Insert the gasket into the groove in the bell. Apply a sufficient coating of manufacturer approved NSF-61 certified lubricant to the gasket and the spigot end of the pipe before assembling the joint in accordance with the manufacturer's requirements, AWWA C600, and other requirements of this section. The use of improper lubricants can damage gaskets, so ensure that only lubricants approved by the gasket manufacturer are used. Center the spigot end in the bell, and push home the spigot end. The maximum allowable deflection at the joints for push-on joint pipe shall be the lesser of manufacturer's recommendations or as described in the DIPRA Guideline, Installation Guide for Ductile Iron Pipe, as follows:

Size of Pipe	Deflection Angle	Maximum Deflection (18-ft Length)	Maximum Deflection (20-ft Length)
4" - 12"	5 degrees	19"	21"
14" - 42"	3 degrees	11"	12"
48" - 64"	3 degrees	N/A	12"

C. Restrained Push-On:

Assemble and install the restrained push-on joint with the pipes aligned in the same axis according to the manufacturer's recommendations. Use feeler gauge to check all joints installed with push-on restraining gaskets with integral stainless steel locking segments. Contractor shall not reuse restraining gaskets once a joint is disassembled. Check the retainer ring fastener where present. Unless otherwise directed by the manufacturer, joints shall not be deflected until the joint has been fully assembled and checked for proper assembly; deflection shall not exceed manufacturer's recommended allowances.

D. Restrained Mechanical Joints:

1. Use approved restrained joint device according to Section 15130. Slip the follower gland and gasket over the pipe plain end making sure that the small side of the gasket and lip of the gland face the bell socket. Insert the plain end into the bell socket. Push the gasket into position with fingers only, and seat gasket evenly. Slide gland into position, insert bolts, and tighten nuts by hand. Tighten MJ flange bolts alternately per manufacturer's recommendations to the manufacturer's recommended torque rating or, if not provided, to the following normal torques as specified in AWWA C111 Table A.1:

Bolt Size (inch)	Pipe Nominal Size (inches)	Range of Torque in Foot-Pounds
5/8	3	45 -60
3/4	4 – 24	75 – 90
1	30 – 36	100 – 120
1-1/4	42 – 48	120 - 150

2. Secure restrained joint device to pipe barrel in accordance with Section 15130 and the restraint device manufacturer's recommendations.

E. Ball and Socket Joints:

Assemble and install the ball and socket joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Check the retainer ring fastener.

F. Pipe Protection

1. Comply with requirements of Section 15000. Lift pipe in accordance with AWWA Standards C600 and manufacturer's recommendations, subject to the restrictions herein and in Section 15000.

2. Protect cement-mortar lining from damage during transportation (off- and on-site), preparation and installation. Transporting or lifting pipe by inserting lifting forks, chains, hooks, or any other device inside the pipe shall not be permitted. No exception shall be made during application of polyethylene encasement or any other time.

3. Protect asphaltic coating from damage during off- and on-site transportation, preparation and installation. Contractor shall not utilize metal chains, steel cable, etc. to lift or transport pipe. Transporting or lifting pipe using forks on construction equipment shall not be permitted unless the pipe is supported on pallets or lumber and lifted indirectly with the forks.

4. Protect pipe from damage from the jacking device (backhoe bucket, pipe jack, etc.) when assembling each pipe joint (i.e. "pushing home" every pipe). Wood or other suitable (non-metallic) material consistent with the pipe manufacturer's recommendations shall be used to push home the pipe.

END OF SECTION

SECTION 15120

POLYVINYL CHLORIDE (PVC) PIPE

PART 1: GENERAL

1.01 SCOPE OF WORK

The work under this section consists of providing all labor, materials, tools, equipment, and services required to install and test all polyvinyl chloride (PVC) pressure pipe (**4 inches through 12 inches nominal diameter only**) with ductile-iron-pipe-equivalent outside diameters for water distribution and transmission as indicated on the Drawings and as specified within this section and related sections of the Specifications. Contractor shall furnish and install all required pipe restraint components and other related components that are not furnished by the Owner. Refer to Sections 01000, 01011 and 01075 for materials to be furnished by the Owner.

1.02 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, and certifications for all products furnished under this section in accordance with Section 01300.

B. Required certifications include those specified under Quality Assurance below.

1.03 QUALITY ASSURANCE

A. PVC pipe shall meet the minimum quality requirements by conforming to the below-referenced AWWA/ANSI standards as modified herein. PVC pipe will be accepted on the basis of the Manufacturer's certification that the materials conform to this section.

B. The Owner reserves the right to sample and test these materials subsequent to delivery at the project site.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 02558 Identification/Location Guide

H. Section 15000 Piping - General Provisions

I. Section 15020 Disinfecting Pipelines

J. Section 15025 Flushing and Cleaning Pipelines

K. Section 15030 Pressure and Leakage Tests

L. Section 15105 Ductile Iron Pipe and Fittings

M. Section 15130 Piping Specialties

N. 15150 Gate Valves

O. Section 15170 Tapping Sleeves, Saddles, and Valves

P. Section 15180 Fire Hydrants

Q. Section 15185 Abandonment of Mains and Hydrants

R. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps

S. Section 15200 Service Lines

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASTM D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

B. ASTM D2122 - Determining Dimensions of Thermoplastic Pipe and Fittings

C. ASTM D2152 Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion

D. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

E. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

F. ASTM D2855 – Standard Practice for Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

G. ASTM F412 - Standard Terminology Relating to Plastic Piping Systems

H. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

I. ASTM F1668 - Standard Guide for Construction Procedures for Buried Plastic Pipe

J. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

K. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In., for Water Transmission and Distribution

L. AWWA Manual M23 -- PVC Pipe - Design and Installation

M. NSF/ANSI 14 Plastic Piping System Components and Related Materials

N. NSF/ANSI 61 Drinking Water System Components – Health Effects

O. Plastic Pipe Institute TR-2, PVC Range Composition Listing of Qualified Ingredients

PART 2: PRODUCTS

2.01 GENERAL

A. No foreign-manufactured pipe shall be allowed. All pipe and restraints shall be produced solely in the United States.

B. PVC pipe shall be used where shown on the Drawings, specified in Section 01075, listed in the Bid “Schedule of Prices” and Bid Tab, or where otherwise approved by the Engineer and Owner.

C. All materials that come in contact with potable water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

2.02 PIPE MATERIALS

A. All PVC pipe shall be PVC 1120 pressure pipe made from clean, virgin class 12454 PVC compound conforming to resin specification ASTM D1784 with outside diameter dimensions of cast iron pipe and shall conform to all applicable requirements of ASTM D1784 and D2241. The PVC compounds shall be treated or certified suitable for potable water products by the National Sanitation Foundation (NSF) Testing Laboratory (NSF Standard No. 61). All PVC pipe shall be blue in color.

B. PVC pipe 4 inch through 12 inch nominal size shall meet the requirements of AWWA C900. When AWWA C900 conflicts with the listed ASTM standards, the requirements of AWWA C900 shall prevail.

C. Pipe Class: All PVC pipe installed shall be DR 14 (305 psi Pressure Class per AWWA C900) unless otherwise indicated in this section, on the Drawings and/or in Section 01011. In no case shall PVC pipe with a wall thickness less than DR 14 be permitted. The pipe shall be capable of withstanding the overburden pressure determined by the depth of burial in field. When Certa-Lok™ restrained joint C900 PVC pipe is installed by horizontal directional drilling method, it shall be DR 14 (305 psi Pressure Class per AWWA C900) unless otherwise indicated on the Drawings or specified in Section 01011. PVC pipe pressure classes were increased in the latest revision of AWWA C900; however, American Water does not allow pipe in its system to be fully subject to the revised Pressure Class pressures in AWWA C900 latest revision. DR 14 shall not be subjected to working pressures exceeding 200 psi.

D. Minimum pipe stiffness (F/dY) at 5% deflection shall be as follows when tested in accordance with D2241:

1. DR 14 pipe: 914 psi for all sizes

E. The pipe shall be designed to pass a quick burst test pressure of 985 psi (DR 14 pipe) applied in 60 to 70 seconds when tested in accordance with ASTM D1599, as referenced in ASTM D2241.

F. Standard laying lengths shall be 20-feet (±1 inch). Random lengths of not more than 15% of the total footage of each size may be shipped in lieu of the standard lengths. Reruns of reclaimed material shall not be accepted.

G. The pipe shall have bell and spigot ends with push-on, O-ring rubber gasket, compression type joints conforming to the requirements of ASTM 2672. Elastomeric gaskets shall conform to the requirements of ASTM F477 for high-head (>50 ft.) applications in all respects.

H. Restrained Joint Pipe: Appropriate restraint shall be provided at all fittings and valves and at other locations as shown on the Drawings or required in Section 01011. PVC pipe-to-pipe joints shall be restrained using an external restraint harness as specified in Section 15130. Gaskets utilizing integral locking segments such as Field-Lok gaskets are not permitted for use with PVC pipe. Certa-Lok™ restrained joint C900 pipe may be used where restrained joint pipe is required, including horizontal directional drilling applications where allowed by Section 02458 and approved by the Engineer. Restrained joint PVC pipe shall utilize couplings with high-strength, flexible thermoplastic splines, which shall be inserted into mating, precision-machined full-circumferential grooves in the pipe and coupling to provide full 360-degree restraint with evenly distributed loading. Couplings shall be designed for use at or above the pressure class of the pipe and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall meet the zero leakage test requirements of ASTM D3139. The pipe, couplings, and locking splines shall be completely non-metallic

and interchangeable; and the complete restrained joint pipe system shall meet all requirements of AWWA C900. Restrained joint "sweeps" shall not be used.

I. Fittings

No PVC fittings (including "sweeps") shall be permitted. All fittings for PVC pipe 4" diameter and larger shall be mechanical joint ductile iron fittings connected to PVC pipe with mechanical joint restraint devices as specified in Section 15130, unless otherwise indicated on the Drawings. Concrete thrust blocks shall be installed where shown on the Drawings.

2.03 MANUFACTURERS

Acceptable PVC pipe manufacturers are:

A. JM Eagle, Inc.
5200 West Century Boulevard
Los Angeles, CA 90045
(800) 621-4404
www.jmeagle.com

B. North American Pipe Corporation
2801 Post Oak Blvd., Suite 600
Houston, TX 77056
(713) 840-7473
www.northamericanpipe.com

C. Diamond Plastics Corporation
1212 Johnstown Road
Grand Island, NE 68803
(800) PVC-PIPE
www.dpcpipe.com

D. Northern Pipe Products
1302 39th Street NW
Fargo, ND 58102
800-747-7655
www.northernpipe.com

E. Sanderson Pipe
875 International Boulevard
Clarksville, TN 37040
800-669-3553
www.sandersonpipe.com

F. Vulcan Plastics, a division of Consolidated Pipe & Supply Company Inc.
1205 Hilltop Parkway
Birmingham, AL 35204
800-467-7261
www.consolidatedpipe.com

PART 3: EXECUTION

3.01 PACKAGING, HANDLING AND STORAGE

A. The manufacturer shall ensure that the interior of all pipe is clean and install plastic cleanliness plugs in all pipes to keep the pipe interiors clean or cover adequately to prevent dust or truck exhaust from entering pipes.

B. Sections of pipe having been discovered with cuts or gouges in excess of 10% of the pipe wall thickness shall not be used.

C. Any section of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture is visible, shall be marked as rejected and removed at once from the work.

3.02 INSTALLATION

Except as modified herein, installation of PVC pipe shall be in full accordance with AWWA C605, AWWA Manual M23, and the Uni-Bell "Handbook of PVC Pipe Design and Construction." In the event of conflicting requirements or guidelines within these referenced publications, the requirements of AWWA C605 shall prevail. Contractor shall also follow the provisions of Sections 02210 and 15000, other sections as applicable, and all manufacturers' recommendations, in addition to the following requirements:

A. Assemble pipe using the following types of joints:

1. Gasketed bell joint – Integral with the pipe,
2. Gasketed coupling – A double gasketed coupling as specified in Section 15130, or
3. Restrained mechanical joint (for pipe to fitting and pipe to valve joints only) – As specified in Section 15105.
4. Restrained Joint: Coupling – Joints for restrained joint PVC pipe (Certa-Lok™) shall be as specified in Article 2.02 above.

B. Assemble push-on joints in accordance with the pipe manufacturer's recommendations. Assemble mechanical joints in accordance with the fitting and restraint manufacturers' recommendations.

C. Do not remove factory installed gaskets. Keep the joint free of dirt, sand, grit, grease or any foreign material. Apply NSF certified lubricant when assembling gasketed joints in accordance with the pipe manufacturer's requirements. The use of improper lubricants can damage gaskets.

D. Good pipe alignment is essential for proper joint assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint; that is, do not suspend the pipe and swing it into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the

proper depth of insertion, and Contractor shall use extreme caution to avoid over-inserting pipe into the bell.

E. Protect pipe from damage when assembling ("pushing home") pipe joints. Wood or other suitable (non-metallic) material consistent with the pipe manufacturer's recommendations shall be used as a cushion while pushing home the pipe. Avoid metal to plastic contact. Neither deflection of PVC pipe joints nor bending of PVC pipe are permitted. All angles shall be made with proper fittings.

F. PVC pipe shall not be installed with less than 3 feet of cover. DR 14 PVC pipe shall not be installed with more than 30 feet of cover.

G. Pressure testing of DR 14 PVC pipe shall not exceed 305 psi.

H. Only ductile iron fittings per specification 15105 may be used with PVC pipe. PVC fittings are not permitted. See detail drawings and Section 15130 for transitions between different pipe materials.

I. Research has documented that certain pipe materials (such as polyvinyl chloride, polyethylene, and polybutylene) and certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products specified in this section shall only be installed in soils that are free of both petroleum products and organic solvents. If during the course of pipeline installation, the Contractor identifies or suspects the presence of petroleum products or any unknown chemical substance in the native soil, Contractor shall stop installing pipe in the area of suspected contamination and notify the Engineer immediately. Contractor shall not resume installing piping in the area of suspected contamination until direction is provided by the Engineer.

J. Unless otherwise shown on the Drawings or indicated in Section 01011, PVC pipe shall not be installed at sites where frequent excavation can be anticipated in the vicinity of the pipe (including treatment plant and booster station sites), where the pipeline is laid on a river channel bottom, or with less than 3 feet of cover over the top of pipe. PVC pipe shall not be installed in any circumstance with less than 3 feet or more than 30 feet of cover over the crown of the pipe. Unless otherwise shown on the Drawings or approved in writing by the Engineer.

3.03 TAPPING

A. Use a tapping sleeve or saddle in accordance with Section 15170 and/or 15200 (as appropriate).

END OF SECTION

SECTION 15125

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to provide and test all high density polyethylene (HDPE) pressure pipe and fittings (4 inches through 48 inches nominal diameter) with ductile-iron-pipe-equivalent outside diameters for water distribution and transmission as indicated on the Drawings and as specified within this section and related sections of the Specifications. This section shall also apply to installation of HDPE water mains smaller than 4-inch diameter to the extent applicable (materials for HDPE pipe smaller than 4-inch diameter are specified in Section 15200). Contractor shall furnish and install all required pipe, pipe restraint components, and other related components. HDPE pipe will not be furnished by the Owner. Refer to Sections 01000, 01011 and 01075 for materials to be furnished by the Owner.

B. When water mains smaller than 4-inch diameter are required, high density polyethylene pipe in accordance with Section 15200 shall be used.

1.02 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, certifications and other required submittals for all products furnished under this section in accordance with Section 01300.

B. The following product data is required from the pipe manufacturer:

1. Pipe Size
2. Dimensionality
3. Pressure Class
4. Color
5. Recommended Minimum Bending Radius
6. Recommended Maximum Safe Pull Force (if pipe will be used for directional drilling, pipe bursting, or other trenchless installation method)
7. Certificate of compliance from the pipe manufacturer that the product pipe is in compliance with Project requirements.

C. Submit fusion method(s), quality control procedures, and documentation for fusion process.

D. Fusion Technicians Certifications: Submit required certifications, including those specified under Quality Assurance below and all proposed fusion technicians'

applicable certifications and qualifications. Fusion Technicians' Certifications shall have been completed within the past two years.

E. Submit verification by the pipe manufacturer that the Contractor has been trained in the proper method of handling, joining, and installing the new pipe (including installation by directional drilling and/or pipe bursting where applicable). Contractor shall have satisfactorily performed a minimum of five (5) equivalent projects throughout the past five years.

F. POST-CONSTRUCTION SUBMITTALS

A fusion technician's joint report of as-recorded data for every fusion joint performed on the project, including joints that were rejected, shall be provided by the Contractor and/or fusion provider and shall also be supplied to the pipe supplier or manufacturer promptly upon request. Specific requirements of the fusion technician's joint report shall include:

1. Pipe Size and Thickness
2. Machine Size
3. Fusion Technician Identification
4. Job Identification
5. Fusion Joint Number
6. Fusion, Heating, and Drag Pressure Settings
7. Heat Plate Temperature
8. Time Stamp
9. Heating and Cool Down Time of Fusion
10. Ambient Temperature.

1.03 QUALITY ASSURANCE

A. HDPE pipe and fittings shall meet the minimum quality requirements by conforming to the below-referenced AWWA/ANSI and ASTM standards as modified herein. HDPE pipe and fittings will be accepted on the basis of the Manufacturer's certification that the materials conform to this section.

B. The certification for HDPE fittings shall list a fitting description, quantity, bare fitting weight, source, and applicable AWWA standard (C906). The certification shall accompany each delivery of the material to the project site.

C. Owner and Engineer reserve the right to witness pipe manufacturing at the manufacturer's facility where the pipe to be provided for the Work will be produced. Owner and Engineer reserve the right to inspect, sample, and test these materials subsequent to delivery at the project site. Such inspections shall in no way relieve the manufacturer of the responsibilities to provide products that comply with the applicable standards and this section. Should the Engineer wish to witness the manufacture of specific pipes, the manufacturer shall provide the Engineer with adequate advance notice of when and where the production of

those specific pipes will take place. Approval of the products or tests is not implied by the Engineer's decision not to inspect the manufacturing, testing, or finished pipes.

D. HDPE pipe shall be fused only by certified fusion technicians, as documented by the pipe supplier or manufacturer, by the fusion machine manufacturer, or by other documentation acceptable to the Engineer. The fusion equipment operator shall be fully trained in the use of the respective equipment.

E. Owner and Engineer reserve the right to perform onsite card checks for fusion technicians' qualifications and to stop any fusion work being performed by personnel unable to promptly provide documentation of the required qualifications.

F. For HDPE installations 16-inch diameter and larger, Contractor shall, upon request by the Owner or Engineer, and at no additional cost to the Owner, arrange for the pipe manufacturer's field representative to be on-site during installation of HDPE to oversee the fabrication of five (5) butt fusion joints for each work crew installing this type of joint.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 02350 Pipe Bursting of Water Mains

H. Section 02458 Horizontal Directional Drilling (HDD)

I. Section 02558 Identification/Location Guide

J. Section 15000 Piping - General Provisions

K. Section 15020 Disinfecting Pipelines

L. Section 15025 Flushing and Cleaning Pipelines

M. Section 15030 Pressure and Leakage Tests

N. Section 15105 Ductile Iron Pipe and Fittings

O. Section 15130 Piping Specialties

P. Section 15150 Gate Valves

Q. Section 15155 Butterfly Valves

R. Section 15170 Tapping Sleeves, Saddles, and Valves

S. Section 15180 Fire Hydrants

T. Section 15185 Abandonment of Mains and Hydrants

U. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps

V. Section 15200 Service Lines

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASTM D638 - Standard Test Method for Tensile Properties of Plastics

B. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

C. ASTM: D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer

D. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique

E. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping

F. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

G. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

H. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

I. ASTM F412 - Standard Terminology Relating to Plastic Piping Systems

J. ASTM F714 - Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter

K. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing

L. ASTM F1473 - Standard Test Method for North Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins

M. ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

N. ASTM F1668 - Standard Guide for Construction Procedures for Buried Plastic Pipe

O. ASTM F2206 - Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock or Block Stock

P. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

Q. Plastic Pipe Institute TN 34 - Installation Guidelines For Electrofusion Couplings 14" and Larger

R. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks

S. AWWA Manual M55 - PE Pipe Design and Installation

T. Plastic Pipe Institute (PPI) "Handbook of Polyethylene Pipe"

U. PPI TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe

V. NSF/ANSI 14 Plastics Piping System Components and Related Materials

W. NSF/ANSI 61 Drinking Water System Components – Health Effects

X. NSF/ANSI 372 Drinking Water System Components – Lead Content

PART 2: PRODUCTS

2.01 GENERAL

A. No foreign-manufactured items provided under this section shall be allowed. All pipe, fittings, saddles, and other HDPE appurtenances shall be produced solely in the United States.

B. HDPE pipe shall be used where shown on the Drawings and may be used where approved by the Engineer. HDPE pipe shall be used both for pipe bursting

applications installed in accordance with Section 02350 and for horizontal directional drilling applications installed in accordance with Section 02458 unless otherwise shown on the Drawings, specified in Section 01011 or 01075, listed in the Schedule of Prices, or otherwise approved by the Engineer and Owner.

C. The nominal pipe diameter shall be as specified on the Contract Drawings. HDPE pipe sizes shall be nominal diameters of 4", 6", 8", 12", 16", 20", 24", 30", 36", 42", or 48" only with outside diameters conforming to ductile iron pipe sizes (DIPS). HDPE pipe size shall be selected to provide the required inside diameter, which may require pipe to be upsized, at the Engineer's direction, to the next size listed above when HDPE pipe is used in place of ductile iron or PVC pipe.

D. HDPE fittings shall not be used except for saddles, adapters and temporary caps as specified below. All other fittings shall be ductile iron.

E. All materials that come in contact with potable water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

2.02 HDPE PIPE AND FITTINGS

A. All HDPE pipe and fittings shall fully meet the requirements of AWWA C906 and shall be made from the same virgin resin meeting the requirements of the Plastic Pipe Institute (PPI) material designation PE 3408/3608 or PE 4710 (where PE 4710 is required on the Drawings, in Section 01011, and/or in Section 01075, PE 3408/3608 shall not be permitted) with an ATSM D3350 minimum cell classification of PE 345464C. A higher number cell classification limit which gives a desirable higher primary property per ASTM D3350 may be submitted for approval by the Engineer and, if approved, may be used at no extra cost to the Owner.

B. The pipe and fittings shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

C. The material shall have a minimum Hydrostatic Design Basis (HDB) of 1,600 psi (11.03 MPA) at 73 degrees F per ASTM D 2837. The material shall be black with minimum 2% carbon black for ultraviolet protection. Permanent identification of water piping service shall be provided by co-extruding longitudinal blue stripes into the pipe outside surface at no less than two locations around the pipe's circumference, so at least one stripe is visible from any angle. The striping material shall be the same material as the pipe material except for color, which shall be blue. Stripes printed or painted on the outside surface shall not be acceptable.

D. All HDPE pipe and fittings shall be minimum Pressure Class 160 psi with wall thickness not less than dimension ratio (DR) 11, unless otherwise shown on the Drawings or specified in Section 01011, 02458 or this section. However, all HDPE pipe installed with more than 20 feet of cover and all HDPE pipe installed

by pipe bursting methods shall be minimum Pressure Class 200 psi and wall thickness not less than DR 9.0, unless otherwise shown on the Drawings or specified in Section 02350 or 01011. HDPE pipe shall not be subjected to working pressures exceeding the pipe's Pressure Class.

E. HDPE elbows/bends, tees, and crosses are not allowed.

2.03 FITTINGS, SADDLES, ADAPTERS AND TEMPORARY CAPS

A. Plain end butt fused mechanical joint adapter fittings shall be used when joining polyethylene pipe to valves, ductile iron fittings, or other pipe materials. Butt fusion fittings shall comply with ASTM D3261. When using a butt-fused adapter, a Type 316 stainless steel stiffener shall be used.

B. Butt fused IPS to DIPS adapters shall be used to connect DIPS-size HDPE pipe to IPS-size HDPE pipe.

C. Saddles for branch/service connections 2-inch diameter and smaller shall be conventional fusion type, side fusion (sidewall fused) tapping saddles in conformance with ASTM D1598, D1599, and AWWA C906, rated for at least 200 psi working pressure with NSF-61- and NSF-372-compliant female threaded brass alloy insert per AWWA C800 (CC threads unless otherwise specified in Section 01011) to receive a corporation stop. Saddle branch shall be PE 3408/3608 or PE 4710 HDPE per ASTM D3350 with cell classification 345454C or higher. A Type 304 or 316 stainless steel compression ring shall be provided around the outer diameter of the branch outlet opposing the threaded insert.

D. HDPE branch saddles for 3-inch diameter branch/service connections shall be conventional fusion or electrofusion type as directed and/or approved by the Owner or Engineer. 3-inch saddles shall be DR 11 or DR 9 PE 3408/3608 or PE 4710 with a pressure rating that equals or exceeds the water main Pressure Class. No HDPE saddles shall be permitted for branch/service connections larger than 3-inch.

E. Electrofusion fittings, couplings, and saddles shall only be used where permitted by the Engineer and shall not be permitted for use with HDD. Electrofusion fittings shall comply with ASTM F1055.

F. Mechanical (compression) fittings and couplings shall be as specified in Sections 15105 and 15130 and shall use gaskets and restraining devices specifically designed for, or tested and found to be acceptable for, use with polyethylene pipe. Type 316 stainless steel stiffeners shall be utilized in the HDPE pipe with all mechanical joint (compression) ductile iron fittings, couplings, and valves. Compression-type HDPE or PVC fittings shall not be used. T-bolts and nuts shall be high-strength, corrosion-resistant low-alloy steel with the characteristics listed in Table 6 of AWWA C111. T-bolts shall be Xylan or FluoroKote #1 (corrosion resistant). Other bolts and nuts shall be as specified in Section 15130.

2.04 PIPE ROLLERS

A. Pipe rollers shall be designed for the purpose of supporting and guiding pipe with minimal friction.

B. Pipe rollers shall be of sufficient size to fully support the weight of the pipe during handling and installation and shall not damage the pipe in any way. Spacing shall be as recommended by the HDPE pipe manufacturer and shall prevent pipe abrasions and additional stress on the piping.

2.05 ACCEPTABLE MANUFACTURERS—HDPE PIPE AND FITTINGS

A. Performance Pipe
A Division of Chevron Phillips Chemical Company
5085 West Park Blvd., Suite 500
P.O. Box 269006
Plano, Texas 75093

B. JM Eagle
5200 West Century Boulevard
Los Angeles, California 90045

C. WL Plastics Corporation Corporation
3575 Lone Start Circle, Suite 300
Fort Worth, TX 76177

D. Poly-Cam (Series 415 side fusion saddles only)
1101 McKinley St.
Anoka, MN 55303

E. ISCO Industries (adapters and fittings only*)
926 Baxter Ave.
Louisville, KY 40204
*Pipe manufactured by Performance Pipe or JM Eagle may be supplied through ISCO.

F. Georg Fischer Central Plastics LLC Pipe & Fabricated Products (formerly Independent Pipe Products Inc.) (adapters and fittings only)
39605 Independence
Shawnee, OK 74804

G. Nupi Americans Inc. (adapters and fittings only)
1511 Superior Way
Houston, TX 77039

H. Improved Piping Products, Inc. (adapters and fittings only)
4311 Director Drive
San Antonio, TX 78219

I. Improved Piping Products, Inc. (adapters and fittings only)
4311 Director Drive
San Antonio, TX 78219

PART 3: EXECUTION

3.01 PACKAGING, HANDLING, AND STORAGE

A. The manufacturer shall ensure that the interior of all pipe is clean and install plastic cleanliness plugs in all pipes to keep the pipe interiors clean or cover adequately to prevent dust or truck exhaust from entering pipes.

B. Contractor shall take care not to damage any HDPE pipe. All pipes shall be visually inspected for gouges. Gouges in excess of ten percent (10%) of the pipe wall thickness are considered excessive and are not acceptable. In areas where excessive gouges or other damage is present, the affected pipe section shall be cut out and removed. The remaining, undamaged portions of the pipe shall be rejoined by butt fusion to make a continuous section.

3.02 PIPE INSTALLATION

Installation of HDPE pipe and fittings shall be in full accordance with AWWA Manual M55, except as modified herein. Contractor shall follow the provisions of Sections 02210, 02350, 02458, and 15000; other sections as applicable; and all manufacturers' recommendations, in addition to the following requirements:

A. Trenching, bedding, and backfilling shall be comply with Section 02210. Trenching shall be performed in accordance with ASTM D2774.

B. Unless authorized in writing by the Engineer on a case-by-case basis, changes in direction shall be accomplished by bending the pipe in lieu of installing a fitting, subject to approval by the Engineer. Maximum pipe bending radius shall be in conformance with AWWA Manual M55 and the manufacturer's recommendation for the specific diameter and dimension ratio (DR) of the pipe. The following table shows minimum bending radius based upon the allowable strain of the pipe wall. Potential flow restrictions, surge and other non-trench stability and pipe strain issues may reduce the values shown here per the Engineer's and/or manufacturer's recommendations. The minimum bend radius multiplier determines the minimum (cold) radius of the pipe curvature, which is calculated by multiplying the outside diameter of the pipe by the multiplier for the appropriate DR used. Bending radius allowed by the manufacturer can vary, so Contractor shall verify the multiplier with the manufacturer prior to ordering the pipe. In no case shall the installed radius be less than 125% of the manufacturer's permitted bending radius.

PE pipe Dimension Ratio (DR)	Minimum Bending Radius Multiplier*
11.0	25 times pipe O.D.
9.0	20 times pipe O.D.

*When installed by HDD, minimum bending radius shall be as specified in Section 02458.

C. The HDPE pipe shall be continuously or partially supported on rollers or other Engineer-approved friction-decreasing implements during joining and installation, such that the pipe is not over-stressed or critically abraded prior to or during installation. A sufficient quantity of rollers or other approved implements, spaced per the pipe manufacturer's guidelines, shall be used to assure adequate support and resist excessive sagging of the pipe during installation. Contractor shall ensure that pipe is not permitted to slide sideways on the rollers or other implements.

D. Tracer wires shall be installed with the HDPE pipe as specified in Section 02458 and 02558.

E. HDPE pipe shall not be employed with directional drilling through rock or other abrasive conditions unless it is encased and only with approval of the Engineer.

F. Research has documented that certain pipe materials (such as polyethylene, polybutylene, polyvinyl chloride, and asbestos cement) and certain elastomers, such as used in jointing gaskets and packing glands, may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied in this section shall only be installed in soils that are free of both petroleum products and organic solvents. If during the course of pipeline installation the Contractor identifies or suspects the presence of petroleum products or any unknown chemical substance in the native soil, Contractor shall stop installing piping in the area of suspected contamination and notify the Engineer immediately. Contractor shall not resume installing piping in the area of suspected contamination until direction is provided by the Engineer.

G. Unless otherwise shown on the Drawings or indicated in Section 01011, HDPE pipe shall not be installed at sites where frequent excavation can be anticipated in the vicinity of the pipe (including treatment plant and booster station sites) or where the pipeline is laid on a river channel bottom (except when installed by HDD). HDPE pipe shall not be installed in any circumstance with less than 3 feet or more than 25 feet of cover over the crown of the pipe.

3.03 PIPE AND FITTING JOINING

A. All HDPE pipe joining shall be by butt fusion procedures. Electrofusion shall be used only as permitted by the Engineer. Service connections shall be as specified in Article 3.04 below.

B. HDPE pipe thermal butt fusion welding is to be performed in accordance with the Plastic Pipe Institute "Handbook of Polyethylene Pipe," Polyethylene Joining Procedures, and 49 CFR 192, Subpart F, latest edition.

C. Butt fusion and electrofusion procedures shall be in accordance with the manufacturer's recommendations and the requirements herein. Surfaces must be clean and dry before joining. The wall thicknesses of the adjoining pipes shall have the same DR at the point of fusion unless a specific fitting is specified.

D. Each butt-fused joint shall be precisely aligned and shall have uniform roll back beads resulting from the use of proper temperature and pressure. The joint interior surfaces shall be smooth. Internal bead projections shall not be greater than 3/16-inch, or they shall be removed. The fused joint shall be watertight. The tensile strength at yield of the butt-fusion joints shall not be less than that of the pipe. A specimen of pipe cut across the butt-fusion joint shall be tested in accordance with ASTM D-638.

E. Only appropriately sized and outfitted fusion machines that have been approved by the pipe manufacturer shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:

1. HEAT PLATE - Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe manufacturer's guidelines.
2. CARRIAGE – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
3. GENERAL MACHINE - Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
4. DATA LOGGING DEVICE - The current version of the pipe manufacturer's recommended and compatible software shall be used. Data logging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

F. Integrity of heating plate in the fusion equipment shall be checked a minimum of twice per each 8 hour work shift for temperature uniformity.

G. Other equipment specifically required for the fusion process shall include the following:

1. Pipe rollers shall be used for support of pipe to either side of the machine
2. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement and /or windy weather.
3. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
4. Facing blades shall be appropriate for cutting HDPE pipe.

H. JOINT RECORDING

1. Butt fusion equipment shall be equipped with a Datalogger. Records of each weld (including, as a minimum, heater temperature, fusion pressure, and a graph of the fusion cycle) shall be appropriately identified and provided to the Engineer daily.
2. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of thermoplastic pipe. The software shall register and/or record the parameters required by the pipe manufacturer and these Specifications. Data not logged by the data logger shall be recorded manually and be included in the Fusion Technician's joint report.

I. Electrofusion reports of each weld shall be appropriately identified and provided to the Engineer. The reports shall include, as a minimum, the fusion date, time, ambient temperature, fitting type and size, user ID, and the manufacturer of the part.

J. Quality Control of HDPE fusion process (both butt fusion and electrofusion, as applicable) shall be adhered to and monitored by Contractor with all related documentation submitted to the Engineer.

K. All fused joints will be subject to acceptance by the Engineer prior to pipe installation. All defective joints shall be cut out and replaced at no cost to the Owner. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above. In addition, if in the opinion of the Engineer any section of pipe has other defects, including those hereinafter listed, that may indicate damaged, improperly manufactured, faulty, or substandard pipe, said pipe shall be discarded or returned to the manufacturer and not used. Defects warranting pipe rejection include the following: concentrated ridges, discoloration, excessive spot roughness, and pitting; insufficient or variable wall thickness; pipe damage from bending, crushing, stretching or other stress; pipe damage that impacts the pipe strength, the intended use, the internal diameter of the pipe, internal roughness characteristics; or any other defect of manufacturing or handling.

L. Unless otherwise approved in writing by the Owner and Engineer, mechanical (compression) fittings shall be used only when joining polyethylene materials to other piping materials or valves and shall be installed as specified in Sections 15105 and 15130. Blocking must be provided at changes in direction for any mechanical fittings.

M. ELECTROFUSION

1. Electrofusion joining shall be done in accordance with the fitting and pipe manufacturers' recommended procedures and ASTM F 1290 and PPI TN 34. The process of electrofusion requires an electricity source, a transformer (commonly called an electrofusion box) that has wire leads, a method to read

electronically (by laser or otherwise) input from the barcode of the fitting, and a fitting that is compatible with the type of electrofusion box used. The electrofusion box shall be capable of reading and storing the input parameters and the fusion results for later download to a record file.

2. Qualification of the fusion technician shall be demonstrated by evidence of electrofusion training within the past year on the equipment to be utilized for this application. For a pipe surface to be properly prepared for electrofusion, the outer layer or "skin" of the pipe shall be removed to expose a clean, virgin pipe material. This can be achieved by using one of several types of approved scraping tools. Wood rasps or metal files are not acceptable methods. It is very important to note that abrasive materials, such as sandpaper or emery cloth, should never be used in place of a scraping tool. A minimum of 0.007 to 0.010 inch of the pipe's surface material shall be removed during the scraping process in order to expose a clean virgin material. The pipe surface shall be clean and free from any type of contaminants that may be spread before scraping begins. Should the pipe surface be contaminated with dirt, mud or drilling fluids before scraping, plain water shall be used to remove the surface level of these contaminates. However, water shall not be used to clean the pipe surfaces once the virgin material has been exposed. In those instances, a minimum 70% isopropyl alcohol concentration, with no additional additives, shall be used as a cleaning agent. For applications where a fitting will be moved around on the pipe, such as a repair application where a coupling will be pushed completely over one end of the pipe, the pipe shall be scraped for the entire length of the coupling to prevent a clean fitting from being contaminated by unscraped pipe.
3. Marks may be made on the outer surface of the pipe as a visual aid to help indicate the required scraper coverage. Marks made on the pipe shall not be made with a "grease pencil" or other type of petroleum based marker that will leave a contaminant behind.
4. Care shall be taken to ensure that the polyethylene pipe is not out-of-round before attempting the electrofusion process. Out of round pipe shall be removed or corrected in accordance with the pipe manufacturer's instructions.
5. All pipe that shall be fitted with electrofusion couplings shall be restrained or sufficiently supported on each side of the pipe to restrict movement during the fusion and cooling process and alleviate or eliminate sources of stress and/or strain until both the fusion cycle and the cooling cycle are completed. Electrofused fittings shall be cooled for the time required by the manufacturer.
6. Electrofusion fittings shall only be re-fused in the event of an input power interruption, i.e. fusion leads were detached during fusion, generator runs out of fuel, processor malfunction, or other circumstance that results in processor input power interruption.

N. Polyethylene pipe shall be joined to ductile iron pipe by the use of butt-fused mechanical joint adapters as specified in Part 2. When using a butt-fused adapter to connect to a valve or to another pipe material, a Type 316 stainless steel stiffener shall be used.

O. Flange adapters, when required, shall be butt fused to the polyethylene pipe and shall use Type 316 stainless steel stiffener rings. Flange bolts must span the entire width of the flange joint, and provide sufficient thread length to fully engage the nut. MJ Adapter kit shall include HDPE anchor fitting, standard rubber gasket, extra length corrosion resistant T-bolts, internal Type 316 stainless steel stiffener, and C-153 (2”-12”) or C-110 (14”-24”) heavy body ductile iron gland ring.

3.04 SERVICE CONNECTIONS AND TAPPING

A. Unless specifically indicated on the Contract Drawings, no mechanical service saddles or taps are permitted on HDPE pipe without written approval by the Owner.

B. Side-fusion (sidewall fused) polyethylene hot tapping saddles shall be provided for each 2-inch nominal diameter and smaller branch/service connection to HDPE mains as specified in Part 2 above, and branch saddles for 3-inch branch/service connections to HDPE mains shall be provided as specified in Part 2 above. HDPE main shall be tapped with a tapping tool or machine that meets the pipe and saddle manufacturers’ requirements. Installation of sidewall fused polyethylene saddles and HDPE branch saddles shall be in accordance with AWWA Manual M55, PPI TR-33, ASTM F2620 and shall be by the conventional saddle fusion method unless otherwise approved in writing by the Owner.

C. Connections to new mains larger than 3-inch nominal diameter shall be made with ductile iron tees in accordance with Section 15105 and 15130.

D. For connections larger than 3-inch nominal diameter to existing HDPE mains, mechanical clamps or tapping sleeves or saddles designed for HDPE pipe (of the correct outside diameter) and meeting the requirements of Section 15170 shall be used unless otherwise indicated on the Drawings and/or specified in Section 01011 and/or 01075.

3.05 ANCHOR RESTRAINTS

A. Concrete anchor collars located at each end of the watermain shall be provided.

3.06 TESTING

A. Pressure testing shall be conducted in accordance with the Manufacturer’s recommended procedures and Section 15030, or as otherwise recommended in writing by the Engineer.

B. Stream Crossings shall be pressure testing prior to chlorination and disinfection.

C. A ¾-inch NPT test nipple and plug shall be provided on each tapping saddle to allow pre-testing of the saddle assembly before making the tap.

D. Any third party inspections will be paid for by the Owner.

END OF SECTION

SECTION 15130

PIPING SPECIALTIES

PART 1: GENERAL

1.01 SCOPE OF WORK

The Work under this section consists of providing all labor, materials, tools, equipment, and services required to provide the various miscellaneous piping specialties addressed herein as indicated on the Drawings; as specified within this section and Sections 01011, 02210, and 15000; and as required to provide a complete, operational installation that fulfills the requirements of the Contract Documents. Contractor shall furnish all piping specialties that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

1.02 GENERAL REQUIREMENTS

This section is intended to supplement the other sections of the Specifications, and the items covered in this section are directly related to work specified in the related sections. All work specified in this section shall also comply fully with all other applicable sections, such as 15000, 15105, 15120, 15125, 15150, and 15155—regardless of whether or not direct references are included herein.

1.03 SUBMITTALS

A. Contractor shall submit Shop Drawings, installation instructions, certifications, and other required submittals for all products furnished under this section in accordance with Section 01300. The following submittals shall be submitted:

1. Polyethylene encasement
2. Valve boxes
3. Ultra-compact restrained MJ adapters
4. T-bolts (shall be Xylan or Fluorokote #1, corrosion resistant).
5. Flange adapters
6. Restraint harnesses for PVC pipe joints
7. Couplings for joining dissimilar pipe materials or sizes
8. Mechanical joint retaining glands
9. Insulation and weatherproof jacketing (where applicable)
   a. Submittals for insulation shall identify thickness, k-value, and accessories.
   b. Submittals for insulation intended for freeze protection shall include an energy analysis report by the insulation manufacturer using appropriate conditions and assumptions for the specific installation to estimate the time for non-flowing water (or water flowing at a minimum velocity indicated by

the Engineer) in the pipeline to reach 32 degrees Fahrenheit and subsequent additional time to freeze solid.

c. Submittals for exposed insulation shall include available colors (at least white and silver) to be selected by the Owner.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 01700 Project Closeout

G. Section 02210 Trenching, Backfilling and Compacting

H. Section 02558 Identification/Location Guide

I. Section 15000 Piping – General Provisions

J. Section 15020 Disinfecting Pipelines

K. Section 15025 Flushing and Cleaning Pipelines

L. Section 15030 Pressure and Leakage Tests

M. Section 15105 Ductile Iron Pipe and Fittings

N. Section 15120 Polyvinyl Chloride (PVC) Pipe

O. Section 15125 High Density Polyethylene (HDPE) Pipe

P. Section 15150 Gate Valves

Q. Section 15155 Butterfly Valves

R. Section 15170 Tapping Sleeves, Saddles & Valves

S. Section 15180 Fire Hydrants

T. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps

U. Section 15200 Service Lines

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASME / ANSI B1.1 - Unified Inch Screw Threads

B. ASME / ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

C. ASME / ANSI B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300

D. ASME / ANSI B18.2 - Square and Hex Bolts and Screws (Inch Series)

E. ASTM A36 – Standard Specification for Carbon Structural Steel

F. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength

G. ASTM A536 – Standard Specification for Ductile Iron Castings

H. AWWA C104 / ANSI A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

I. AWWA C105 / ANSI A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems

J. AWWA C110 / ANSI A21.10 - Ductile-Iron and Gray-Iron Fittings

K. AWWA C111 / ANSI A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

L. AWWA C116 / ANSI A21.16 - Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

M. AWWA C153 / ANSI A21.53 - Ductile-Iron Compact Fittings

N. AWWA C213 – Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

O. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

P. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In., for Water Transmission and Distribution

Q. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks

R. Ductile Iron Pipe Research Association (DIPRA) Field Polyethylene Installation Guide

S. NSF/ANSI 61 Drinking Water System Components – Health Effects

T. NSF/ANSI 372 Drinking Water System Components – Lead Content

PART 2: PRODUCTS

2.01 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement for pipe and pipe-shaped appurtenances shall be tube-form made of virgin polyethylene and conforming to AWWA C105. Tube sizes shall be per AWWA C105 and as recommended by the manufacturer. For wrapping odd-shaped appurtenances and making repairs, either flat sheet or split-tube polyethylene may be used. All polyethylene encasement shall have a minimum thickness of 12 mils.

B. The polyethylene film supplied shall be blue in color (or as specified in Section 01011) and distinctly marked (at minimum 2 foot intervals) with the following information:

1. manufacturer's name (or trademark),
2. year manufactured,
3. minimum film thickness and material type (i.e. LLDPE or HDCLPE),
4. range of nominal pipe diameter size
5. ANSI/AWWA C105/A21.5 (compliance)
6. a warning: "WARNING–CORROSION PROTECTION–REPAIR ANY DAMAGE
7. labeled "WATER"

C. ACCEPTABLE MANUFACTURERS: POLYETHELNE ENCASEMENT

a. Marshall Plastic Film, Martin, Michigan, as supplied by Peistrup Paper Products, Inc., 1185 Research Blvd., St. Louis, MO 63132, (314) 993-0970,. http://www.marshallplastic.com/#).

b. AA Thread Seal Tape, Inc. 1275 Kyle Court, Wauconda, IL 60084 (800) 537-7139, www.aathread.com

D. Tape used with polyethylene encasement shall be standard gray or black duct tape a minimum of 1.5" wide. Tape shall bond securely to both metal surfaces and polyethylene film.

2.02 VALVE BOXES

A. Valve boxes shall be round cast iron as specified herein and approved by the Engineer. Valve boxes shall be of the standard, adjustable, cast iron extension type, multiple piece, 5¼-inch shaft, screw type, and of such length as necessary to extend from the valve to finished grade. Cast iron valve boxes shall be hot coated inside and out with an asphaltic compound.

B. The casting shall be manufactured of ¼-inch thick clean, even grain, gray cast iron with minimum tensile strength of 21,000 psi. The valve box shall be smooth; true to pattern; free from blowholes, sand holes, projections, and other harmful defects.

C. Top section (excluding cover) shall weigh at least 2 pounds per inch height. Extensions shall weigh at least 15 pounds per foot height. Cover shall weigh at least 9 pounds.

D. Valve boxes shall be designed so as to prevent the transmission of surface loads directly to the valve or piping.

E. Valve box bases for gate valves through 12-inch diameter shall conform to the following:

Valve Size	Minimum Base	Minimum Weight
12" and smaller	round, 8" in height, 10-7/8" diameter at bottom	30 pounds

F. Valve boxes for butterfly valves and gate valves larger than 20-inch diameter shall have a minimum shaft diameter of 5-1/4 inches, wall thickness of at least ¼ inch, and a weight of at least 60 pounds (for 2-piece valve box at standard depth).

G. Top section shall be adjustable to fit the installed depth of cover over the valve. The seating surface of both the top section and the lid cover shall be cast so the cover will not rock after it has been seated and will fit tightly with little or no play in the fit. Cover shall have the word “WATER” cast into the top.

H. For each valve, whether furnished by the Contractor or Owner, the Contractor shall furnish and install an HDPE valve box alignment device. The alignment device shall be two-pieces that lock together under the operating nut without requiring removal of the nut. Valve box alignment devices shall be BoxLok as manufactured by Emma Sales, LLC or American Flow Control as follows:

1. For 10” and smaller valves, provide model # BoxLok-2.
2. For 12” and larger valves, provide model # BoxLok-1.

I. Valve boxes shall be fitted with cast iron or steel extension stems where necessary to raise the operating nut to within five feet (5’) of finished grade, such that valves are easily operable with a standard 6-ft. length T-wrench. Extension stems shall be suitably sized to transmit the maximum torques required to operate the valve with appropriate safety factor. Hardware for extension stems shall be Type 316 stainless steel. Stainless steel centering rings (marked with proper opening direction) shall be provided to stabilize extension stems in the valve box.

J. Acceptable Manufacturers:

1. Bingham & Taylor
2. Star Pipe Products
3. E. J. Prescott
4. Tyler Union
5. Clay and Bailey Manufacturing Co.

2.03 ULTRA-COMPACT RESTRAINED MJ ADAPTERS

A. Where multiple fittings are required in proximity to one another and/or a fitting is required in proximity to a valve, an ultra-compact restrained MJ adapter may be used in lieu of pipe spool piece and multiple restrained MJ retainer glands.

B. Ultra-compact restrained MJ adapters shall meet the requirements for ductile iron fittings as specified in Section 15105, shall have either asphaltic seal coating in accordance with AWWA C104 and C110 or fusion bonded epoxy coating conforming to AWWA C116 inside and out, and all materials that come in contact with potable water shall be NSF 61 certified.

C. Ultra-compact restrained MJ adapters shall use a bolt-through positive restraint design allowing the bolts to pass around the fitting while providing a metal surface to compress the MJ gaskets.

D. Ultra-compact restrained MJ adapters shall not be used to connect directly to a butterfly valve without the valve manufacturer's approval, and Contractor shall ensure that operation of the butterfly valve is unaffected by the adjacent fitting, regardless of flow direction.

E. Ultra-compact restrained MJ adapters shall be manufactured within the United States. No foreign products will be acceptable.

F. Acceptable Manufacturers:

1. Foster Adaptors by Infact Corporation

2.04 RODS, BOLTS, LUGS, BRACKETS, AND CORROSION-PROTECTION

A. Anti-rotation T-bolts shall be used on mechanical joints and shall be of domestic origin meeting the current provisions of AWWA C111. T-bolts and nuts shall be high-strength, corrosion-resistant low-alloy steel with the characteristics listed in Table 6 of AWWA C111. T-bolts shall be Xylan or FluoroKote #1 (corrosion resistant).

B. Flange bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. Bolts and nuts hall be threaded in accordance with ASME/ANSI B1.1, Unified Inch Screw Threads (UN and UNR Thread Form) class 2A external and class 2B internal. Material for bolts and nuts

shall conform to ASTM A307, 60,000 PSI Tensile Strength, Grade B, unless otherwise specified in Section 01011. Xylan or FluoroKote #1 hex bolts (corrosion resistant) shall be used on any buried flange bolts, except as otherwise specified in Section 15170.

C. All other bolts, steel rods (threaded and non-threaded), lugs and brackets used for buried service, shall be either Type 304 or 316 stainless steel or ASTM A36 or A307 carbon steel with Xylan or FluoroKote #1 corrosion resistant coating. Threaded stainless steel components shall be coated with an anti-seize coating to prevent galling.

D. Where threaded rods are permitted, the rods and tabs shall be designed for the pressure class (or pressure rating) of the pipe or the specified restraint system design pressure, whichever is greater. Threaded rods shall have lengths less than 10 feet between fittings.

2.05 RESTRAINED FLANGE ADAPTERS

A. Flange adapters shall only be used in exposed locations; they are not permitted for buried applications. All flange adapters shall be restrained.

B. Restrained flange adapters shall be made of ductile iron conforming to ASTM A536 and shall be rated for the same working pressure as the pipe on which they're used. Country of origin and date/date code shall be cast or stamped on for traceability. Flange adapters shall have ANSI Class 150 bolt patterns compatible with AWWA C110.

C. Restrained flange adapters shall be capable of deflection during assembly and allow for pipe to be field-cut. Adapters shall be able to accommodate a gap between the end of the pipe and the mating flange of at least 0.6 inch for nominal pipe sizes up to 8-inch, at least 1.0 inch for nominal pipe sizes from 12-inch to 20-inch, and at least 1.25 inches for nominal pipe sizes greater than 20-inch, without affecting the integrity of the seal.

D. Restraint shall consist of multiple individual actuated gripping wedges fitted with torque-limiting actuating screws to ensure proper initial set of gripping wedges.

E. Flange adapters, including casting bodies, wedge assemblies, and related parts, shall be coated both internally and externally with a fusion bonded epoxy, electrostatically-applied and heat-cured polyester-based powder coating, or equal to provide corrosion-, impact-, and UV-resistance.

F. Acceptable manufacturers:

1. EBAA Iron, Inc. (MegaFlange Series 2100)
2. ROMAC Industries, Inc. (Style RFCA).
3. No other manufacturers will be accepted as equal.

G. All restrained flange adapters shall be produced solely in the United States; no foreign-manufactured items shall be allowed (even if named herein).

H. All materials that come in contact with potable water shall be NSF 61 certified.

2.06 RESTRAINT HARNESSES FOR PVC PIPE JOINTS

A. Where restraint of PVC pipe to pipe joints is required, all joints shall be bell and spigot joints with external split serrated restraint harnesses.

B. Joint restraint systems shall be rated for a pressure equal to the pressure class of the pipe on which it is used (per AWWA C900) or the specified restraint system design pressure, whichever is greater.

C. Restraint harnesses shall utilize a split serrated ring to grip the plain-end of the pipe and a split serrated ring to grip the barrel of the pipe behind the bell. No more than two bolts shall be used to join each split serrated ring, which shall tighten the ring against the pipe. A sufficient number of thrust rods in accordance with article 2.04 above shall connect the two restraint rings to each other. Restraints shall require only conventional tools and installation procedures per AWWA C900. Other types of restraining devices, including devices with a non-serrated ring on the bell-end, shall not be accepted.

D. Restraint rings shall be made of ductile iron conforming to ASTM A536 and shall be coated both internally and externally with a fusion bonded epoxy or electrostatically-applied and heat-cured polyester-based powder coating to provide corrosion-, impact-, and UV-resistance. Country of origin and date/date code shall be cast or stamped on for traceability.

E. Restraint bolts, steel rods (threaded and non-threaded), nuts and washers shall be either Type 304 or 316 stainless steel or ASTM A36 or A307 carbon steel with Xylan or FluoroKote #1 corrosion resistant coating.

F. Restraint devices shall be either listed by Underwriter Laboratories or approved by Factory Mutual.

G. All restraint harnesses shall be produced solely in the United States; no foreign-manufactured items shall be allowed (even if named herein).

H. Acceptable manufacturers:

1. EBAA Iron, Inc. (Series 1900)
2. Romac Industries, Inc. (Series 600)
3. Ford Meter Box Company, Inc. (Series 1390)
4. No other manufacturers will be accepted as equal.

2.07 COUPLINGS FOR JOINING DISSIMILAR PIPE MATERIALS OR SIZES

A. When connecting HDPE pipe to pipe of another material, the preferred method shall be to utilize an appropriate plain end butt-fused mechanical joint adapter fitting (as specified in Section 15125) fused to the HDPE pipe and make a restrained mechanical joint connection. However, when approved by the

Engineer, a coupling per this subsection may be utilized to join HDPE pipe to pipe of another material.

B. Type 316 stainless steel pipe stiffeners shall be provided at all mechanical connections to HDPE pipe unless otherwise approved in writing by the Engineer.

C. Where approved by the Engineer, couplings for joining dissimilar pipe materials (and/or pipes of different outside diameters) shall be sleeve type consisting of a center sleeve and, on each end, an end ring, a multi-range gasket, stainless steel spanner, and one or two Type 304 stainless steel bolts and nuts. Bolts shall be coated with an anti-seize coating to prevent galling.

D. Coupling body sleeve shall be fabricated of ductile iron or carbon steel and shall be fusion-epoxy coated per AWWA C116 or C213 and shall be NSF 61 certified.

E. End ring shall be fabricated of ductile iron or carbon steel and shall compress the gasket when the bolt(s) is/are tightened. End ring shall be epoxy coated.

F. Gaskets shall be EPDM or nitrile, as approved by the Engineer, and shall be NSF-61 certified.

G. Couplings shall be completely factory-assembled and shall not require any field disassembly.

H. Pressure rating shall be at least equal to the minimum pressure class of the two pipes to be joined and shall maintain rated sealing under the following conditions:

1. Angular deflection of 4 – 10 degrees per end (depending on pipe size) to a total of 8 – 20 degrees,
2. Longitudinal pipe movement of up to 10 mm.

I. All couplings shall be produced solely in the United States; no foreign-manufactured items shall be allowed (even if named herein).

J. Where indicated on the Drawings, required by Section 01011, or directed by the Engineer, couplings shall be adequately restrained for the maximum potential pressure. Restraint may be provided by an approved mechanical joint harness or by a concrete thrust collar designed or approved by the Engineer. Proper anchor flanges approved by the Engineer shall be provided where concrete thrust collars are used.

K. Acceptable manufacturers:

1. Krausz Industries Ltd. (Hymax® Coupling),
2. ROMAC Industries, Inc. (Macro HP),
3. No other manufacturers will be accepted as equal.

2.08 MECHANICAL JOINT RETAINING GLANDS AND OTHER MECHANICAL JOINT RESTRAINT DEVICES

A. All mechanical joint restraint devices shall conform to the requirements of AWWA C111 and/or C153. Joint restraint systems shall be rated for a pressure equal to the pressure class of the pipe on which it is used (per AWWA C151, C900, or C906, as applicable) or the specified restraint system design pressure, whichever is greater.

B. All mechanical joints for connecting pipe to valves, fittings, or other components, shall utilize restrained mechanical joint retaining glands with restraint consisting of multiple individual actuated gripping wedges fitted with torque-limiting actuating screws to ensure proper initial set of gripping wedges. Glands shall require only conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly. Set screws, pins, and other types of restraining devices shall not be accepted.

C. Gland body, wedges, and wedge actuating components shall be made of ductile iron conforming to ASTM A536 Grade 65-45-12. Country of origin and date/date code shall be cast or stamped on for traceability. Gripping wedges shall be heat treated within a range of 370 to 470 BHN. Every retaining gland shall be designed for the specific pipe material and diameter on which it is used.

D. Restraint systems, including casting bodies, wedge assemblies, and related parts, shall be coated both internally and externally with a fusion bonded epoxy or electrostatically-applied and heat-cured polyester-based powder coating to provide corrosion-, impact-, and UV-resistance.

E. Split retaining rings shall be provided where necessary to restrain existing mechanical joints on existing piping.

F. Restraint devices shall be either listed by Underwriter Laboratories or approved by Factory Mutual.

G. Acceptable manufacturers of retaining glands are:

1. EBAA Iron, Inc. (MegaLug),
2. Tyler Union (TUFGrip, domestic only),
3. Romac Industries, Inc. (RomaGrip with Romabond).
4. No other manufacturers will be accepted as equal.

H. Mechanical joint couplings used to connect two plain pipe ends shall be fully restrained to prevent axial separation. The restraint system shall consist of retaining glands as specified above. Where approved by the Engineer, mechanical couplings may be sleeve type restrained mechanical joint couplings as manufactured by:

1. EBAA Iron, Inc. (Mega-Coupling)
2. ROMAC Industries, Inc. (400RG Restraint Coupling).
3. ROMAC Industries, Inc. (ALPHA restrained joint coupling)
4. No other manufacturers will be accepted as equal.

I. To restrain otherwise unrestrained couplings, external restrained harnesses shall be provided. External restrained harnesses shall use wedge-type retaining glands as specified above connected by threaded rods or tie bars to restrain the two pipes to each other. Restraint harnesses shall be manufactured by:

1. EBAA Iron, Inc.,
2. Tyler Union (domestic only),
3. Romac Industries, Inc.
4. No other manufacturers will be accepted as equal.

J. Restrained harnesses connecting PVC pipe ends may be of the serrated ring style as specified above for PVC pipe-to-pipe joints.

K. All retaining glands and other joint restraint devices shall be produced solely in the United States; no foreign-manufactured items shall be allowed (even if named herein).

L. Gaskets shall meet the requirements of Sections 15105, 15120, and/or 15125, as applicable.

2.09 INSULATION AND WEATHERPROOF JACKETING SYSTEM FOR EXPOSED SMALL PIPING, VALVES, AND FITTINGS (<=8-INCH NOMINAL DIAMETER)

A. Flexible unicellular, closed-cell elastomeric piping insulation: ASTM C 534, Type I. AP Armaflex by Armacell Company.

B. Insulation shall be mold-resistant and shall be non-wicking.

C. Minimum insulation thickness shall be 1-1/2 inches for 4" diameter pipe and larger, and 1 inch for smaller pipe.

D. Jackets for exterior insulation shall be either:

1. Smooth or embossed ASTM C 921 Type I aluminum metal jacket with weather-proof construction. Minimum jacket thickness shall be 0.031 inches for exterior installations. Fastening shall use preformed "2"-lock seam with 2 inch butt strap with sealant. Bonds shall be 1/2 inch aluminum with wing seals. Fittings

shall be prefabricated 0.031 inch thickness aluminum as manufactured by ITW Insulation Systems, Houston, Texas or Metro Supply Company, Woodland Park, NJ.

E. Insulation for valves, fittings and flanges shall be mitered segments of the same product used as pipe insulation. As an alternative to insulation with separate jackets, flexible elastomeric insulation with laminated polymeric membrane covering as specified for larger piping may be used for valves, fittings and flanges.

F. Pipe insulation jackets shall be at least 36" long as measured along the pipe.

G. Special care shall be taken to make all exterior insulation jackets completely waterproof by the use of appropriate sealants at all joints, etc.

H. Staples, Bands, Wires, Adhesives, Cement, Tapes and Sealers: As recommended by insulation manufacturer for applications indicated.

2.10 INSULATION AND WEATHERPROOF JACKETING SYSTEM FOR EXPOSED LARGE PIPING, VALVES, AND FITTINGS (>8-INCH NOMINAL DIAMETER)

A. Flexible unicellular, closed-cell elastomeric insulation with a 16 mil thickness laminated polymeric membrane covering that is UV-, puncture- and tear-resistant—i.e. a UV protective blended polymeric top surface and a puncture-resistant blended polymeric base, around a scrim reinforced core. ArmaTuff PLUS II by Armacell Company. Flexible elastomeric insulation shall be by the same manufacturer as flexible elastomeric piping insulation provided for smaller piping.

B. Insulation shall be mold-resistant and shall be non-wicking.

C. Minimum insulation thickness shall be 2 inches.

D. The membrane shall have a 10-year warranty against breakdown due to UV radiation. Insulation layer between outer layer of duct and exterior jacket shall be a mold-resistant flexible elastomeric thermal insulation.

E. Insulation for valves, fittings and flanges shall be mitered segments of the same product used as pipe insulation.

F. Pipe insulation jackets shall be at least 36" long as measured along the pipe.

G. Special care shall be taken to make all exterior insulation jackets completely waterproof by the use of appropriate sealants at all joints, etc.

H. Staples, Bands, Wires, Adhesives, Cement, Tapes and Sealers: As recommended by insulation manufacturer for applications indicated.

2.11 INSULATION AND WATERPROOF JACKETING SYSTEM FOR BURIED PIPING, VALVES, AND FITTINGS

INSULATING MATERIALS:

A. Flexible Elastomeric Cellular:

1. Material: Flexible expanded closed-cell structure with smooth skin on both sides.
2. Form: Tubular materials conforming to ASTM C 534, Type I.
3. Thermal Conductivity: 0.30 average maximum at 75 degrees F.
4. Coating: Water-based latex enamel coating or other as recommended by insulation manufacturer.

B. Cellular Glass:

1. Insulation: Cellular glass block insulation conforming to ASTM C552, “Specification for Cellular Glass Block and Pipe Thermal Insulation”.
2. Jacketing: Flexible, resilient membrane waterproof against most soil and water conditions. PITTWRAP Jacketing by Pittsburgh Corning Corporation.
3. Asphalt Coating: PITTCOTE 300 Finish, by Pittsburgh Corning Corp.
4. Reinforcing Fabric: PC Fabric 79, by Pittsburgh Corning Corp.
5. Strapping Tape: Glass fiber reinforced, 1" width, Scotch Brand #880 by 3M.
6. Bore Coating: Hydrocal B-11, by U.S. Gypsum.
7. High Temperature Sealant: Maximum temperature limit, 500 degree F. RTV 736 by Dow Corning Corporation.

C. Thickness: Thickness of insulation shall be at least as shown in the table below, as recommended by the manufacturer.

MINIMUM PIPE INSULATION THICKNESS	
Nominal Pipe Diameter	**Insulation Thickness**
Less than 6"	As recommended by manufacturer
6" - 8"	2.5"
10" - 12"	3.5"
Greater than 12"	As recommended by manufacturer

D. Adhesive shall be solvent-based, contact adhesive recommended by insulation manufacturer.

JACKETING:

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. PVC Jacketing: High-impact, ultra-violet-resistant PVC, 20-mils thick, roll stock ready for shop or field cutting and forming to indicated sizes. Adhesive shall be as recommended by insulation manufacturer.

C. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultra-violet-resistant PVC. Adhesive shall be as recommended by insulation manufacturer.

D. Other jacketing as recommended by the insulation manufacturer for the intended buried service may be used with approval of the Engineer.

E. Flexible, vapor-barrier sealing compounds with a temperature range of at least negative 20 to 180 degrees Fahrenheit shall be as recommended by the insulation manufacturer for the intended buried service with approval of the Engineer.

ACCESSORIES AND ATTACHMENTS:

A. Bands: 3/4-inch wide, in one of the following materials compatible with jacket:

1. Galvanized Steel: 0.005 inch thick.
2. Aluminum: 0.007 inch thick.
3. Brass: 0.01 inch thick.
4. Nickel-Copper Alloy: 0.005 inch thick.

B. Wire: 14-gage nickel copper alloy, 16-gage, soft-annealed stainless steel, or 16-gage, soft-annealed galvanized steel.

C. Select accessories compatible with pipe and insulation materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either wet or dry conditions.

ACCEPTABLE MANUFACTURERS:

Subject to compliance with above requirements, provide products by one of the following:

A. Flexible Elastomeric Cellular:

1. ArmaCell AP Armaflex
2. K-Flex USA / NOMACO / IMCOA.

B. Cellular Glass:

1. Pittsburgh Corning Corporation FOAMGLAS Insulation.

PART 3: EXECUTION

3.01 INSTALLATION, GENERAL

A. Install “piping specialties” in accordance with the general provisions provided in Sections 01000, 15000, and 15105 and the additional requirements herein.

3.02 INSTALLATION OF POLYETHYLENE ENCASEMENT

A. Encase all ductile iron piping, all valves, and all metallic appurtenances in polyethylene to prevent contact with surrounding backfill and bedding material.

B. The Contractor shall install polyethylene encasement on the pipe directly prior to the installation of the piece of pipe. Install the polyethylene material in accordance with the DIPRA Field Polyethylene Installation Guide and AWWA C105. Polyethylene tubes shall be installed per Method A described in AWWA C105. Polyethylene shall fit snugly and not tightly stretched.

C. The Contractor shall be responsible for the means, methods, techniques, sequences and procedures necessary for the installation of the polyethylene encasement in compliance with current DIPRA recommendations.

D. All holes or tears shall be repaired with tape. Large holes or tears shall be repaired by taping another piece of polyethylene over the hole.

E. Dig bell holes, and slide polyethylene encasement over the adjacent pipe providing a minimum of 1 foot of overlap of each adjacent pipe section.

F. Where polyethylene-wrapped pipe being installed connects to a pipe that is not wrapped (including existing pipe), extend the wrap a minimum of 3 feet onto the previously uncovered pipe. This includes service lines which shall be wrapped in polyethylene or dielectric PVC tape.

G. Tape joint overlaps and at every 3 foot interval along the barrel of the pipe (2 foot intervals when installed below the water table). Tightly secure polyethylene encasement using two to three circumferential passes of adhesive tape on the pipe to polyethylene encasement connection and the overlap polyethylene encasement to polyethylene encasement connection.

H. Store all polyethylene encasement and tape out of the sunlight.

I. Exposure of wrapped pipe to sunlight should be kept to a minimum. Pipe can be stored with the polyethylene encasement on the pipe for a maximum of 14 days.

J. At no time shall the polyethylene-encased pipe be subjected to a point load during handling, temporary storage, or installation. The polyethylene encasement must be moved away from the timbers or hoisting device while on the pipe to prevent point loads and resulting pin holes.

K. The polyethylene encasement shall be installed up to the operating nut level on all valve boxes, leaving the operating nut of the valve exposed and free to be

operated. Polyethylene encasement shall be installed up to the ground surface on all fire hydrants.

L. Install two layers of polyethylene encasement where pipe is installed within 100 feet of a cathodically-protected pipeline (e.g. conveying natural gas, petroleum, etc.).

M. Polyethylene encasement shall be properly secured in place prior to forming or pouring any concrete encasement or thrust blocking.

N. Openings in the encasement shall be provided for branches, air valves, blow-off assemblies, and similar appurtenances by making an X-shaped cut in the encasement and temporarily folding back the film. After installation of the appurtenance, tape the slack securely to the appurtenance and repair the cut and any other damaged areas with tape. Continue installation of polyethylene on ductile iron pipe branches, overlapping and taping the first piece of polyethylene encasement to the adjacent installation.

O. Direct service taps for polyethylene-encased pipe shall follow the procedure described in AWWA C105 and C600. Access to the main for tapping through polyethylene is accomplished by making two to three circumferential passes of adhesive tape around the pipe and over the polyethylene encasement. The tap is to be made directly through the tape and polyethylene encasement.

P. Two layers of polyethylene encasement shall be installed and secured on all pipe installed by horizontal directional drilling as specified in Section 02458 per DIPRA installation procedures, including those in DIPRA's Horizontal Directional Drilling with Ductile Iron Pipe Handbook.

3.03 INSTALLATION OF VALVE BOXES

A. Valve boxes shall be provided for all buried valves.

B. Valve boxes shall be supported so that no load can be transmitted from the valve box to the valve. Refer to Indiana American Water Standard Detail Drawing for typical valve and valve box installation.

C. Install a self-centering alignment ring at the operating nut. Ensure that the bottom of the valve box is centered over the operating nut.

D. All sections of each valve box shall be aligned and plumb directly over the operating nut. Valve boxes shall be carefully backfilled evenly around the full circumference to maintain alignment.

E. Extension stems shall be installed plumb and centered within the valve box. Extension stems shall be securely attached to the operating nut (and to each other) so the shaft will not pull off the operator. Install stainless steel centering rings for all extension stems.

F. Tracer wire shall be installed at the valve and extend upward along the exterior of the valve box for connection of location equipment in accordance with Section 02558.

3.04 INSTALLATION OF COUPLINGS AND JOINT RESTRAINT DEVICES

A. All couplings and joint restraint devices shall be installed per the manufacturer's instructions and in conformance with all other applicable sections.

B. All couplings and joint restraint devices shall be wrapped with polyethylene encasement.

3.05 STORAGE, HANDLING, PROTECTION, AND INSTALLATION OF INSULATION AND JACKETING (ALL TYPES)

A. Protect pipe insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. The Contractor shall protect the insulation from moisture at all times until fully installed. Comply with the Manufacturer's recommendations for handling, storage, and protection during installation.

B. Insulation of exposed piping shall not be installed until piping has been field tested, painted (where required) and approved by the Owner.

C. The Contractor shall insure that surfaces of pipes, valves, and fittings are clean, free of foreign materials (including rust, scale, and dirt), and dry prior to installation of insulation. Insulation shall be installed so as to make surfaces smooth, straight, even, and substantially flush with the adjacent insulation.

D. The Contractor shall follow the manufacturer's printed instructions for the materials used.

E. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated. Apply insulation with a minimum number of joints.

F. Tightly butt longitudinal seams and end joints. Bond with adhesive or as recommended by the manufacturer. For cellular glass block insulation, taper ends at 45 degree angle and seal with lagging adhesive.

G. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Apply adhesives and coatings at the manufacturer's recommended coverage rate.

I. Apply insulation with integral jackets per the manufacturer's instructions and as follows:

    1. Pull jacket tight and smooth.

2. Overlap circumferential joints or cover with butt strips at least 3-inches wide and of same material as insulation jacket. Secure joints with adhesive or as recommended by the manufacturer.

3. Overlap longitudinal seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Secure seams as recommended by the manufacturer. Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 degrees F.

3. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.

4. Repair damaged insulation jackets per the manufacturer's recommendations as approved by the Engineer. Extend the repair at least 2 inches in both directions beyond the damaged insulation jacket and around the entire circumference of the pipe.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION:

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe.

B. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive. Seal seams and joints with adhesive.

C. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive. Miter cut materials to cover elbows and tees. Overlap adjoining pipe insulation.

3.07 INSTALLATION OF INSULATION AND WATERPROOF JACKETING SYSTEM FOR BURIED PIPING:

In addition to the above requirements, the following are additional requirements for insulation applied to piping installed below ground:

A. Terminate insulation at anchor blocks.

B. Exterior Wall Penetrations: For penetrations of below grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor barrier coating.

C. Apply insulation continuously through sleeves and manholes, except as otherwise directed by the Engineer.

D. Finishing: Seal insulation materials as recommended by the manufacturer. If no other directions are provided, and if compatible with the insulation and jacketing, apply 3 coats of asphaltic mastic to a finish thickness of 3/16 inch over insulation materials. Apply 10 x 10 mesh glass cloth between coats. Overlap edges of glass cloth by 2 inches.

END OF SECTION

SECTION 15150

GATE VALVES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to install and test all buried gate valves as indicated on the Drawings and as specified within this section. Contractor shall furnish retaining glands and other related components not furnished by the Owner. Contractor shall fully furnish and install gate valves that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

B. This section does not apply to gate valves to be installed above ground or otherwise exposed.

1.02 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, Operating and Maintenance Manuals, and certifications, for all products furnished under this section in accordance with Section 01300. In addition, if insertion valves are provided, Contractor shall submit documentation validating the installing company’s current certification by the valve manufacturer.

1.03 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 01700 Project Closeout

G. Section 02210 Trenching, Backfilling and Compacting

H. Section 02558 Identification/Location Devices

I. Section 15000 Piping - General Provisions.

J. Section 15020 Disinfecting Pipelines

K. Section 15025 Flushing and Cleaning Pipelines

L. Section 15030 Pressure and Leakage Tests

M. Section 15105 Ductile Iron Piping and Fittings

N. Section 15120 Polyvinyl Chloride (PVC) Pipe

O. Section 15125 High Density Polyethylene (HDPE) Pipe

P. Section 15130 Piping Specialties

Q. Section 15170 Tapping Sleeves, Saddles, & Valves

R. Section 15180 Fire Hydrants

1.04 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service

B. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

C. AWWA C550 – Protective Interior Coatings for Valves and Hydrants

D. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

E. ASME / ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

F. ASME / ANSI B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300

G. NSF/ANSI 61 Drinking Water System Components – Health Effects

H. NSF/ANSI 372 Drinking Water System Components – Lead Content

PART 2: PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated on the Contract Drawings and/or in Section 01011, all valve 3-inch through 12-inch nominal size shall be resilient-seated gate valves per this section. Unless otherwise indicated, valves 16-inch and larger nominal size shall be butterfly valves per Section 15155. Where gate valves 16-inches nominal size and larger are required by the Drawings and/or by Sections 01000, 01011, and/or 15170, such large gate valves shall be resilient-seated per this section. All valves shall have openings through the body of the same or greater cross-sectional area as that of the pipe to which they are attached.

B. Larger gate valves shall only be used for tapping valves or where specifically called out on the Contract Drawings.

C. All gate valves shall have cast or ductile iron body with non-rising stem and square nut operator suitable for buried service conforming to AWWA C509 or C515, as applicable.

D. Valve ends shall be mechanical joint (MJ) in accordance with AWWA C111 unless otherwise shown on the Drawings or Alpha-Romac restrained joint push-on joint valves. In no case shall non-MJ, push-on joint valves be provided.

E. Elastomers shall be Buna-N or EPDM.

F. The interior and exterior of all gate valves shall be epoxy coated at the factory by the valve manufacturer in accordance with AWWA C550 (6 - 8 mil average, 4 mil minimum).

G. Bolts and nuts shall be stainless steel for Bonnet, stuffing box, and wrench nut cap screw.

H. All valves shall be designed to operate in the vertical position, except as otherwise specified herein. Gate valve shall only be installed in a horizontal orientation when required by the Drawings or when approved in writing by the Owner due to insufficient available depth of cover to permit vertical orientation.

I. Valve shafts shall be suitably sized to transmit the torques required to operate the valve with the rated pressure on one side and atmospheric pressure on the other with appropriate safety factor.

J. Vertical gate valves 24-inch nominal size and larger shall be provided with spur gear operators.

K. All valves shall be NSF 61 and NSF 372 certified.

L. Valves shall open left unless otherwise indicated in Section 01011.

M. Large gate valves shall be provided with integral bypass valves when recommended by the manufacturer for the specified pressure rating.

N. All valves and restraints shall be produced solely in the United States. Manufacturers and models indicated in this section shall only be allowed if the valves are assembled and tested in the United States.

O. All valves furnished by the Contractor shall be obtained from a vendor approved by the Owner.

2.02 RESILIENT-SEATED GATE VALVES

A. Resilient-seated gate valves shall comply fully with AWWA C509 or C515 except as modified herein. Stems shall be made of a bronze alloy with low zinc content in accordance with AWWA C509 4.2.3.5.3 (2009) or C515 4.2.3.3.3 (2009). Stem seals shall be double or triple O-ring stem seals.

B. The valves shall be designed for a minimum working pressure of 250 psi and a differential pressure of 250 psi.

C. All valves shall be tested (Operation Test and Hydrostatic Tests) at the manufacturer's plant in accordance with AWWA C509 or C515, as applicable. Internal hydrostatic test pressure shall be at least 500 psi unless otherwise noted on the plans. Provide the Engineer with certified copies of all factory test reports prior to shipment. The Engineer reserves the right to observe all tests.

2.03 RESILIENT-SEATED GATE VALVES WITH RESTRAINED JOINTS

A. Resilient-seated gate valves shall comply fully with AWWA C509 or C515 except as modified herein. Stems shall be made of a bronze alloy with low zinc content in accordance with AWWA C509 4.2.3.5.3 (2009), C515 4.2.3.3.3 (2009), or 314 stainless steel. Stem seals shall be double or triple O-ring stem seals.

B. The valves shall be designed for a minimum working pressure of 250 psi and a differential pressure of 250 psi.

C. All valves shall be tested (Operation Test and Hydrostatic Tests) at the manufacturer's plant in accordance with AWWA C509 or C515, as applicable. Internal hydrostatic test pressure shall be at least 500 psi unless otherwise noted on the plans. Provide the Engineer with certified copies of all factory test reports prior to shipment. The Engineer reserves the right to observe all tests.

D. Grippers shall be ductile (nodular) iron, meeting or exceeding ASTM A 536, Grade 65-45-12. Machine sharpened and heat treat-ed. Xylan 1424 coated. Draw Hooks shall be uncoated 304 stainless steel; Ramp Runners shall be Nylon 66, Black, 14% Glass filled; coating for Center ring shall be Romacote fusion bonded epoxy, NSF 61 Certified. End rings are Romabond polyester. Bolts, nuts and hardware shall be 304 stainless steel.

2.04 HORIZONTALLY-ORIENTED GATE VALVES

Horizontally-oriented gate valves will only be permitted as indicated above.

A. Horizontally-oriented gate valves shall be resilient-seated valves as specified above conforming to the applicable requirements of AWWA C515 (as modified herein) and shall be designed and manufactured for horizontal installation. Unless otherwise approved in writing by the Engineer, horizontal valves shall be provided with bronze rollers housed in a bronze scraper on both sides of the wedge traveling in a Type 316 stainless steel track to clean the track when the valve is closing. Plastic wedges or scrapers are not acceptable. All horizontally-oriented gate valves shall have enclosed bevel gears, regardless of valve size.

2.05 INSERTION VALVES

A. Where shown on the Drawings or otherwise directed by the Owner, an insertion gate valve shall be installed on an existing pipeline. Insertion valves shall be in strict accordance with these requirements.

B. Insertion valves shall be resilient gate valves in conformance with AWWA C509 or C515 with a 250 psi pressure rating. Valves shall have ductile iron or stainless steel body and bonnet with a triple bonnet to body seal, including two O-rings above and one below the thrust collar. Ductile iron components Interior and exterior of the valve shall be coated with a minimum 10 mils fusion-bonded epoxy in compliance with AWWA C550 and certified to NSF 61. Insertion valves resilient wedge shall be materials specified in AWWA C509, C515 or reinforced EPDM. Insertion valves shall also meet the other requirements specified herein for resilient-seated gate valves.

C. Insertion valves and equipment used for installation shall be capable of installation while the pipeline is under pressure without interrupting the flow of water. Valve and equipment shall include a means of inspecting and cleaning the seating surface under pressure. Once installed, valve shall provide a clear, unobstructed waterway. Valve shall be operational in unbalanced pressure conditions; pressure equalization shall not be necessary to open the valve.

D. Valve gate shall be fully encapsulated in rubber, shall operate within body channels that guide the gate, and shall seal against the valve body without ever touching the host pipe. Valves that seal against the pipe shall not be acceptable.

E. The bonnet shall have a triple O-ring seal around the stem.

F. All moving parts of the valve shall be replaceable without depressurizing the main.

G. Valve shall be compatible with the existing pipe material, shall have mechanical joint ends conforming to AWWA C111, and shall be permanently restrained to the pipe at both ends with split restrained mechanical joint glands conforming to the requirements of Section 15130. Valve connection shall allow for removal/replacement of the downstream pipe with the valve closed without removing pressure from the upstream side of the valve.

2.06 ACCEPTABLE MANUFACTURERS

A. Resilient Seated Gate Valves:

1. Mueller Company, Decatur, Illinois;
2. McWane, Inc. (Clow, Kennedy, and M&H Divisions) Oskaloosa, Iowa, Corona, California, Elmira, New York, and Anniston, Alabama, respectively;
3. United State Pipe Decatur, Illinois;
4. American Flow Control, Birmingham, Alabama;

B. Resilient Seated Gate Valves with Restrained Joints:

1. Romac Industries, Inc. ALPHA restrained joint by American Flow Control, Birmingham, Alabama.

C. Horizontally-oriented Gate Valves

1. McWane (Clow, Kennedy, and M&H Divisions)
2. American Flow Control, Birmingham, Alabama;

D. Insertion Valves

1. InsertValve by Team Industrial Services
2. Insta-Valve 250 Patriot™ by Hydra-stop, 8-inch diameter and smaller.

PART 3: EXECUTION

3.01 INSTALLATION

A. Prior to installation, inspect valves for direction of opening, freedom of operation, tightness of pressure containing bolting, cleanliness of valve ports and seating surfaces, handling damage, and cracks. Correct defective valves or hold for inspection by the Engineer.

B. Install the valves in strict accordance with the requirements contained in Section 15000 and detail drawings. All gate valves shall be restrained in accordance with Sections 15000, 15105, 15120, 15125, and 15130, as applicable.

C. Set valve and join to the pipe in the manner specified in Sections 15105, 15120, 15125, and 15130, as applicable. Provide crushed stone and concrete pads as shown on Owner's Standard Detail Drawings for valve installation, so that the pipe is not supporting the weight of the valve. Do not use valves to bring misaligned pipe into alignment during installation. Set valve plumb with operating nut facing straight upward.

D. Insertion valves shall be installed in accordance with the manufacturer's recommendations by a company authorized by the manufacturer. After installation of the valve body on the pipe, a pressure test of 1.5 times the working

pressure shall be sustained for at least 15 minutes prior to proceeding with the installation. If the valve body is repositioned, the test shall be repeated. The tapping machine shall remove a complete spool piece of the pipe intact. Flow through the pipe shall not be interrupted at any time throughout installation of the valve unless authorized in writing by the Owner. Seating surface shall be inspected and cleaned under pressure to ensure a clean seat.

E. Make all valves tight under their working pressures after they have been placed and before the main is placed in operation. Any defective parts shall be replaced at the Contractor's expense.

F. Provide a valve box for each valve per Section 15130. Set the top of the valve box neatly to existing grade, unless directed otherwise by the Engineer. Do not install in a way that allows the transfer shock or stress to the valve. Center and plumb the box over the wrench nut of the valve. Tracer wire shall be terminated at the valve box and extended to grade. Refer to Owner's Standard Detail Drawing for a typical valve box installation.

G. Valve shall be polyethylene encased, per Section 15130 prior to backfill. The polyethylene encasement shall be installed up to the operating nut and over the lower portion of the valve box leaving the operating nut exposed and free to be operated within the valve box.

H. Provide valve marking posts and concrete pads at locations designated by the Engineer and as shown on Owner's Standard Detail Drawing for typical valve box installation.

3.02 PROTECTION

A. If polyethylene encasement is applied to the pipe, the entire valve shall be encased in polyethylene encasement per Section 15130 prior to backfill. The polyethylene encasement shall also encase the valve box up to the operating nut level, leaving the operating nut exposed and free to be operated within the valve box.

END OF SECTION

SECTION 15155

BUTTERFLY VALVES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to install and test all buried butterfly valves as indicated on the Drawings and as specified within this section. Contractor shall furnish retaining glands and other related components not furnished by the Owner. Contractor shall fully furnish and install butterfly valves that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

B. This section does not apply to butterfly valves to be installed above ground or otherwise exposed.

1.02 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, Operating and Maintenance Manuals, and certifications for all products furnished under this section in accordance with Section 01300. Shaft and operator orientation of each valve shall be clearly indicated on the Shop Drawings. Also, Shop Drawings shall include end clearance dimensions when the disc is in the full open position.

1.03 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 01700 Project Closeout

G. Section 02210 Trenching, Backfilling and Compacting

H. Section 02558 Identification/Location Guide

I. Section 15000 Piping - General Provisions

J. Section 15020 Disinfecting Pipelines

K. Section 15025 Flushing and Cleaning Pipelines

L. Section 15030 Pressure and Leakage Tests

M. Section 15105 Ductile Iron Piping and Fittings

N. Section 15125 High Density Polyethylene (HDPE) Pipe

O. Section 15130 Piping Specialties

1.04 REFERENCES

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. AWWA C504 – Rubber-Seated Butterfly Valves, 3 In. Through 72 In.

B. AWWA C550 – Protective Interior Coatings for Valves and Hydrants

C. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

D. NSF/ANSI 61 Drinking Water System Components – Health Effects

E. NSF/ANSI 372 Drinking Water System Components – Lead Content

PART 2: PRODUCTS

2.01 GENERAL—RUBBER-SEATED BUTTERFLY VALVES

A. Unless otherwise indicated on the Contract Drawings and/or in Section 01011, all valves 16” and larger shall be butterfly valves per this section, except for tapping valves, which shall be gate valves per Sections 15150 and 15170.

B. Valve ends shall have integrally-cast mechanical joint (MJ) ends in accordance with AWWA C111 unless otherwise shown on the Drawings. In no case shall non-MJ, push-on joint valves be provided.

C. Valve (or at least all valve components in contact with the water) shall be NSF 61 and NSF 372 certified.

D. Shaft orientation of butterfly valves shall be as specified in Part 3 of this section.

E. Manual buried operators shall be either worm gear or traveling nut type and shall be furnished with 2-inch square AWWA operator nuts suitable for buried service. All operators shall be fully-gasketed and grease packed and designed to withstand submersion in water to 10 psi. Operators shall require a minimum of 30 turns for 90 degrees or full stem valve travel. The capacity of the manual operator shall be adequate to drive the valve under a differential pressure equal to the valve's pressure rating and at maximum anticipated flow. Input required at nuts to produce required output torque shall be less than 150 ft.-lbs. Operators shall be designed to withstand an input at the nut of at least 450 ft.-lbs. without damage to any operator components.

F. Valves shall open left unless otherwise indicated in Section 01011.

G. Butterfly valves shall be tight-closing, rubber-seated and shall fully conform to AWWA C504 except as modified herein.

H. Valves shall meet the full structural requirements of the applicable class of AWWA C504. Butterfly valves shall be Class 150B unless otherwise indicated on the Drawings and/or in Section 01011.

I. All butterfly valves bodies shall be ductile iron (conforming to ASTM A536, Grade 65-45-12) or gray cast iron (conforming to ASTM A126, Grade B) with thicknesses strictly in accordance with AWWA C504.

J. Valve disc shall be ductile iron (conforming to ASTM A536, Grade 65-45-12) or cast iron (conforming to either ASTM A126, Grade B or ASTM A48, Class 40C) and shall have ASTM A276 Type 316 stainless steel edges (seating surfaces). All disc seating edges shall be smooth and polished. Disc shall rotate a full 90-degrees from the tight shut position to the full open position.

K. The interior and exterior of all butterfly valves (including the disc) shall be epoxy coated at the factory by the valve manufacturer in accordance with AWWA C550 (6 - 8 mil average, 4 mil minimum).

L. Valve bearings shall be permanently self-lubricating nylon sleeves or Teflon PTFE-lined sleeves with non-metallic backing. The shaft seal shall be self-adjusting, self-compensating type, monolithic V-Type packing. Packing shall be as manufactured by Chevron, or equal.

M. Valves shall be intended for buried service and designed to allow valve operation after long periods of inactivity without damage to the valve or leakage. Valves shall be mounted with all Type 316 stainless steel nuts, bolts, and other hardware.

N. All valves shall be tested (performance tests, leakage tests, and hydrostatic tests) at the manufacturer's plant in accordance with AWWA C504. Internal hydrostatic test pressure shall be at least twice the rated pressure. Provide the Engineer with certified copies of all factory test reports prior to shipment. The Engineer reserves the right to observe all tests.

O. All valves and restraints shall be produced solely in the United States. Manufacturers and models indicated in this section shall only be allowed if the valves are assembled and tested in the United States.

P. All valves furnished by the Contractor shall be obtained from a vendor approved by the Owner.

2.02 RUBBER-SEATED BUTTERFLY VALVES SMALLER THAN 24-INCH SIZE

A. Valve seats shall be bonded-in, recess-mounted Buna-N or EPDM seats meeting the test procedures outlined in ASTM D-429 Method B and must be simultaneously molded in, vulcanized, and bonded to the body and the seat.

B. Valve shaft shall consist of a one-piece unit constructed of 18-8 Type 304 stainless steel and extending full-size through the discs and bearings. Shaft diameter shall be in accordance with Table 3 of AWWA C504 at a minimum and shall be suitably sized to transmit the torques required to operate the valve with the rated pressure on one side and atmospheric pressure on the other with appropriate safety factor. Valve disc shall be securely attached to the shaft by means of conservatively-sized stainless steel pins, mechanically secured. O-ring seal shall be provided on pin if required to prevent leakage.

C. The valve assembly shall be designed to ensure centering of the disc in the body with positive disc alignment without play at all times.

2.03 RUBBER-SEATED BUTTERFLY VALVES 24-INCH AND LARGER SIZE

A. Disc shall be of the “offset” design to provide a full 360-degree seating surface with no external ribs transverse to flow.

B. Valve seats shall be Buna-N or EPDM recess-mounted and securely fastened in the valve body by mechanical means without use of devices located in the flow stream. Any required seat attachment hardware shall be 316 stainless steel (neither snap rings nor spring loaded retainer rings are permitted). Mechanically-fastened seats shall be capable of being replaced in the field without removing the valve from the line or moving the disc along the shaft axis. Bonded-in seats will not be permitted.

C. Valve shall utilize a two-piece “stub-shaft” constructed of 18-8 Type 304 stainless steel. Shaft diameter shall be in accordance with Table 3 of AWWA C504 at a minimum and shall be suitably sized to transmit the torques required to operate the valves with the rated pressure on one side and atmospheric pressure on the other with appropriate safety factor. Valve disc shall be securely attached to the shaft by means of conservatively-sized stainless steel pins, mechanically secured. O-ring seal shall be provided on pin if required to prevent leakage.

D. Valve bodies shall have integral trunnions for housing shaft bearings and seals. The valve assembly shall be furnished with a factory set two-way thrust bearing designed to center the valve disc in the valve seat at all times. Thrust bearing assembly shall be fastened to the bottom of the valve shaft with 316 stainless

steel hardware that is not exposed to the fluid, and thrust-collar cavity shall be packed with grease and fully gasketed to prevent leakage.

2.04 ACCEPTABLE MANUFACTURERS

A. Henry Pratt Co. (Groundhog MJ X MJ)

B. Mueller Co. (Lineseal III, Catalog No. 3211-20 or 3211-23)

C. DeZurik (Bulletin 43 BAW style, MJ ends)

D. No other manufacturers shall be allowed unless otherwise indicated in Section 01011.

PART 3: EXECUTION

3.01 INSTALLATION

A. Prior to installation, inspect valves for direction of opening, freedom of operation, tightness of pressure containing bolting, cleanliness of valve ports and seating surfaces, handling damage, and cracks. Correct defective valves or hold for inspection by the Engineer.

B. Butterfly valves shall be installed in strict accordance with the requirements of AWWA C504, Section 15000, and this section. All butterfly valves shall be restrained in accordance with Sections 15000, 15105, 15120, 15125, and 15130, as applicable.

C. Set valve and join to the pipe in the manner specified in Sections 15105, 15120, 15125, and 15130, as applicable. Provide crushed stone and concrete pads as shown on Owner's Standard Detail Drawings for valve installation, so that the pipe is not supporting the weight of the valve. Do not use valves to bring misaligned pipe into alignment during installation.

D. If a combination of Class 150B and Class 250B valves are used on the same Contract, Contractor shall ensure that the appropriate valve class is used in each location as shown on the Drawings or directed by the Engineer.

E. Butterfly valves installed in horizontal piping shall be installed with the shaft in a horizontal orientation unless otherwise shown on the Drawings, required by this section or Section 01011, or directed by the Engineer. Set valve plumb with operating nut facing straight upward.

F. Where a butterfly valve is installed in proximity to a pipe bend(s), the valve shall be installed at least two (2) pipe diameters upstream of the bend(s). Butterfly valves installed downstream of a bend(s) shall be located at least five (5) pipe diameters away from the nearest bend. If a butterfly valve is installed downstream of a vertical bend and within five (5) pipe diameters, the valve shall be installed with the shaft in a vertical orientation.

G. Make all valves tight under their working pressures after they have been placed and before the main is placed in operation. Any defective parts shall be replaced at the Contractor's expense.

H. Provide a valve box for each valve per Section 15130. Set the top of the valve box neatly to existing grade, unless directed otherwise by the Engineer. Do not install in a way that allows the transfer shock or stress to the valve. Center and plumb the box over the wrench nut of the valve. Tracer wire shall be terminated at the valve box and extended to grade. Refer to Owner's Standard Detail Drawing for a typical valve box installation.

I. Valve shall be polyethylene encased, per Section 15130 prior to backfill. The polyethylene encasement shall be installed up to the operating nut and over the lower portion of the valve box leaving the operating nut exposed and free to be operated within the valve box.

J. Provide valve marking posts and concrete pads at locations designated by the Engineer and as shown on Owner's Standard Detail Drawing for typical valve box installation.

3.02 PROTECTION

A. If polyethylene encasement is applied to the pipe, the entire valve shall be encased in polyethylene encasement per Section 15130 prior to backfill. The polyethylene encasement shall also encase the valve box up to the operating nut level, leaving the operating nut exposed and free to be operated within the valve box.

END OF SECTION

SECTION 15170

TAPPING SLEEVES, SADDLES AND VALVES

PART 1: GENERAL

1.01 SCOPE OF WORK

The Work under this section consists of providing all labor, materials, tools, equipment, and services required to install and test all tapping sleeves, tapping valves, and tapping saddles as indicated on the Drawings and as specified within this section. Contractor shall furnish and install all materials specified under this section that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

1.02 SUBMITTALS

Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, certifications and other required submittals for all products furnished under this section in accordance with Section 01300.

1.03 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 02025 Existing Utilities and Structures

G. Section 02210 Trenching, Backfilling and Compacting

H. Section 15000 Piping - General Provisions

I. Section 15030 Pressure and Leakage Tests

J. Section 15105 Ductile Iron Piping and Fittings

K. Section 15120 Polyvinyl Chloride (PVC) Pipe

L. Section 15125 High Density Polyethylene (HDPE) Pipe

M. Section 15130 Piping Specialties

N. Section 15150 Gate Valves

O. Section 15200 Service Lines

1.04 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. AWWA C110 – Ductile-Iron and Gray-Iron Fittings

B. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

C. AWWA C207 – Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In.

D. AWWA C550 – Protective Interior Coatings for Valves and Hydrants

E. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances

F. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

G. AWWA C800 – Underground Service Line Valves and Fittings

H. AWWA Manual M9 – Concrete Pressure Pipe

I. ASTM A182 – Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service

J. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

K. ASTM A285 – Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength

L. ASTM A380 – Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

M. ASTM A536 - Standard Specification for Ductile Iron Castings

N. ASTM A743 – Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

O. ASME / ANSI B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300

P. ASME/ANSI B16.5 - Pipe Flanges and Flanged Fittings

Q. ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (Inch)

R. ANSI MSS SP-60 – Connecting Flange Joints Between Tapping Sleeves and Tapping Valves

S. NSF/ANSI 61 Drinking Water System Components – Health Effects

T. NSF/ANSI 372 Drinking Water System Components – Lead Content

U. *Tapping Guide for PVC Pressure Pipe*, UNI-PUB-8, Uni-Bell PVC Pipe Association.

PART 2: PRODUCTS

2.01 GENERAL

A. Taps 2-inch nominal diameter and smaller may be made with either a tapping sleeve or tapping saddle, unless otherwise indicated on the Drawings and/or specified in Section 01011. Neither tapping saddles nor outlet-seal tapping sleeves are permitted for taps 3-inch diameter or larger, which require a tapping sleeve with a full-circumference seal around the existing pipe.

B. All tapping sleeves shall be stainless steel with flanged joint branch outlet unless otherwise indicated on the Drawings and/or specified herein or in Section 01011. All taps the same nominal size as the pipe to be tapped (i.e. size-on-size) on pipe larger than 12-inch diameter shall be made with cast iron/ductile iron (mechanical joint) tapping sleeves as specified herein. Stainless steel tapping sleeves shall not be permitted for size-on-size taps larger than 12-inch.

C. Except as otherwise specified or indicated on the Drawings, all tapping saddles (2-inch and smaller) shall be designed for a minimum working pressure of 150 psi. All tapping sleeves shall be designed for a minimum working pressure of 200 psi for 12-inch and smaller and at least 150 psi for larger than 12-inch.

D. All tapping sleeves and saddles shall be appropriate for the existing pipe material, outside diameter, and condition. Mechanical tapping saddles are not allowed on HDPE piping. Refer to Section 15125 for fusion saddle requirements.

E. A ¾-inch NPT test nipple and plug shall be provided on each tapping sleeve (½-inch NPT for cast iron/ductile iron tapping sleeves) in compliance with ANSI/ASME B1.20.1 to allow pre-testing of the sleeve assembly before making the tap.

F. All gaskets and seals shall be formed from vulcanized EPDM or Buna-N (NBR) with antioxidant ingredients to resist swelling and set after installation. No reclaimed or recycled materials shall be used.

G. All tapping sleeves and saddles shall be NSF 61 and NSF 372 certified.

H. Markings: Each sleeve shall bear indelible markings, stenciled, coded or marked in a satisfactory manner to indicate:

1. Manufacturers name
2. Part Number
3. Date of manufacture
4. Serial Number – metal stamp on edge of flange
5. Rated Working Pressure
6. Test Pressure
7. Certified to ANSI/NSF-61
8. U/L Stamp Approval for all Materials

I. Quality control & Testing: Quality control procedures shall be employed to insure that the shell, gaskets, lug, armor plate, gasket and related hardware are manufactured to be free of any visible defects. All sleeves shall have been factory tested to 1.5 times the rated working pressure.

J. Warranty: The manufacturer shall warrant the sleeves to be free from defects and perform as advertised for a period of 10 years from the date of manufacture.

K. The following table indicates the allowable branch connection types, including the allowable application of the various types of tapping saddles and sleeves specified herein, based on the nominal size of the main to be tapped and the nominal branch/tap size. Other connection methods and/or application of tapping saddles and sleeves shall only be used if authorized in writing by the Owner.

<table>
<tr><th colspan="7">Allowable Branch Connection Types</th></tr>
<tr><th rowspan="2">Main Size (Nominal-inches) and Material</th><th colspan="6">Branch/Tap Size (Nominal, inches)</th></tr>
<tr><th>½ to 1</th><th>1½ to 2</th><th>3</th><th>4 - 12</th><th>>= 16 (smaller than main)</th><th>>= 16 (size-on-size)</th></tr>
<tr><td>2 (PE)</td><td colspan="2">2.05 or brass tee*</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>3 (HDPE)</td><td colspan="2" rowspan="2">side-fusion or electrofusion saddle*</td><td rowspan="2">HDPE branch saddle*</td><td rowspan="2">HDPE branch saddle*</td><td>N/A</td><td>N/A</td></tr>
<tr><td>>= 4 (HDPE)</td><td>Owner approval required</td><td>Owner approval required</td></tr>
<tr><td>4 – 12 (PVC)</td><td>2.02 or 2.03</td><td>2.02, 2.03, or 2.05</td><td>2.05</td><td>2.05</td><td>N/A</td><td>N/A</td></tr>
<tr><td>4 – 12 (CI/DIP)</td><td rowspan="2">direct tap, 2.02, 2.03, 2.06</td><td rowspan="2">2.02, 2.03, 2.05, 2.06</td><td>2.05</td><td>2.05</td><td>N/A</td><td>N/A</td></tr>
<tr><td>>= 16 (CI/DIP)</td><td>2.05</td><td>2.05</td><td>2.05</td><td>2.04</td></tr>
<tr><td colspan="7">* In accordance with Sections 15125 and 15200.</td></tr>
<tr><td rowspan="5">Connections Types Specified in this Section:</td><td colspan="6">2.02 = Tapping Saddle – Ductile Iron</td></tr>
<tr><td colspan="6">2.03 = Tapping Saddle – Stainless Steel</td></tr>
<tr><td colspan="6">2.04 = Tapping Sleeve – Cast Iron/Ductile Iron (MJ)</td></tr>
<tr><td colspan="6">2.05 = Tapping Sleeve – Stainless Steel</td></tr>
<tr><td colspan="6">2.06 = Tapping Saddle – Brass</td></tr>
</table>

2.02 TAPPING SADDLES – DUCTILE IRON

A. Tapping saddles shall only be used for taps 2-inch diameter and smaller. Taps 1-inch diameter and smaller in ductile iron pipe may be direct tapped without a tapping saddle except when otherwise required by the Specifications.

B. Saddles shall have either threaded or flanged outlets as required for the application.

C. Ductile iron tapping saddles shall consist of ductile iron outlet casting, attached to the pipeline with one or two wide, high strength stainless steel strap(s). Tapping saddles shall be manufactured and tested in accordance with applicable parts of AWWA C800. Body shall be high strength ductile iron conforming to ASTM A536 or A395. Castings shall be sealed to pipeline with a heavy-duty rubber o-ring or gasket conforming to ASTM-D2000. All saddles shall be sized for the specific piping application. One side of the saddle shall have closed bolt lugs, and the other side may have open or closed bolt lugs. The ductile iron body and lugs shall be finished with factory epoxy coating.

D. Threaded outlets shall conform to AWWA C800 for high pressure class. Flanged outlets shall conform to AWWA C110 and ANSI B16.42, shall be counter bored and compatible for use with tapping valves and tapping equipment.

E. Bolts, washers, and nuts shall be as specified below.

F. Acceptable manufacturers and models (Only threaded models are listed here; if flanged saddle is required, Contractor shall submit comparable model for approval.):

1. Mueller (DR1S or DR2S)
2. JCM Industries (Models 403 and 404)
3. Ford (Style FS101, FS202, or FSD202)
4. Romac Industries (Model 101S)
5. Cascade (Style CNS).

2.03 TAPPING SADDLES – STAINLESS STEEL

A. Tapping saddles shall only be used for taps 2-inch diameter and smaller. Saddles shall have either threaded or flanged outlets as required for the application.

B. Stainless steel tapping saddles shall consist of a Type 304 (18-8) stainless steel shell (either one or two piece) and Type 304 stainless steel tapped outlet. Tapping saddles shall be manufactured and tested in accordance with applicable parts of AWWA C800. All metal surfaces shall be passivated after fabrication in compliance with ASTM A380. Shell shall be sealed to pipeline with a heavy-duty rubber o-ring or gasket conforming to ASTM-D2000. All saddles shall be sized for the specific piping application. Saddle shall have closed bolt lugs, and the other side may have open or closed bolt lugs.

C. Threaded outlets shall conform to AWWA C800 for high pressure class. Flanged outlets shall conform to ANSI B16.5 and shall be counter bored and compatible for use with tapping valves and tapping equipment.

D. Each saddle shall be stenciled, coded or marked in a satisfactory manner to identify the size range. The markings shall be permanent type, water resistant, that will not smear or become illegible.

E. Bolts, washers, and nuts shall be as specified below.

F. Acceptable manufacturers and models (Only threaded models are listed here; If flanged saddle is required, Contractor shall submit comparable model for approval.):

1. Ford (Style FS300),
2. Cascade (Style CS or CSC).

2.04 TAPPING SLEEVES – CAST IRON/DUCTILE IRON (MECHANICAL JOINT)

A. Cast iron/ductile iron tapping sleeves are required for size-on-size taps 16-inch diameter and larger unless otherwise indicated on the Drawings and/or specified in Section 01011. Cast iron/ductile iron tapping sleeves shall not be used for other taps unless authorized in writing by the Owner.

B. Cast iron/ductile iron tapping sleeves shall be solid-body mechanical joint cast iron (or ductile iron) meeting ASTM A536 with full-circumference O-Ring type gaskets at each end and side seal gaskets. The sleeves shall be made in two halves which can be assembled and bolted around the main. Split-ring mechanical joint retaining glands (per Section 15130) shall be used to secure the gasket at each end of the sleeve and restrain the sleeve to the pipe.

C. Cast iron/ductile iron tapping sleeves shall have a working pressure rating of 150 psi minimum.

D. All sleeves shall include the end joint accessories and split glands necessary to assemble sleeve to pipe.

E. Test Plug Outlet and Plug: The test plug shall be ½-inch minimum NPT threaded 304 brass plug.

F. Bolts, washers, and nuts shall be as specified below.

G. Cast iron sleeves shall be factory epoxy coated inside and out.

H. Acceptable manufacturers and models:

   a. U.S. Pipe / Mueller (Catalog number H-615, H-616, or H-619)

   b. American Flow Control (Series 2800 ductile iron)

2.05 TAPPING SLEEVES – STAINLESS STEEL

A. The entire fitting, including the outlet and outlet flange, shall be stainless steel type 304 (18-8). A 14 gauge minimum Type 304 stainless armor plate shall be vulcanized into the gasket to span the lug area. The body, lug, and gasket armor plate shall be in compliance with ASTM A240. All metal surfaces, including welds, shall be fully chemically passivated after fabrication in compliance with ASTM A380.

B. All stainless steel tapping sleeves shall be provided with integral flanged joint outlets. Outlet shall be a one-piece Type 304 stainless steel casting provided with an outlet flange that is either integral to the outlet or welded to the outlet with outside seam MIG weld and inside seam TIG weld. Outlet flange shall be in conformance with AWWA C207 Class D (175 – 150 psi), ANSI B16.5 Class 150 and either ASTM A240 or ASTM A743 and shall be compatible with AWWA C110/ANSI 21.10 flange to accept a flanged by mechanical joint (FL X MJ) gate valve and may be recessed per MSS SP-60. Tapping sleeve (including flanged outlet) shall be suitable for use with the tapping/gate valve to be used..

C. Shell: Top shell (branch side) shall be Type 304 stainless steel 11 gauge minimum. Back shell shall be Type 304 stainless steel 14 gauge minimum.

D. The sleeve construction shall provide a positive means of preventing gasket cold flow and/or extrusion.

E. Bolt Lugs and Bolts, Washers, Nuts: The bolt lugs shall be 7 gauge minimum MIG welded (GMAW) to the shell at all contact points. The lug shall have a pass-through, removable-bolt design to avoid alignment problems. Finger lug designs are not approved, and bolts shall NOT be integrally welded to the sleeve. Tapping sleeve shall have a lug design similar to the approved models listed below. Bolts and washers shall be T-304 SST 5/8-11. Nuts shall be T-304 SST with factory-applied internal anti-seize coating to prevent galling.

F. Test Plug Outlet and Plug: The test plug outlet shall be ¾-inch NPT threaded type 304 stainless steel with brass plug. Stainless steel plugs shall not be used in stainless steel tapping sleeves unless approved by the Engineer and unless an anti-seize coatings and Teflon tape is used to prevent galling.

G. Shell Gasket: The gasket shall be virgin SBR with ¼-inch grid-pattern design and provide a complete 360 degree watertight sealing surface around the pipe. Size and shape to provide an adequate compressive force against the pipe to insure a positive seal under all combinations of joint and gasket tolerances. Section of gasket that bridges gap between shells shall have a T-304 SST armor. Armor shall be 3-inch minimum width and shall extend the full length of the sleeve. Armor to be TIG welded (GTAW) to the branch shell.

H. Branch Gasket: Shall be Virgin SBR with double O-ring and hydraulic lip. Gasket shall have Type 304 stainless steel ring insert molded within to prevent radial expansion under pressure. Gasket shall have twin O-ring seals on backside for protection.

I. Tapping Sleeve units for concrete, steel cylinder pipe shall be furnished with load bearing setscrews on the gland flange to transfer loads on the outlet away from the steel cylinder and onto the sleeve.

J. If required on the Drawings or in Section 01011, unit shall be protected by electrostatically applied baked epoxy or polyurethane.

K. Acceptable manufacturers and models:

1. Mueller (Catalog No. H-304),
2. JCM Industries (Model 432),
3. Ford (Style FTSAS),
4. Romac Industries (Model SSTIII), (Style 304 for 2-inch PE)
5. Cascade (Style CST-EX).

2.06 TAPPING SADDLES – BRASS

L. Tapping saddles shall only be used for taps 2-inch diameter and smaller. Taps 1-inch diameter and smaller in ductile iron pipe may be direct tapped without a tapping saddle except when otherwise required by the Specifications.

M. Saddles shall have threaded outlets as required for the application.

N. Brass tapping saddles shall attach to the pipeline with two wide, high strength bronze straps. Tapping saddles shall be manufactured and tested in accordance with applicable parts of AWWA C800. Castings shall be sealed to pipeline with a heavy-duty rubber o-ring or gasket conforming to ASTM-D2000. All saddles shall be sized for the specific piping application. One side of the saddle shall have closed bolt lugs, and the other side may have open or closed bolt lugs.

O. Threaded outlets shall conform to AWWA C800 for high pressure class.

P. Bolts, washers, and nuts shall be brass.

Q. Acceptable manufacturers and models

1. Ford (Style 202BS-Brass)
2. Or Approved Equal

2.07 TAPPING VALVES

A. Except as modified in this section, all tapping valves 3-inch nominal diameter and larger shall be gate valves fully complying with Section 15150. All tapping gate valves shall have ductile iron bodies (no gray cast iron). All tapping valves (i.e. corporation stops) 2-inch nominal diameter and smaller shall comply with Section 15200.

B. All tapping gate valves shall be flanged end by mechanical joint end (FL X MJ) unless otherwise indicated on the Drawings.

C. Flanged tapping gate valves with an alignment ring conforming to MSS-SP 60 shall be provided with an alignment ring. The tapping sleeve used shall be provided with a compatible recessed outlet flange.

D. Tapping gate valves (3-inch and larger) shall be designed for a minimum differential pressure of 250 psi, as specified in Section 15150. Smaller diameter tapping valves shall be designed for a minimum differential pressure of 150 psi.

E. Tapping valves shall have an opening larger than the nominal diameter of the tap to accept a full-size shell cutter.

F. Acceptable manufacturers and models

a. Mueller Company, Decatur, Illinois;

b. McWane, Inc. (Clow, Kennedy, and M&H Divisions) Oskaloosa, Iowa, Corona, California, Elmira, New York, and Anniston, Alabama, respectively;

c. United State Pipe Decatur, Illinois;

d. American Flow Control, Birmingham, Alabama;

2.08 BOLTS

A. All bolts shall have American Standard heavy hexagonal head and nut dimensions all as specified in ANSI B18.2, except for stainless steel tapping sleeves designed for use with carriage bolts.

B. Bolts, nuts and washers for stainless steel tapping sleeves and saddles shall be high strength, type 304 (18-8) stainless steel. Stainless steel bolts and nuts shall be factory coated to prevent galling.

C. Bolts, nuts and washers for ductile and gray cast iron tapping sleeves and saddles shall be high strength, Xylan or FluoroKote #1 suitable for direct bury in corrosive soils as specified in Sections 15105 and 15130.

D. Bent or damaged bolts will be rejected.

PART 3: EXECUTION

3.01 SITE INVESTIGATION

A. Upon providing the required advance notice to the Owner and receiving authorization, Contractor shall excavate the existing pipe at the proposed tap location prior to ordering the tapping sleeve or saddle.

B. Contractor shall fully expose the pipe within the limits of the proposed tapping sleeve or saddle and shall verify the type of existing pipe, the outside diameter, roundness, and condition of the pipe on which the tapping sleeve/saddle is to be installed.

C. If any existing joint, fitting, tap, or other obstruction is located at the proposed tap location, the Contractor shall coordinate with the Engineer to determine the appropriate adjustment to the proposed tap location.

3.02 INSTALLATION

A. Only wet taps (with the existing water main under pressure) shall be permitted. Operating conditions (e.g. flow rates, operating pressure, etc.) shall be confirmed with the Owner or Engineer prior to ordering materials. Equipment and methods used to perform the tap shall be appropriate for the operating conditions.

B. Install the tapping sleeves, saddles, and valves in strict accordance with the manufacturers' instructions and requirements of Section 15000. Tapping

sleeve/saddle outlets shall be installed horizontal and level unless otherwise approved by the manufacturer and Engineer.

C. Contractor shall ensure compatibility of tapping valve and tapping sleeve prior to installation. Contractor shall properly assemble tapping valve to sleeve or saddle and assure proper alignment between the sleeve/saddle and valve to ensure proper passage of the cutter during the tapping procedure.

D. All bolts and nuts shall be kept clean and shall be handled carefully. Bolts and nuts shall be kept free of nicks and shall not be tossed or thrown. Bolts/nuts shall not be over-torqued. Pneumatic wrenches shall not be used unless approved by the sleeve/saddle manufacturer. Stainless steel bolts and nuts shall be assembled with an anti-seize coating to prevent galling.

E. The tapping procedure shall be completed in accordance with the tapping machine manufacturer's instructions. Unless otherwise approved by the Engineer, a full-size shell cutter (i.e. equal to or larger than the tap nominal diameter) shall be used.

F. Taps on prestressed concrete cylinder pipe (PCCP) shall be made by the pipe manufacturer or other Subcontractor experienced in tapping PCCP and authorized by the Engineer. Tapping of PCCP shall be in full accordance with the pipe manufacturer’s recommendations, and tapping sleeves/saddles shall be compatible with PCCP.

G. Taps on asbestos cement (A-C) pipe require appropriate protective equipment and special procedures not addressed herein. Only properly certified and experienced individuals employed by a properly licensed Subcontractor may make taps on A-C pipe.

3.03 PROTECTION

A. The entire sleeve and valve assembly shall be encased in polyethylene encasement per Section 15130 prior to backfill.

3.04 PRELIMINARY TESTING

A. Perform a hydrostatic test of the tapping sleeve and valve assembly in accordance with Section 15030 after installation of the tapping sleeve and valve, but prior to making the tap. The test shall be made with the valve open using a tapped mechanical joint cap. No leakage is acceptable. The test pressure shall be maintained for a minimum of 15 minutes.

B. Perform hydrostatic test of tapping saddles as recommended by the manufacturer.

END OF SECTION

SECTION 15180

FIRE HYDRANTS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to install fire hydrants at the locations shown on the Drawings (or where designated by the Engineer) and as specified within this section and related sections of the Specification. Contractor shall install all fire hydrants and accessories furnished by the Owner; Contractor shall provide (both furnish and install) all fire hydrants and accessories that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

1.02 COORDINATION

A. Contact the local water district and obtain written fire hydrant mechanical details (including number and sizes of hose and pumper nozzle outlets) for the water district prior to ordering any fire hydrants for the Work.

1.03 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, Operating and Maintenance Manuals, certifications, and other required submittals for all products furnished under this section in accordance with Section 01300.

1.04 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01500 Temporary Facilities

F. Section 01600 Products

G. Section 01700 Project Closeout

H. Section 02025 Existing Utilities and Structures

I. Section 02210 Trenching, Backfilling and Compacting

J. Section 02558 Identification/Location Guide

K. Section 15000 Piping – General Provisions

L. Section 15020 Disinfecting Pipelines

M. Section 15025 Flushing and Cleaning Pipelines

N. Section 15030 Pressure and Leakage Tests

O. Section 15105 Ductile Iron Pipe and Fittings

P. Section 15130 Piping Specialties

Q. Section 15150 Gate Valves

R. Section 15185 Abandonment of Mains and Hydrants

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASME / ANSI B18.2 - Square and Hex Bolts and Screws (Inch Series)

B. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength

C. AWWA C104 / ANSI A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

D. AWWA C105 / ANSI A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems

E. AWWA C110 / ANSI A21.10 - Ductile-Iron and Gray-Iron Fittings

F. AWWA C111 / ANSI A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

G. AWWA C116 / ANSI A21.16 - Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

H. AWWA C150 / ANSI A21.50 - Thickness Design of Ductile-Iron Pipe

I. AWWA C151 / ANSI A21.51 - Ductile-Iron Pipe, Centrifugally Cast

J. AWWA C153 / ANSI A21.53 - American National Standard for Ductile-Iron Compact Fittings

K. ANSI/AWWA C502 Dry-Barrel Fire Hydrants

L. ANSI/AWWA C550 Protective Interior Coatings for Valves and Hydrants

M. AWWA C600 - AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances

PART 2: PRODUCTS

2.01 MATERIALS

A. All fire hydrants shall be ductile and/or gray cast iron and conform to the requirements of AWWA C502, traffic-model break-away type fire hydrants. The hydrant shall be break-away traffic flange, 5-1/4" valve opening, 6" mechanical joint pipe connection.

B. Fire hydrants shall be rated for at least 250 psi operating pressure and tested to 500 psi.

C. Hydrants shall be 3-way outlet unless otherwise required. The number and sizes of hose and pumper nozzle outlets is dependent on the local regulation. (Most typical is two (2) bronze male threaded 2-1/2" hose outlet nozzles and one (1) bronze male threaded 4-1/2" pumper outlet nozzle with American National Fire Hose Connection Screw Threads (NH).) Where indicated in Section 01011 or otherwise required by the local fire department authority, each hydrant shall be furnished with a Storz quick-connect outlet connection on the pumper nozzle. Prior to ordering any hydrants without a Storz outlet connection, Contractor shall confirm with both the local fire department authority and the Owner's local Operations District.

D. The hydrant interior ferrous surfaces downstream of the main valve shall be factory coated by the hydrant manufacturer with a water-based enamel, epoxy or approved equivalent coating. Coating may be applied in two or three coats, according to coating manufacturer's recommendations, for total dry film thickness of 12 – 18 mils.

E. The inside of the hydrant shoe shall be coated with liquid or powder (thermosetting or fusion-bonded) epoxy coating system that conforms to NSF 61 in accordance with AWWA Standard C550 (6 – 8 mil average dry film thickness, 4 mil minimum).

F. The hydrant exterior shall be factory coated by the hydrant manufacturer with coating system as follows:

1. Exterior Above Traffic Flange (Including Bolts & Nuts):
   a. Surface preparation shall be in accordance with coating manufacturer's specifications.

b. Primer, intermediate and top coats shall be enamel, epoxy, polyurethane or approved equivalent coating (8 – 12 mil average dry film thickness).

2. Exterior Below Traffic Flange:
   a. Surface preparation shall be in accordance with coating manufacturer's specifications.
   b. Primer and intermediate coats shall be coal tar epoxy in general conformance with SSPC Paint Specification No. 16. Apply two (2) coats with dry film thickness (DFT) of 8 – 10 mils each for total DFT of 16 – 20 mils.
   c. Finish coat shall be in accordance coating and hydrant manufacturers' specifications. Apply one coat with dry film thickness of 6 – 8 mils.

G. All fire hydrants shall open left and be clearly marked on the top of the hydrant with a 1-1/2" pentagon top nut.

H. Each hydrant shall utilize not less than two (2) O-ring seals where the stem passes through the bonnet.

I. All hydrants shall have a standard mechanical joint bell inlet connection compatible with the anchor couplings to be used.

J. All hydrants shall be tested and certified in conformance with NSF 61.

2.02 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers and models, subject to the specifications set forth, include:

1. American Darling B-84-B-5 with ALPHA restraint joint (by the American Flow Control Division of ACIPCO), 5-1/4" valve opening, with optional Storz outlet connection where required
2. Kennedy Guardian Figure K81D (by Kennedy Valve Company Division of McWane, Inc.), 5-1/4" valve opening, or Figure K-81A with Storz outlet where required
3. Mueller Super Centurion 250 Model A-423, 5-1/4" valve opening, with integral Storz pumper outlet connection option where required.

B. Refer to Section 01011 for manufacturers accepted in each of the Owner's Operations Districts. For each Operations District, only the manufacturer(s) indicated in Section 01011 as allowed for that district shall be provided.

C. No other hydrant manufacturers or models shall be accepted.

D. All fire hydrants furnished shall be produced solely in the United States. Manufacturers and models indicated in this section shall only be allowed if the hydrants are assembled and tested in the United States.

PART 3: EXECUTION

3.01 INSPECTION PRIOR TO INSTALLATION

A. Contractor shall inspect all fire hydrants upon receipt. Cycle each hydrant to full open and full closed positions to ensure that no internal damage or breakage has occurred during shipment and handling. Check all external bolts for proper tightness. Inspect condition of internal and external coatings.

B. After inspection, close the hydrant valves and replace the outlet nozzle caps to prevent the entry of foreign matter. Protect stored hydrants from the weather/elements with the inlets facing downward.

3.02 INSTALLATION

A. Locate hydrants as shown on the Drawings or as directed by the Engineer and in compliance with local regulations. The location shall provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. When placed behind the curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than eighteen to twenty-four inches, depending on local requirements, from the gutter face of the curb. All hydrants shall stand plumb with the pumper nozzle facing the curb. Set hydrants with nozzles at least eighteen inches above the finished grade as shown on the Indiana American Water Standard Detail Drawing for fire hydrants. Set the break flange at least two but no more than six inches (2" – 6") above finished grade, or as directed by the Engineer.

B. Unless otherwise shown on the Drawings, all hydrant laterals shall be ductile iron material with polyethylene encasement, assembled with the hydrant connected to an independent six-inch isolation (watch) gate valve with a six-inch anchor coupling; and each hydrant lateral shall be connected to the water main with a six inch anchor coupling. All hydrant assemblies shall be restrained from the hydrant back to the main. Anchor couplings shall be as specified in Section 15105.

C. Engineer may require hydrant protection using steel pipe bollards when hydrant installations have a greater than normal exposure to vehicular damage (e.g. parking lot installations, unusual driving situation, etc.). Contractor shall install all such protection designated by the Engineer. Locate bollards as necessary adjacent to the hydrant and in such a manner as to not interfere with the ability to connect hoses or operate the hydrant. Refer to Indiana American Water Standard Detail Drawing for typical fire hydrant installation. Additionally, locate the bottom of the bollard and encasement higher than (but not directly above) the hydrant supply piping and valve to prevent the possibility of damage to the piping should the bollard be displaced when hit. Payment for bollards shall be per the supplemental unit price schedule.

D. Unless otherwise directed by the Engineer, excavate a drainage pit two feet in diameter and two feet deep below but not beyond each hydrant. Fill the pit with compacted ¾ inch clean granular fill under and around the base of the hydrant to

a level 6 inches above the hydrant drain opening. No hydrant drainage pit shall be connected to a sewer.

E. The fire hydrant lead, gate valve, and fire hydrant barrel shall be encased in polyethylene encasement up to finish grade per Section 15130 prior to backfill. The polyethylene encasement shall not interfere with drainage of the hydrant.

F. Notify the Engineer of situations where the ground water table is above the drain opening of dry barrel hydrants. If directed by Engineer, plug the drain opening using a method acceptable to the hydrant manufacturer. No drainage pit is required when the hydrant drain is plugged. Mark the hydrant, in a manner acceptable to the Owner, to indicate that the drain opening has been plugged. Operation of a hydrant with plugged drain leaves the hydrant barrel full of water, thus Contractor shall pump the hydrant barrel dry after each use until Final Acceptance.

G. Thrust blocking at the base of each hydrant must not obstruct the drainage outlet of the hydrant. The size and shape of concrete thrust blocking shall be approved by the Engineer. Use the thrust blocking material specified in Section 03305.

3.03 TESTING

After installation and before backfilling (and after pressure testing the water main) test the hydrant as follows:

A. Pressure Test

1. Open the hydrant fully and fill with water; close all outlets.
2. To prevent caps from being blown off dry-barrel hydrants and to prevent other possible damage, vent air from the hydrant by leaving one of the caps slightly loose as the hydrant is being filled. After all air has escaped, tighten the cap before proceeding.
3. Apply line pressure.
4. Check for leakage at flanges, nozzles and operating stem.
5. If leakage is noted, repair or replace components or complete hydrant until no leaks are evident.
6. Record static pressure at hydrant.

B. Flow Test

1. Coordinate with Owner for hydrant flow testing.
2. Remove the cap from one 2-½ inch nozzle, and fully open the hydrant.
3. Use a pitot gauge and a chart specific to the pitot gauge used to estimate the hydrant flow rate.

C. Drainage Test for Dry-Barrel Hydrants

1. Following the pressure test and flow test, close hydrant.

2. Remove one nozzle cap and place pylon or hand over nozzle opening.
3. Drainage rate should be sufficiently rapid to create a noticeable suction.
4. After backfilling, operate the hydrant to flush out any foreign material.
5. Tighten nozzle caps, then back them off slightly so that they will not be excessively tight; leave tight enough to prevent removal by hand.

D. After installation, testing and surface restoration, clean all hydrants above the bury line and touch up any damaged paint in accordance with the hydrant manufacturer's recommendations and the Owner's local Operations District's standards (see Section 01011 for required colors). Surfaces to be painted shall be prepared in accordance with the manufacturer's recommendations and shall be coated with two (2) coats of the hydrant manufacturer's recommended exterior UV-resistant paint compatible with the factory paint system and of the same color. Take extreme care to avoid getting any paint on the "O" ring under the top operating nut or on the hydrant nozzles. Should paint be found on the "O" ring, the Contractor shall remove the paint and replace the "O" ring at its expense. Any paint on the hydrant nozzles shall be removed at the Contractor's expense.

END OF SECTION

SECTION 15185

ABANDONMENT OF MAINS AND HYDRANTS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment, and services required to abandon and demolish water mains, valves, hydrants, and other related appurtenances as indicated on the Drawings and as specified within this section and in Section 01011.

1.02 GENERAL REQUIREMENTS

A. Install new hydrants; successfully complete all required flushing, testing, and disinfection; make designated connections to existing water lines; and transfer all existing services from existing water mains to new pipelines prior to abandoning existing water mains or hydrants. Minimize service interruptions; do not disconnect existing services or depressurize existing water mains until all services have been transferred to the new pipeline.

B. Water mains shall generally remain in place without further action unless otherwise indicated on the Contract Drawings, specified in Section 01011, or otherwise directed by the Engineer. When water mains are judged to be of questionable structural condition, they shall be filled with grout or flowable fill. Pipe located above ground (e.g. mounted on bridges, etc.) shall be removed, together with hangers and hardware, whether or not so indicated elsewhere in the Contract Documents.

1.03 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01700 Project Closeout

E. Section 02025 Existing Utilities and Structures

F. Section 02210 Trenching, Backfilling and Compacting

G. Section 15000 Piping – General Provisions

H. Section 15105 Ductile Iron Pipe and Fittings

I. Section 15120 Polyvinyl Chloride (PVC) Pipe

J. Section 15125 High Density Polyethylene (HDPE) Pipe

K. Section 15130 Piping Specialties

L. Section 15150 Gate Valves

M. Section 15155 Butterfly Valves

N. Section 15170 Tapping Sleeves, Saddles and Valves

O. Section 15180 Fire Hydrants

P. Section 15190 Air Release, Blow-off Outlets and Sampling Taps

Q. Section 15200 Service Lines

PART 2: PRODUCTS

Not Used

PART 3: EXECUTION

3.01 CUTTING AND PLUGGING (CAPPING)

A. Disconnect all service lines from existing main to be abandoned by cutting, crimping, plugging or isolation of the corporation stop valve.

B. Once all services have been disconnected from the main to be abandoned, cut the existing pipeline to provide a break between the portion of the system remaining in use and the portion to be abandoned, remove all hydrants designated to be abandoned, and cap, restrain and concrete thrust block all remaining live ends of the existing mains including hydrant laterals.

C. Immediately prior to disconnection of the main to be abandoned, completely cover existing hydrants designated to be abandoned to prohibit use until the hydrants are removed.

D. Unless otherwise directed by the Engineer, the Contractor shall completely remove all abandoned hydrants, air valves, water meter installations, and curb stops. Unless otherwise directed by the Engineer, the Contractor shall either completely remove the valve box or remove the top section and fill the remainder of the valve box with an Owner-approved material by approved methods, The retired valve may remain unless otherwise indicated on the Drawings or required by the Engineer. Contractor shall exercise care not to damage materials that are required to be returned to the Owner.

E. For any valve boxes not removed from abandoned valves, Contractor shall remove the upper 6-inches of the valves box and fill the existing valve box with concrete flush to existing grade and remove any portion of the valve box extending above grade.

F. Where required by the Engineer, Contractor shall dispose of these abandoned components as directed by the Engineer at no additional cost to the Owner.

G. Refer to Section 15185 for requirements regarding delivery of these removed products to the Owner.

H. Cut the existing pipe at the point shown on the Contract Drawings or designated by the Engineer. The method of cutting shall be in accordance with Section 15000.

I. Cut and caps of existing mains to be abandoned shall be completed with the use of mechanical joint caps and restrained by retainer glands attached to the end of the existing main. Cut and caps shall be installed at the nearest existing tee and valve to minimize dead-end segments of retired mains connected to the in-service watermain. Materials shall be compatible with the pipe being capped and shall meet the applicable requirements of Section 15105, 15120, and/or 15125. After the cap is installed, provide concrete blocking to adequately brace the cap. Temporary blocking shall be placed against the abandoned pipe, and a permanent, approved concrete thrust block shall be poured between the two caps to hold both in place. Additional permanent blocking of the live main may be required by the Engineer such that future disturbances of the abandoned pipe shall not affect the permanent blocking of the live main. If required by the Engineer, a concrete anchor collar (a.k.a. deadman) shall be installed to anchor the pipe in place. When a concrete anchor collar is required, a keyway shall be excavated around the pressurized pipeline, a split restrained anchor collar per Section 15130 shall be installed around the pipe, and concrete shall be poured around the pipe within the keyway. Also, if required by the Engineer to adequately restrain existing pipe, external restraining harnesses in accordance with Section 15130 shall be installed on existing pipe joints.

J. After the water line has been capped and the permanent concrete blocking has been installed, backfill the excavation as specified in Section 02210.

K. Remove all temporary blow-off assemblies and sampling taps as required by Sections 15020, 15025 and 15190.

3.02 ASBESTOS CEMENT PIPE

A. Whenever possible and unless otherwise required by the Contract Drawings and/or Section 01011, asbestos cement (AC) pipe to be abandoned shall be abandoned in place entirely intact.

B. To the extent possible, any pipe required to be removed, shall be removed in such a way that it is not crumbled, pulverized or reduced to powder. United States EPA considers intact asbestos cement pipe to be a Category II nonfriable

asbestos-containing material (ACM) as defined in the revised Clean Air Act National Emissions Standards for Hazardous Air Pollutants for asbestos (Asbestos NESHAP) in 40 CFR Section 61.141. However, this material becomes regulated asbestos-containing material (RACM) as defined in 40 CFR Section 61.141 when it becomes "friable asbestos material" or when it "has a high probability of becoming or has become crumbled, pulverized or reduced to powder by the forces expected to act on the material during the course of demolition or renovation operations regulated by [40 CFR Part 61 Subpart M]." Consequently, if any AC pipe will be (or has a high probability of being) cut, crushed, or otherwise becoming friable, that pipe shall be completely removed from the site and transported as asbestos waste material, in accordance with CRF Section 61.150, to an approved landfill that accepts asbestos waste material.

C. All cutting, crushing, handling, removal, and transportation of AC pipe shall only be performed by a company and personnel properly licensed, trained, and specialized in handling RACM who will strictly adhere to all relevant regulations and standards. Owner will arrange for and pay for all such specialized activities related to AC pipe affected by this Contract.

D. Under no circumstances shall any crushed or otherwise friable AC pipe be buried or otherwise disposed of on the construction site without the express written permission of the Owner, Engineer, and property owner, all of which shall be obtained by the Contractor. Such written permission shall acknowledge the following:

1. The backfilling and burial of any crushed AC pipe in place would cause these locations to be considered active waste disposal sites and therefore subject to the requirements in 40 CFR Section 61.154. Contractor shall be responsible for compliance with all such requirements for a period of one year following Substantial Completion.
2. Furthermore, if no additional asbestos-containing waste material is buried at that location for a year, the site would become an inactive waste disposal site subject to the requirements of 40 CFR Section 61.151(e) and Section 61.154(h). Contractor shall be responsible for any work, permitting, etc. associated with converting the site to inactive status.
3. Subsequently, the owner of the land shall be required to comply with the requirements for active and inactive waste disposal sites discussed above. Contractor shall provide written notice to the property owner of all applicable regulations and requirements and shall provide copies of all related permits, notifications, etc.

END OF SECTION

SECTION 15190

AIR VALVES, BLOW-OFF ASSEMBLIES AND SAMPLING TAPS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of providing all labor, materials, tools, equipment and services required to provide air valves, blow-off assemblies and sampling tap assemblies at locations shown on the Drawings (or where designated by the Engineer) and as specified within this section and related sections of the Specifications. Contractor shall furnish and install all air valves, blow-off assemblies, sampling taps and related appurtenances that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

B. Sampling taps are used for disinfection of the water mains and related sampling as described in Section 15020. Sampling tap assemblies shall be installed at locations approved by the Engineer consistent with the requirements of Sections 15020. A sampling tap shall be installed near the proposed connection to any existing main (within 10 feet of beginning of new main), at all dead-ends and at intervals not exceeding 1,200 feet along the entire pipeline(s).

C. Copper pipe, corporation stops, curb stops, and miscellaneous fittings shall be provided in accordance with Section 15200.

D. All automatic air valve installations shall be installed within a precast concrete structure in accordance with Section 03450.and the Owner's Standard Details.

E. Automatic air valve installations shall not be located in areas subject to flooding or in areas of high groundwater where flooding of the manhole may occur. Air valve structures should drain to the ground surface, or to drainage/absorption pits underground. The manholes shall not connect to any storm drain or sanitary sewer.

F. Whenever the term "air valve" is used within this section, it is intended to mean a combination air valve that provides the functions of both an air release valve and an air/vacuum valve. Only air valves that include all these functions shall be installed.

G. Sizing of blow-off assemblies shall be coordinated with the requirements of Section 15025. Installed blow-off assemblies shall be adequate to achieve the required flushing velocity in the water main.

H. Blow-off assemblies may be permanent or temporary as directed or approved by the Engineer. Permanent blow-off assemblies shall be installed with above- or below-grade flushing hydrants, whereas temporary blow-off assemblies may be installed without flushing hydrants.

I. Marker posts shall be installed for air valves and blow-off assemblies in accordance with Section 02558 where shown on the Drawings, Specified in Section 01000 or Section 01075, or otherwise required by the Owner or Engineer.

1.02 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, operating and maintenance manuals, certifications, and other required submittals for all products furnished under this section in accordance with Section 01300.

B. Air valve submittals shall include documentation indicating the following:

1. Pressure rating
2. Inlet and outlet connection size(s) and types (i.e. threaded or flanged)
3. Air intake and exhaust orifice size(s)
4. Air intake and exhaust capacity vs. pressure differential
5. All appurtenances and options to be supplied
6. Dimensions, including complete assembled height

1.03 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 01700 Project Closeout

G. Section 02210 Trenching, Backfilling and Compacting

H. Section 02558 Identification/Location Guide

I. Section 03450 Precast Concrete Structures

J. Section 15000 Piping – General Provisions

K. Section 15020 Disinfecting Pipelines

L. Section 15025 Flushing and Cleaning Pipelines

M. Section 15030 Pressure and Leakage Tests

N. Section 15105 Ductile Iron Pipe and Fittings

O. Section 15130 Piping Specialties

P. Section 15150 Gate Valves

Q. Section 15170 Tapping Sleeves, Saddles and Valves

R. Section 15180 Fire Hydrants

S. Section 15200 Service Lines

1.04 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ANSI/AWWA C512 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

B. NSF/ANSI 61 Drinking Water System Components – Health Effects

C. NSF/ANSI 372 Drinking Water System Components – Lead Content

PART 2: PRODUCTS

2.01 GENERAL

A. All products furnished under this section shall meet all applicable AWWA standards and shall meet the requirements of NSF 61 and NSF 372.

B. All 2” and smaller piping, corporation stops, curb stops, ball valves, and other service line fittings shall be provided in conformance with Section 15200. All 2” and smaller piping used for air valves and blow-off assemblies shall be Type K copper or threaded brass as shown on the Owner’s Standard Detail Drawings and directed by the Engineer.

C. All 3” and larger piping shall be ductile iron provided in conformance with Section 15105.

D. All air valves and other components shall be compatible with the pipe material to be used. Contractor shall provide all required adapters, pipe nipples, spool

pieces, and other miscellaneous supplies as required for a complete and functioning installation.

2.02 AIR VALVES

A. All air valves provided under this section shall be combination air valves that provide the following functions:

1. Quickly release large volume of air during pipeline filling
2. Release small volume of accumulated air from the pressurized pipeline at a controlled rate
3. Quickly admit large volume of air in the event of water main depressurization (i.e. below atmospheric pressure).

B. Provide 1” air valves for water mains 12” nominal diameter and smaller unless noted otherwise on the Drawings or authorized by the Engineer. Provide 2” air valves for water mains 16” nominal diameter and larger unless noted otherwise on the Drawings. For the air/vacuum functions of the valve, air valves shall allow unrestricted airflow both ways through the valve without any restrictions smaller than the full nominal pipe size (i.e. 0.785 and 3.14 square inches for 1” and 2” valves, respectively).

C. Air valve bodies shall be either ASTM A126 Class B cast iron or ASTM A536 Grade 65-45-12 ductile iron. Floats and other internal parts shall be stainless steel. Seats shall be Buna-N or EPDM rubber.

D. Combination air valves shall be provided with NPT threaded or ANSI flanged inlet and outlet(s) compatible with inlet and outlet piping.

E. Combination air valves shall be rated for at least 150 psi operating pressure (but not less than the actual system operating pressure) and tested to 150% of rated operating pressure.

F. Size of air release orifice shall be appropriate for the operating pressure at the installed location, as recommended by the air valve manufacturer.

G. Acceptable manufacturers and models, subject to the specifications set forth, include:

1. GA Industries DUOJET, Data Sheet 970.03 (2” only)
2. DeZurik APCO Series 140C
   a. Model No. 143C (1”)
   b. Model No. 145C (2”)
3. Val-Matic
   a. Model 201C.2 (1”)
   b. Model 202C.2 (2”)
4. Crispin C-Series
   a. Model C10 (1”)
   b. Model C21 or C22 (2”)

5. Mueller-Pratt WCV Series
   a. Model WCV 10-564-300 (1”)
   b. Model WCV 20-332-300 (2”)

H. No other air valve manufacturers or models shall be accepted unless otherwise indicated in Section 01011 or specifically identified on the Drawings.

I. All air valves furnished shall be produced solely in the United States. Manufacturers and models indicated in this section shall only be allowed if the air valves are assembled and tested in the United States.

2.03 BLOW-OFF ASSEMBLIES AND SAMPLING TAP PIPE AND FITTINGS

A. Piping for blow-off assemblies shall be copper, polyethylene, or ductile iron in accordance with Section 15200, 15125, or 15105, respectively. Sizing shall be as indicated on the Drawings or otherwise directed otherwise by the Engineer and shall be coordinated with the requirements of Section 15025. Installed blow-off assemblies shall be adequate to achieve the required flushing velocity in the water main.

B. Piping for sampling taps shall be ¾-inch copper or polyethylene in accordance with Section 15200 and this section.

2.04 FLUSHING HYDRANTS FOR BLOW-OFF ASSEMBLIES

A. Blow-off assemblies for permanent applications shall include an above- or below-ground flushing hydrant as shown on the Drawings, specified in Section 01075, or directed by the Engineer. Flushing hydrants shall be self-draining, non-freezing, and have MJ inlets. Above-ground flushing hydrants shall have NST hose nozzle outlets and 1-1/2” pentagon operating nuts. All working parts shall be serviceable from above with no digging required.

B. Acceptable manufacturers and models, subject to the specifications set forth, include:

1. Eclipse #2 Post Hydrant by the Kupferle Foundry (above-ground)
2. Truflo #TF500 by the Kupferle Foundry (below-ground)
3. Mueller A-411 2-1/8” Post Type Fire Hydrant (above-ground)
4. Mueller A-412 2-1/8” Flush Type Fire Hydrant (below-ground)

C. All flushing hydrants furnished shall be assembled and tested in the United States.

PART 3: EXECUTION

3.01 INSPECTION PRIOR TO INSTALLATION

A. Contractor shall inspect all air valves and flushing hydrants prior to installation. Cycle each flushing hydrant to full open and full closed positions to ensure that no internal damage or breakage has occurred during shipment and handling. Check all external bolts for proper tightness. Inspect condition of coatings.

B. After inspection, close the flushing hydrant valve and replace the outlet nozzle cap to prevent the entry of foreign matter. Protect stored air valves and flushing hydrants from the weather/elements with the inlets facing downward.

3.02 INSTALLATION (GENERAL)

A. Refer to Section 15000 for pipe installation. Refer to the Owner's Standard Detail Drawings for typical installation details for air valve assemblies and blow-off assemblies. Refer to section 15200 for information about selected components (copper pipe, corporation stops, curb stops, curb boxes) common to service lines.

B. Provide appropriate protection between dissimilar metals. Provide dielectric unions at corporation stops to prevent transfer of any electrical stray currents from copper piping to water main.

C. Utilize a minimum of interconnecting fittings.

D. Air valve outlets and blow-off assemblies shall not connect to any storm drain or sanitary sewer.

3.03 INSTALLATION OF AIR VALVES

A. Taps for air valves shall be made on the top (crown) of the water main at a location with the highest elevation or as indicated on the Drawings. Air valve installations shall be installed plumb vertically.

B. A full-port brass or bronze ball valve with vinyl-coated handle shall be installed on the inlet side of the air valve to allow the air valve to be isolated from the water main for maintenance.

C. The outlet of the air valve shall be piped and extended to at least one foot above grade and provided with a screened, downward-facing elbow. Outlet piping shall be the same size as the inlet piping. For air valves with a separate, smaller-size outlet connection for the air release portion of the valve, the smaller outlet piping shall be connected to the main outlet pipe with a tee below grade. A union shall be installed in each outlet piping near the air release valve to facilitate removal of the valve for maintenance.

D. Air valve and outlet piping shall not interfere with personnel access into the structure.

E. Unless otherwise directed by the Engineer, excavate a drainage pit at least two feet deep and four square feet (4 sq. ft.) in surface area around or adjacent to each automatic air valve structure. Fill the pit and around the structure with

compacted ¾ inch clean granular fill to a level 6 inches above the structure's floor. No air valve structure drain shall be connected to a sewer.

3.04 INSTALLATION OF PIPE AND FITTINGS FOR BLOW-OFF ASSEMBLIES AND SAMPLING TAPS

A. Install corporation stop as required by Section 15200. Install polyethylene or copper pipe between the corporation stop and the curb stop location making only gradual changes in grade or alignment, as required. Do not make bends greater than 15 degrees in any direction. Install curb stops with the operating nut in the vertical position.

B. Sampling taps shall consist of a ¾-inch corporation stop and ¾-inch polyethylene or copper service line extended above ground and secured to a wood post or other suitable stationary object or structure. A curb stop or other suitable valve acceptable to the Owner shall be installed at the end of the pipe. The outlet end of this valve shall be kept clean and shall be adequately covered to prevent contamination to the satisfaction of the Resident Project Representative.

C. Temporary blow off assemblies shall terminate above ground.

D. Unless otherwise directed by the Owner, upon successful completion of all flushing, testing and disinfection, the Contractor shall completely remove temporary blow-off assemblies and sampling taps above and below ground, including the corporation stop, piping, appurtenances, etc. Upon removal of each temporary corporation stop, Contractor shall immediately plug the tap with a brass plug. Contractor shall coordinate timing and method of removing and plugging corporation stops with the Owner and Resident Project Representative. Refer also to Section 15185 for related requirements

E. Temporary blow-off sizing shall be as shown on the Owner's Standard Detail Drawings.

F. Open the corporation stop slowly to fill the line. When the line is full and all air has been removed, completely open the corporation stop and close the curb stop valve. Perform a visual leak inspection of all piping, fittings, and taps prior to backfilling. Zero leakage is allowed in 10 minutes.

3.05 INSTALLATION OF FLUSHING HYDRANTS FOR PERMANENT BLOW-OFF ASSEMBLIES

A. Locate flushing hydrants as shown on the Drawing or as directed by the Engineer. The location shall provide complete accessibility and shall be outside of vehicular traffic areas.

B. Engineer may require hydrant protection using steel pipe bollards when hydrant installations have a greater than normal exposure to vehicular damage (e.g. parking lot installations, unusual driving situation, etc.). Contractor shall install all such protection designated by the Engineer. Locate bollards as necessary adjacent to the hydrant and in such a manner as to not interfere with the ability to

operate the hydrant. Refer to the Owner's Standard Detail Drawing for typical fire hydrant installation for requirements for bollards. Additionally, locate the bottom of the bollard and encasement higher than (but not directly above) the blow-off assembly piping and valve to prevent the possibility of damage to the piping should the bollard be displaced when hit. Payment for bollards shall be per the supplemental unit price schedule.

C. Notify the Engineer of situations where the ground water table is above the drain opening prior to installation of the flushing hydrant. Where possible, with the Engineer's approval, relocate flushing hydrants to another location.

D. Connect each flushing hydrant to the main with an independent valve, unless otherwise shown on the Drawings.

E. Install below-ground flushing hydrant within a standard meter pit. All flushing hydrants shall be vertically plumb. Refer to the Owner's Standard Detail Drawing for typical blow-off assembly installation.

F. Unless otherwise directed by the Engineer, excavate a drainage pit two feet in diameter and two feet deep below each hydrant. Fill the pit with compacted ¾ inch clean granular fill under and around the base of the hydrant to a level at least 6 inches above the hydrant drain opening and above the bottom of the meter pit.

G. Unless otherwise directed by the Engineer, the permanent blow-off assembly piping, and valve shall be encased in polyethylene encasement up to finish grade per Section 15130 prior to backfill. The polyethylene encasement shall not interfere with drainage of the hydrant.

H. After installation and before backfilling (and after pressure testing the water main) test the flushing hydrant as follows:

1. Pressure Test
    a. Open the hydrant valve slightly to vent air from the hydrant.
    b. After all air has escaped, securely tighten the cap before proceeding.
    c. Open the hydrant valve fully to apply line pressure.
    d. Check complete flushing hydrant assembly for leakage. No leakage is allowed in 10 minutes.
    e. If leakage is noted, repair or replace components or complete hydrant until no leaks are evident.
2. Drainage Test
    a. Following the pressure test, close hydrant.
    b. Remove the hydrant cap and place pylon or hand over nozzle opening.
    c. Drainage rate should be sufficiently rapid to create a noticeable suction.
    d. After backfilling, operate the hydrant to flush out any foreign material.
    e. Secure cap.

END OF SECTION

SECTION 15200

SERVICE LINES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Work under this section consists of providing all labor, materials, tools, equipment, and services required to install service lines originating at the water main and terminating at either a curb stop connection or a meter pit (including connection to existing service when applicable) as indicated on the Drawings and as specified within this section and related sections of the Specification (including Section 01011). This section shall also apply to HDPE water mains smaller than 4-inch diameter, which shall meet the requirements of this section, except that installation of HDPE water mains smaller than 4-inch diameter shall also be in accordance with Section 15125 to the extent applicable. Contractor shall furnish and install all items that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

B. This section does not include service lines beyond the meter pit or meter installations beyond the curb stop (as applicable).

C. When water mains smaller than 4-inch diameter are required, high density polyethylene pipe in accordance with this section shall be used.

D. Owner shall furnish and install the meter and radio read sensors (if required).

1.02 GENERAL REQUIREMENTS

Refer to Owner's Standard Details for a typical service line installation.

1.03 COORDINATION OF WORK

Contractor shall coordinate with the applicable Owner's Operations District to ensure all Work is provided consistent with applicable requirements of that district.

1.04 SUBMITTALS

A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, certifications, and other required submittals for all products furnished under this section (including those listed under this section within Section 01011) in accordance with Section 01300.

1.05 QUALITY ASSURANCE

A. All furnished products shall meet the minimum quality requirements by conforming to the below-referenced standards and other applicable standards.

1.06 RELATED WORK

A. Section 01000 Summary of Work

B. Section 01011 Special Provisions

C. Section 01075 Basis of Payment

D. Section 01300 Submittals

E. Section 01600 Products

F. Section 01700 Project Closeout

G. Section 02210 Trenching, Backfilling and Compacting

H. Section 02558 Identification/Location Guide

I. Section 15000 Piping – General Provisions

J. Section 15020 Disinfecting Pipelines

K. Section 15025 Flushing and Cleaning Pipelines

L. Section 15030 Pressure and Leakage Tests

M. Section 15125 High Density Polyethylene (HDPE) Pipe

N. Section 15130 Piping Specialties

O. Section 15170 Tapping Sleeves, Saddles & Valves

1.07 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

A. ASTM B88 – Standard Specification for Seamless Copper Water Tube

B. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping

C. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

D. ASTM D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

E. ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

F. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

G. ASTM F1668 - Standard Guide for Construction Procedures for Buried Plastic Pipe

H. ASTM F2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems using Hydrostatic Pressure

I. AWWA C600 Installation of Ductile-Iron Mains and Their Appurtenances

J. AWWA C605 Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

K. AWWA C800 Underground Service Line Valves and Fittings

L. AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. Through 3 In., for Water Service

M. AWWA Manual M55 PE Pipe—Design and Installation

N. NSF/ANSI 14 Plastics Piping System Components and Related Materials

O. NSF/ANSI 61 Drinking Water System Components – Health Effects

P. NSF/ANSI 372 Drinking Water System Components – Lead Content

Q. *Tapping Guide for PVC Pressure Pipe*, UNI-PUB-8, Uni-Bell PVC Pipe Association.

PART 2: PRODUCTS

2.01 GENERAL

A. All products furnished under this section (including components specified under this section in Section 01011) shall meet all applicable AWWA standards and shall meet the requirements of NSF 61 and NSF 372, except for components that will not come in contact with potable water (e.g. meter yokes).

B. Service line material shall be as shown on the Drawings, as required by the Owner's Operations District, and/or as directed by the Engineer.

C. All corporation stops, curb stops, ball valves, and other service line and meter installation fittings shall be compatible with the service line material to be used. Regardless of the part numbers specified, it is the Contractor's responsibility to ensure compatibility of all products.

2.02 POLYETHYLENE SERVICE LINE MATERIAL

A. High density, ultra-high molecular weight (UHMW) polyethylene service line manufactured from PE 4710 resin shall be Pressure Class 200 (DR9) conforming to AWWA Standard C901. Pipe sizes (3/4", 1", 1-1/2", 2" and 3") shall be as shown on the Drawings, as indicated in Section 01075, or as directed by the Engineer.

B. Polyethylene pipe sizing shall be copper tube size (CTS) or outside-diameter controlled iron pipe size (IPS) as required by the Owner's local Operations District or as directed by the Engineer. Unless otherwise specified in Section 01011, all service line pipe shall be CTS, except that all 3" HDPE pipe shall be IPS.

C. HDPE fittings shall not be used other than as specified in Section 15125, unless otherwise approved in writing by the Owner.

D. Polyethylene service line color shall be blue.

E. Acceptable manufacturers:

1. Endot Industries, Inc. (EndoPure or Endopoly)
2. J-M Manufacturing Company, Inc.
3. JM Eagle

2.03 COPPER SERVICE LINE MATERIAL

Copper pipe shall be Type L or Type K, as specified, meeting the requirements of ASTM Standard B88. The pipe size (3/4", 1", 1-1/2", or 2") and type are to be determined by the Engineer. Type K is normally required in corrosive environments where polyethylene is not allowed.

2.04 CORPORATION STOPS

A. Corporation stops shall be of the brass, ball valve type manufactured in accordance with AWWA Standard C800. The inlet connection shall have standard AWWA tapered threads unless otherwise specified in Section 01011 or required by the Engineer. The outlet connection shall be copper or brass compression connection end or pack joint for polyethylene pipe, as required (refer to Section 01011). The sizes shall range from 1/2" to 2" and shall match the size of specified service line material.

B. Acceptable manufacturers and model numbers are:

1. Ford Meter Box Company - FB400 thru FB1600 (unless otherwise listed in Section 01011)
2. Mueller - B-25000N (unless otherwise listed in Section 01011)
3. A.Y. McDonald – 4701B Series (unless otherwise listed in Section 01011)

2.05 CURB STOPS

A. Curb stops (when required) shall be bronze body construction, ball valves, with double O-ring stem seals. Curb stops (when required) shall conform to AWWA Standard C800. End connections shall be suitable for copper or brass compression connection or pack joint for polyethylene pipe, as required. Sizes shall be from 3/4" to 2" and shall match the service line size.

B. Acceptable manufacturers and model numbers:

1. Ford Meter Box Company – B22 Series (unless otherwise listed in Section 01011)
2. Mueller - B-25204N (unless otherwise listed in Section 01011)
3. A.Y. McDonald - 6100 Series (unless otherwise listed in Section 01011)

2.06 CURB BOXES

A. Curb boxes (when required) shall be standard cast iron, sliding or screw type, 1" or 2-1/2" as required, complete with lid and head bolt. Boxes shall be adjustable from 18-inches to 66-inches. The box size will be determined by the Engineer.

B. Acceptable manufacturers:

1. Bingham & Taylor
2. Mueller
3. Handley Industries
4. Clay & Bailey
5. A.Y. McDonald
6. Quality Water Products

2.07 METER PITS, RINGS/COVERS, AND LIDS

A. Unless otherwise indicated in Section 01011, meter pits for services 2-inch and smaller shall be round corrugated (or ribbed) plastic tile with straight walls and an inside diameter as indicated in the following table based on the service size. Meter pit length/depth shall be as indicated in Section 01011 for each individual Operations District. Meter pits shall have a white interior and include an integral anti-settling flange on the bottom.

Service size (in.) Meter (Single or Dual)	Meter Pit Inside Diameter (in.)	Manufactured Pit Setter Ford Meter Box Co. Pit, Components, Cover, Lid	Ford Meter Box Co. Cover and Lid	A.Y. McDonald Cover and Lid	Vestal Cover/Ring and Lid
5/8 and ¾ (Single)	20	-	As specified in Section 01011		
5/8 and ¾ (Dual)	24	-	As specified in Section 01011		
1	24	-	MC-24-T	74M24-T	As specified in Section 01011
1½	30/36	As specified in Section 01011	MC-30-T	74M30-T	Per local Operations District
2	36	As specified in Section 01011	MC-36-T	74M36-T	Per local Operations District
>=3	Precast concrete	As specified in Section 01011	As specified in Section 03450		

B. Acceptable Manufacturers (meter pits):

1. Series B Molded polymer enclosures manufactured by DFW Plastics, Inc.
2. Round polyethylene blend Heavywall Meter Pits manufactured by Carson Plastic by Oldcastle, Inc.
3. Plastic Meter Pits by EJ USA (East Jordan)
4. White dual wall, corrugated HDPE Meter Pits manufactured by ADS (only where named in Section 01011)
5. Corrugated HDPE Meter Pits manufactured by FRATCO, Franceville, IN.

C. Meters pits for 3-inch and larger meters shall be precast concrete structures per Section 03450.

D. Covers and lids for 20-inch diameter meter pits shall be as specified in Section 01011 for each individual Operations District. Covers and lids for 24-inch and larger meter pits shall be monitor covers as indicated in the above table unless otherwise specified in Section 01011 for individual Operations Districts. Lids shall one or two 1¾-inch diameter hole(s) where required to accept a touch-read encoder pad.

E. Acceptable Manufacturers (covers and lids):

1. Vestal Manufacturing Enterprises, Inc.
2. Ford Meter Box Co.
3. A.Y. McDonald
4. Sigma (only where listed in Section 01011)

F. METER PIT RING & COVER: TRAFFIC LOAD RATED: Ford Meter Box Co., Model A3H, or approved equal.

2.08 METER SETTING COMPONENTS

A. Meter setting components, including the following items (where required), shall be as specified in Section 01011 for each Operations District.

1. Yoke bars
2. Setters
3. Branches
4. Ball valves
5. Angle valves
6. Outlet valves
7. Outlet ells / fittings
8. Expansion nuts
9. Meter idlers
10. Adapters

B. Each meter yoke and setter shall be supported by two vertical ½-inch or ¾-inch galvanized steel standpipes (sized to fit the yoke or setter) unless otherwise specified in Section 01011; however, only one standpipe may be used with yokes that are designed for only a single standpipe or where allowed by the Owner (all dual sets shall use two standpipes). Where indicated in Section 01011, a horizontal ¾-inch galvanized steel cross bar shall be installed instead of vertical standpipes to support the yoke or setter; and yoke/setter shall be secured to the cross bar by an approved method.

2.09 MISCELLANEOUS SERVICE LINE FITTINGS

A. Miscellaneous service line fittings such as couplings, adapters, saddles, bends, plugs, service line electrical insulators, etc. shall conform to AWWA Standard C800.

B. Tapping sleeves and saddles shall be as specified in Sections 15170 and 15125.

C. Acceptable manufacturers:

1. Ford Meter Box
2. Mueller
3. A.Y. McDonald

PART 3: EXECUTION

3.01 PACKAGING, HANDLING, AND STORAGE

Refer to Section 15000.

3.02 INSTALLATION (GENERAL)

A. Provide appropriate protection between dissimilar metals. Where metallic service lines are installed or already exist, dielectric unions shall be used at corporation stops to prevent transfer of any electrical stray currents from metallic service lines to metallic water main.

B. Utilize a minimum of interconnecting fittings.

C. All plastic service line connections shall use non-metallic insert stiffeners of the appropriate length and size at the connection between the plastic service line and the corporation stop outlet, except as otherwise specified in this section or Section 01011.

D. After completion of service line installation, but prior to backfilling, open the corporation stop slowly to fill the line. When the line is full and all air has been removed, completely open the corporation and close the curb stop (if applicable). Visually inspect that all piping, fittings, and taps for leaks. Backfill and restore the surface the service line trench in accordance with Division 2 of these Specifications.

E. Services, including meter installations, shall be installed consistent with the Owner's Standard Details, except as otherwise specified in this section or Section 01011 or directed by the Resident Project Representative.

3.03 INSTALLATION OF CORPORATION STOPS

A. Use experienced craftsmen familiar with installation of water service lines when tapping water mains. Make all taps with a suitable tapping machine (Mueller, Ford, Hays or Dresser type) using the proper combined drill and tap. Hand held drilling equipment is not acceptable.

B. Before making the tap, inspect corporation stops for cleanliness, damaged threads, and proper operation of the ball valve prior to installation. Do not install corporation stops that fail this inspection.

C. The main may be tapped along the top half of the pipe at a 45-degree orientation or as shown on the Standard Details. Use a tapping sleeve or saddle for all taps 1½-inch or larger (in ductile iron pipe) and other situations where the water main wall thickness or material (PVC, HDPE, concrete or A-C pipeline material) make it unsuitable for direct tapping. All taps larger than 3-inch shall use a tapping sleeve. Tapping sleeves and saddles shall be in accordance with Sections 15170 and 15125, except where Section 01011 includes district-specific requirements. Verify sleeve or saddle use with Engineer.

D. In the case of multiple services of small diameter (less than 1-inch diameter), corporation stops shall be at least 12 inches apart and at least 22-1/2 degrees above or below the location of any adjacent tap(s) and curb stops and boxes shall be at least one foot apart. In the case of multiple medium diameter (2 inch to 3 inch diameter) services, tap at least 24 inches apart and at least 22-1/2 degrees above or below the location of any adjacent tap(s). However, services 4-inch diameter and larger shall be tapped only on the 3 o'clock or 9 o'clock positions and shall be tapped at least 5 feet apart.

E. Install all corporation stops so that between 2 and 3 threads extend beyond the inside wall of the main. If necessary, make a test tap with the boring bar marked to the proper depth. The corporation stop, when properly installed, will not be shouldered with the main. Do not use lubricants of any type when installing the corporation stop.

F. Use the procedures outlined in AWWA Standard C600 for installing taps on grey iron or ductile iron mains encased in polyethylene.

3.04 SERVICE CONNECTIONS TO PVC PIPE

A. Install service connections in accordance with AWWA Standard C605 and the manufacturer's recommendations using the following methods:

1. Tapping is only permitted through the use of service clamps or saddles.
2. Using injection molded couplings with threaded outlets.
3. Tapping with large service connections through appropriately sized tapping sleeves and valves.
4. Direct tapping of service connections is not permitted. Use only service saddles for AWWA Standard C900 pipe, for nominal pipe sizes 6 inch through 12 inch. Corporation stops shall be threaded and conform to AWWA Standard C800.

3.05 SERVICE CONNECTIONS TO HDPE PIPE

B. Install service connections in accordance with Section 15125, AWWA Manual M55, and the manufacturer's recommendations using the following methods:

1. Direct tapping of service connections is not permitted. Use of tapping saddles or sleeves is only permitted with written authorization by the Owner.
2. Tapping for service connections 2-inch nominal diameter and smaller on water mains larger than 2-inch nominal diameter is only permitted through the use of polyethylene side-fusion saddles in accordance with Section 15125. HDPE electrofusion branch outlets in accordance with Section 15125 shall not be provided unless otherwise approved by the Owner in writing.
3. Connection of service connections to water mains 2-inch nominal diameter and smaller is only permitted through the use of brass tees with adapter couplings. HDPE electrofusion branch outlets in accordance with Section 15125 shall not be provided unless otherwise approved by the Owner in writing.
4. Tapping for service connections 3-inch nominal diameter is only permitted through the use of HDPE branch outlets in accordance with Section 15125 unless otherwise approved by the Owner in writing.
5. Tapping for service connections larger than 3-inch nominal diameter shall be in accordance with Sections 15125 and 15170.

3.06 INSTALLATION OF SERVICE LINE AND FITTINGS

A. Research has documented that certain pipe materials (such as polyethylene, polybutylene, polyvinyl chloride, and asbestos cement) and certain elastomers (such as used in jointing gaskets and packing glands) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Polyethelene service line shall only be installed in soils that are free of both petroleum products and organic solvents. If during the course of pipeline installation the Contractor identifies or suspects the presence of petroleum products or any unknown chemical substance in the native soil, Contractor shall stop installation of service line and notify the Engineer immediately. Contractor shall not resume installing service line in the area of suspected contamination until direction is provided by the Engineer.

B. Excavate the service line trench in accordance with Section 02210. Where augering or moling is permitted, follow guidelines provided by the equipment manufacturer, including making a proper size hole to launch and receive the unit. If moling or augering is employed, take appropriate precautions to avoid damaging other utilities and disturbing the unexcavated surface.

C. Install service line between the tap connection and the curb stop location making only gradual changes in grade or alignment as required. Sharp bends (greater than 15 degrees) in any direction are not allowed unless approved by the Engineer. Installation shall be in accordance with Section 15000 and the Standard Details and in accordance with local regulations.

D. Install all service lines straight, perpendicular to the main, and in line with the new (if applicable) or existing meter pit, curb stop, or customer service line (as applicable). If this cannot be accomplished (as approved by the Resident Project Representative), provide the Owner with accurate as-built dimensions to the tee or

corporation stop. In no case shall service lines be installed parallel to the water main.

E. If fusion of service line is required, it shall be conducted in accordance with Section 15125 or as otherwise approved by the Engineer.

F. All trenched services shall be installed with detectable identification tape per Section 02558.

G. All services shall be installed with location (tracer) wire per Section 02558.

3.07 INSTALLATION OF CURB STOPS

A. Curb stops are typically only required for services with existing indoor meters, other services where a meter pit is not installed, or for permanent sampling or blow-off installations. Curb stops and curb boxes shall be provided where required on the Drawings, in Section 01011, elsewhere in the Specifications, or by the Resident Project Representative. Install curb stops with the operating nut in the vertical position and the curb box centered over the nut. Install curb boxes plum and adjusted to be flush with finished grade. Install and lock curb boxes immediately after installation.

3.08 INSTALLATION OF METER PITS AND METER SETTING COMPONENTS

A. Meter pits shall be located as shown on the Drawings, in accordance with the Owner's Standard Details and local requirements, and as directed by the Resident Project Representative.

B. Meter pit depth shall be as specified in Section 01011 for the Owner's local Operations District.

C. Meter pits shall not be installed within an existing or planned driveway or sidewalk.

D. All specified meter setting components and other miscellaneous service line fittings shall be installed as shown on the Drawings, Standard Details, and directed by the Resident Project Representative.

3.09 POLYETHYLENE ENCASEMENT

A. Provide polyethylene encasement, or other protective wrap approved by the Engineer, on all metal service lines and fittings (valves, stops, etc.) when they are made of different materials than the water main. When the polyethylene is applied on the main, it shall extend for a minimum clear distance of three feet (3') away from the main when services are not being renewed or extend from the main connection to and including the curb stop or curb meter setter for all new copper service lines. Encasement material and installation shall be per Section 15130.

3.010 TESTING OF SERVICES

A. Open the corporation stop slowly to fill the service line. When the line is full and all air has been removed, completely open the corporation stop. Perform a visual leak inspection of all piping, fittings, and taps prior to backfilling. Zero leakage is allowed in 10 minutes.

END OF SECTION