



**STANDARD PIPELINE
MATERIALS AND
CONSTRUCTION
SPECIFICATIONS**

MAY, 2021

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SPECIFICATIONS - MATERIALS
MAY 2021**

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SPECIFICATION – MATERIALS

MAY 2021

1. GENERAL

- 1.1 These specifications are intended to set a standard of quality and design for all materials used in the construction of water mains and appurtenances. Specifications for material not included in these specifications shall be included in other specifications or plans and will be furnished on request. These general and detailed specifications are subject to revision from one project to another. The **CONTRACTOR** shall make himself familiar with the current revision.
- 1.2 **Central Arkansas Water** must approve all material prior to installation.
- 1.3 All material must be of domestic manufacture and in accordance with these standards. Foreign made materials (i.e., pipe, fittings, tapping sleeves, valve boxes, etc.) are strictly prohibited.
- 1.4 Any reference to specifications published by other agencies shall refer to the latest edition or revision of such specifications as of the date of advertising for bids.
- 1.5 Items of materials and/or construction work not specifically addressed herein, but nonetheless required for a complete, operating, and acceptable installation of the work, shall be considered subsidiary to the principal bid item requiring such materials and/or work and the cost thereof shall be considered to be included in the bid price for the principal items.

2. DEFINITIONS

- 2.1 The term "as specified" shall mean as specified by the **Central Arkansas Water** in plans, proposals, other specifications, and written or oral instructions
- 2.2 The term "or equal" shall mean that the proposed material or item shall perform adequately the duties imposed by the general design and is of the same or equal design, substance, and function to that specified by using the name of a product manufacturer, or vendor. Central Arkansas Water shall make final approval of such items or materials.
- 2.3 Abbreviations used throughout these specifications have meanings as follows:

AASHTO	American Assoc. of State Highway & Transportation Officials
AC	Asbestos Cement
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
AWWA	American Water Works Association (Latest Revision)
CF	Copper Flare
CI	Gray Cast Iron
CS or CC	AWWA (Mueller Corporation Stop) Thread
DI	Ductile Iron
DFT	Dry Film Thickness
FIP	Female Iron Pipe
FCF	Female Copper Flare
IP	Iron Pipe
MIP	Male Iron Pipe

PSI	Pounds Per Square Inch
PVC	Polyvinyl Chloride
SSPC	Steel Structures Painting Council
PJ	Pack Joint (Compression fitting)
CTS	Copper Tubing Size
DP	Double / Dual Purpose

3. PIPE

3.1 All pipe furnished shall be designed for the distribution of potable water. Distribution pipe 2-inch and 3-inch diameter shall be PVC. Distribution pipe 4-inch and larger shall be Ductile Iron, except Distribution pipe 12-inch and smaller located outside the extra-territorial jurisdiction may be PVC. Very large transmission main pipe will be specified by CAW. Service lines shall be Copper. All pipe furnished shall be of domestic manufacture and be in compliance with NSF 61. Lubricant furnished for lubricating joints shall be non-toxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart taste or odor to the water. The lubricant container shall be labeled with the manufacturers' name. No pipe will be accepted that has been contaminated with diesel exhaust or any other contaminant.

3.2 **Flanged Ductile Iron Pipe**

The pipe shall have a **cement mortar lining and seal coat** in accordance with ANSI A21.4 (AWWA C104) and NSF 61. **The minimum thickness class for flanged pipe shall be Class 53 unless otherwise specified.** The pipe and flanges shall conform to ANSI A21.15 (AWWA C115), Class 250-psi. Drilling shall conform to ANSI B16.1, Class 125 flange. The flange gasket shall be high quality **molded SBR rubber** with properties matching ANSI/AWWA C111/A21.11 and shall meet the description of “**Specially Designed Gaskets**” shown in the Appendices of AWWA C110, C111, and C115 or approved equal.

3.3 **Ductile Iron Pipe**

3.3.1 Pipe shall conform to ANSI A21.51 (AWWA C151) and shall have a **cement mortar lining and seal coat** conforming to ANSI A21.4 (AWWA C104) and NSF 61. Joints shall conform to ANSI A21.11 (AWWA C111) and may be mechanical joint or push-on joint unless otherwise specified. Gaskets shall be manufactured in the United States and/or Costa Rica. **The minimum class of D.I. pipe shall be THICKNESS CLASS 50 unless otherwise specified.** All ductile iron shall be encased in polyethylene (polywrapped) upon installation (See Section 21 of the Construction Specifications for specifics). All ductile iron mains shall end with a full joint of mechanical joint pipe with a mechanical joint plug and anchor collar.

3.3.2 The following manufacturers are approved for push-on, mechanical joint, and flanged joint ductile iron pipe:

American Pipe
Griffin Pipe
McWane Pipe
U.S. Pipe

3.3.3 The following manufacturers are approved for restrained joint ductile iron pipe:

American Pipe – FLEX-RING, LOK-RING, & FLEX-LOK BALL JT.

Griffin Pipe – SNAP-LOK and SNAP-LOK RIVER CROSSING
U.S. Pipe – TR-FLEX and USI-FLEX BALL JT.

FAST-GRIP and FIELD-LOK gasket restrained joints are NOT acceptable restrained joints unless so indicated in the Bid Schedule. Mechanical Joint and/or Mechanical Joint with Mega-lug retainer glands are NOT acceptable restrained joints unless so indicated in the Bid Schedule.

3.3.3.1 When restrained joint ductile iron pipe is specified on a project, the fittings shall be of the restrained joint design as the restrained joint system used on the pipe.

3.4 **Prestressed Concrete Pressure Pipe**

3.4.1 The pipe shall conform to **AWWA C301** and be the lined-cylinder or embedded-cylinder type as specified. If not specified by type, the type outlined in **Section 1.3 AWWA C301** for the various size ranges shall be furnished unless otherwise specified. The minimum working pressure shall be **200-psi** and the maximum length shall be twenty (20) feet.

3.4.2 The pipe shall be designed to withstand live loads at least equal to **AASHTO H20** loading in combination with earth loads produced by earth cover under the conditions described below:

3.4.2.1 Earth cover and bedding conditions shown in the plans or construction specifications. For purposes of computing earth loads, the cover shall not be less than six (6) feet

3.4.2.2 When not shown in the Plans or Construction Specifications, the earth loads shall be based on eight (8) feet of cover and the live loads shall be based on two (2) feet of cover. Bedding shall be considered "**ordinary**" as defined in **Section 3.2.2.1 AWWA C301**.

3.4.3 All steel surfaces, which are not imbedded in concrete at the place of manufacture, shall be protected by a heavy zinc coating. The coating shall conform to either of the following:

3.4.3.1 Metalized or inorganic zinc coating equal to that provided by the Price Brothers Company or Gifford-Hill American, Inc.

3.4.3.2 At least one heavy coat of Dimetcote E-Z Inorganic Zinc Primer, paintbrush or spray applied. The surfaces to be coated shall be cleaned and degreased before application of the zinc primer.

3.4.4 Concrete for the core of pipe shall be made by using natural aggregate (aggregates such as limestone are unacceptable).

3.5 **PVC Pipe, 2” through 12”**

3.5.1 Polyvinyl Chloride Pipe shall be made from Type 1, Grade 1 or Grade 2, Polyvinyl Chloride Plastic conforming to **ASTM D1784 and CS-256**.

3.5.2 The pipe shall conform to **ASTM D2241** as it applies to Type 1, Grade 1 or Grade 2, Polyvinyl Chloride Plastic, **SDR 17 PRESSURE CLASS 250**.

- 3.5.3 The joints shall be designed so that the pipe and fittings may be connected on the job without the use of glue or adhesive or any special equipment. The pipe and fittings shall have a push-on joint consisting of a single wire ring reinforced rubber gasket. The gasket and the annular recess shall be so designed and shaped that the gasket is locked in place against displacement as the joint is assembled. Gasket dimensions shall be in accordance with manufacturers' standard design dimensions and tolerances and shall be of such size and shape as to provide an adequate compressive force against the plain end and socket after assembly to effect a positive seal under all combinations of joint and gasket tolerances. Gaskets shall be vulcanized natural or vulcanized synthetic rubber. No reclaimed rubber shall be used. The joint shall be designed to withstand the same pressures as required for the pipe. The joint shall be designed so as to provide for the thermal expansion or contraction experienced with a temperature change of at least 75°F.
- 3.5.4 The pipe may be furnished in manufacturers' standard lengths.
- 3.5.5 The pipe shall conform to the specifications 14 and 61 of the National Sanitation Foundation Testing Laboratories, Ann Arbor, Michigan.
- 3.5.6 As a minimum, the pipe and fittings shall have the following data applied to each piece:
 - 3.5.6.1 Nominal Size
 - 3.5.6.2 Type of Material
 - 3.5.6.3 SDR or Class
 - 3.5.6.4 Manufacturer
 - 3.5.6.5 NSF (National Sanitation Foundation seal of approval)
- 3.5.7 SDR 17 pipe shall conform to the above specifications.
 - 3.5.7.1 Only the following manufacturers are acceptable:

Diamond North American J.M. Eagle Vinyl-Plex Vulcan Plastics CertainTeed, including Certa-Lok Yelomine (color – blue) Northern Pipe Products PipeLife Jet Stream

- 3.5.8 Fittings shall be push-joint Ductile Iron or epoxy coated steel coupling, Smith Blair 411 or equal.
- 3.5.9 4” through 12” PVC pipe is only allowed in designated locations outside the “Extra Territorial Jurisdiction” areas of Pulaski County.
- 3.5.10 Do not use PVC pipe when the working pressure exceeds 125 psi.
- 3.5.11 Do not use PVC pipe exceeding 12-inch diameter.

3.6 **Copper Pipe, 3/4" - 2"**

- 3.6.1 Copper pipe shall be ***Type "K"***, soft tempered, seamless, for underground installation, in accordance with **ASTM B88** and **Federal Specifications WW-T-799**. Copper pipe shall meet or better NSF-61 requirements.

3.7 **Polyethylene Service Tubing – NOT ALLOWED FOR PERMANENT PLACEMENT**

- 3.7.1 Polyethylene service tubing (1", SDR 9 min.) may only be used for temporary construction items, such as temporary blowoff, sampling point, or any other item approved by the Engineer. **ANY POLYETHYLENE SERVICE TUBING INSTALLED SHALL BE COMPLETELY DISCONNECTED FROM THE SYSTEM AND THE TUBING SHALL BE REMOVED FROM THE GROUND PRIOR TO PROJECT APPROVAL. ANY TAP ON A MAIN FOR USE OF HDPE TUBING SHALL BE 1" OR LARGER; direct tap with corporation stop on ductile iron pipe through 24" DIP; saddle tap with corporation stop on PVC pipe or DIP larger than 24" diameter.**

3.8 **Smooth Wall Steel Encasement Pipe for Road Crossings and Bored In Place Encasement**

All steel encasement pipe shall be of the dimensions as shown in the Plans and/or Bid Form. The pipe shall be new, smooth wall pipe with beveled ends. The pipe shall be unfinished or black.

Unless otherwise modified by the Plans and/or Bid Schedule, wall thickness of smooth wall steel encasement pipe shall be:

Carrier Diameter (nominal)	Minimum Encasement Diameter(nominal)	NOMINAL Encasement Wall Thickness	MINIMUM Encasement Wall Thickness
2"	5"	0.250"	0.219"
3"	6"	0.250"	0.219"
4"	8"	0.250"	0.219"
6"	12"	0.250"	0.219"
8"	16"	0.250"	0.219"
10"	20"	0.250"	0.219"
12"	24"	0.312"	0.273"
14"	24"	0.312"	0.273"
16"	30"	0.375"	0.328"
18"	30"	0.375"	0.328"
20"	36"	0.500"	0.438"
24"	36"	0.500"	0.438"
30"	48"	0.625"	0.547"
36"	48"	0.625"	0.547"
42"	60"	0.625"	0.547"
48"	66"	0.625"	0.547"
54"	72"	0.750"	0.658"
Sizes not listed to be determined as needed by CAW.			

The pipe steel shall have a minimum yield strength of 35,000-psi. The pipe shall conform to **ASTM A-53 / ASTM A283 / ASTM A-135 / ASTM A-139**, Grade B, CW, physical tests only (no hydrostatic test required). Letter of compliance from the Bidder or mill tickets shall be supplied to the **OWNER** for the delivered pipe.

All pipe less than or equal to 24-inch diameter shall be **Type E** (electric-resistance welded, Grade B) or **Type S** (seamless, Grade B). All pipe greater than or equal to 26-inch diameter shall be **Type E** (electric-resistance welded, Grade B) or **Type S** (seamless, Grade B) or **Rolled Plate** (straight seam, Grade B material) or **Spiral Welded**. Rolled plate pipe shall have only one longitudinal seam per section; sections shall be no shorter than 80-inches long except one short piece will be allowed to complete a specified joint length.

- 3.8.1 Spacers will be required on water pipes four (4) inches and larger. The spacers shall be fusion bonded epoxy coated carbon steel or T-304 stainless steel casing spacers Model SI or SSI as manufactured by Advance Products and Systems, Inc., of Lafayette, Louisiana, or approved equal.
- 3.8.2 A Series 300 stainless steel wire rope cable, 3/8" diameter, shall be provided threaded through the encasement pipe along with the carrier pipes of **six (6)-inch diameter and larger**. Splices should be avoided, but if necessary shall be made with Series 300 stainless steel wire rope cable clamps.

3.8.3 Both ends of the encasement pipe shall have the interior annular space between the carrier pipe and the encasement pipe sealed using a modular, mechanical type interlocking synthetic rubber link seal assembly equal to Link-Seal©. The Link-Seal hardware (nuts and bolts) shall be Type 316 Stainless Steel per ASTM F593-95.

3.9 **PVC Encasement Pipe (when specified or directed for use)**

All PVC encasement pipe shall conform to the polyvinyl chloride pipe specifications contained in **Section 3.5** herein, SDR 17 Pressure Class 250 or C900 DR 18, of the nominal diameter as shown in the Plans or as directed by the Engineer.

3.9.1 Spacers will be required on water pipes four (4) inches and larger. The spacers shall be fusion bonded epoxy coated carbon steel or T-304 stainless steel casing spacers Model SI or SSI as manufactured by Advance Products and Systems, Inc., of Lafayette, Louisiana, or approved equal.

3.10 **Encasement Pipe for Sanitary Sewer Main Crossings**

Encasement pipe for water lines crossing over a sanitary sewer main with less than eighteen (18) inches of clearance or for water lines crossing under a sanitary sewer main shall be either of the following at the **CONTRACTOR'S** option: (a) smooth wall steel pipe, ¼-inch wall thickness or better, (b) solid wall PVC water pipe, SDR 26 wall thickness or better, (c) aluminized corrugated metal pipe, 12-gauge wall thickness or better, (d) corrugated polyethylene storm drain pipe, HANCOR HI-Q or equal, or (e) solid wall polyethylene pipe, SDR 26 wall thickness or better. PVC and polyethylene pipes shall be encapsulated with crushed stone bedding. Encasement pipe shall be placed as a twenty (20) foot long piece where possible. Any joint in the twenty foot length shall be welded or mechanical in nature and shall be watertight. Any encasement pipe long enough to require one or more joints shall not be of a storm sewer or drainage type pipe as the joints of this type of pipe are not considered to be watertight for the purposes of these Specifications. The ends of the encasement pipe shall be sealed watertight. Typically the water line shall be encased. Upon approval by the **ENGINEER**, the sanitary sewer main may be encased in lieu of encasing the water line.

4. FITTINGS

4.1 **Iron Fittings**

Iron Fittings 4" and larger shall be designed for a working pressure of at least 250-psi, shall be ductile iron, and shall be of domestic manufacture. Iron Fittings shall conform to **AWWA/ANSI C110/A21.10** (full bodied) or **AWWA/ANSI C153/A21.53** (compact body). Unless otherwise specified in the Plans or in the Bid Schedule, fittings may be mechanical joint or push-on restrained joint conforming to **ANSI A21.11**. All fittings shall be furnished with gaskets, and mechanical joint fittings shall be furnished with bolts, nuts, and iron glands. All 4" and larger fittings (except solid sleeves, plugs and caps) shall be cement mortar lined in accordance with ANSI A21.4. Two-inch and three-inch iron fittings shall be HARCO ductile iron push-on joint fittings pressure rated at 300 psi. All iron fittings shall be polywrapped upon installation (see **Section 21 of the Construction Specifications** for specifics).

4.1.1 Mechanical Joint Retainer Glands - shall be made from ductile iron and shall be designed for a working pressure of at least 350-psi for 3-inch through 16-inch pipe and at least 250-psi for 18-inch through 48-inch pipe. The retainer gland shall be SERIES 1100 MEGALUG mechanical joint restraint as manufactured by EBAA IRON SALES INC or

UNI-FLANGE SERIES 1400 by FORD METER BOX or DOMESTIC STARGRIP SERIES 3000 by STAR PIPE PRODUCTS or TUF Grip Series by TYLER UNION. All retainer glands shall be of domestic (U.S.A.) manufacture.

4.1.2 Swivel Adapters and Tees.

Shall be designed for a working pressure of at least 250-psi and to fit standard mechanical joint fittings (AWWA C111). One end of the swivel adapter and the branch of the tee shall be provided with a gland that may be rotated 360 degrees on the fitting. Lengths of swivel adapter shall be as specified.

4.1.3 Tapping Sleeves - (4" Tap and Larger)

Sleeves may be iron or steel. **Tapping sleeves shall be designed for a working pressure of at least 175-psi and a test pressure as required for the project (225 psi or greater as required).** Fabricated steel sleeves shall be Type 304 stainless steel OR carbon steel coated with high build Thermo-Set Epoxy. A test plug shall be furnished through the body for hydrostatic pressure testing on all sleeves. See **Section 33.4.1 and 33.11 of the Construction Specifications** for testing requirements. The outlets shall conform to **ANSI B16.1, Class 125** flanges designed to accept tapping valves described herein. All bolts shall be of corrosion resistant alloy. Sleeves may be designed for a watertight seal by the use of mechanical followers or by the use of a gasket placed in a recess between the sleeve body and the pipe barrel. Only sleeves with mechanical followers or full circle gaskets may be used for full size taps. The use of other type sleeves is restricted to taps where the branch is at least one size smaller than the run.

4.1.4 Sleeves/Couplings

Sleeves shall be ductile iron with M.J. followers. Couplings shall be steel or ductile iron with gasketed ends. They shall be **designed for a working pressure of at least 200-psi and a test pressure as required for the project (225 psi or greater as required)** and sized to properly fit the type and class of pipe specified. All bolts shall be of corrosion resistance alloy. Carbon steel couplings shall be coated internally and externally with high build, high strength, **Thermo-set Epoxy coating, 8-10 mil D.F.T. and free of holidays**, or, alternately, steel couplings shall be Type 304 stainless steel.

4.1.5 **Tapping Saddle/Sleeve (F.I.P. or C.C. Outlet)**

Saddles/Sleeves shall be made from iron, bronze or steel and designed for a working pressure of at least 200-psi. Outlets shall be ANSI B16.1, Class 125 flanged tapping outlets or as otherwise specified. Watertight seal shall be accomplished by the use of a gasket placed in a recess between the sleeve body and pipe barrel. The use of these Strap Saddles/Sleeves is restricted to taps where the branch is at least one size smaller than the run. Coating on steel sleeves/saddles shall be as specified in **Section 4.1.4** above. Tapping saddle/sleeve shall meet or better NSF-61 requirements.

4.1.6 **Reducers**

Reducers shall be ductile iron, bell x bell (or M.J. x M.J. with Mega-Lug retainer glands if so specified by the Engineer), **long/full-bodied**, suitable for installation of a standard anchor collar around the reducer. If a reducer is specified as being restrained joint, see **Section 4.1.7** below.

4.1.7 **Restrained Joint Fittings**

When restrained joint ductile iron pipe is specified on a project, the fittings shall also be restrained joint designed for the restrained joint system used on the pipe. Mechanical joint or push-on fittings with retainer glands are not an equal to restrained joint fittings.

4.2 **Reinforced Concrete Fittings**

Fittings shall be designed for a working pressure of 200-psi or as specified in accordance with **AWWA C301**. Outlets shall conform to applicable pipe specifications elsewhere herein.

4.3 **Service Fittings**

4.3.1 All one (1") inch taps will be the direct tap method unless previously approved by the **ENGINEER**. Exceptions may be pressure class D.I., C-900 PVC, and SDR 17 PVC, where the use of saddles may be permitted as approved by the **ENGINEER**.

4.3.2 Service clamps or saddles shall be those manufactured by the following companies or approved equal. The screws and/or nuts shall be of corrosion resistant alloy and shall be of Hex Head configuration. All service fittings shall meet or better NSF-61 requirements.

<u>Size and Description</u>	<u>Cat. No.</u>	<u>Manufacturer</u>
2" x 1" Service Saddle, F AWWA CS Threaded Outlet. For use on steel pipe	311-025609 F101-250-CC4 401	Smith-Blair Ford A.Y. McDonald
6" x 2" Service Saddle, CI, DI, AC FIP Threaded Outlet (double strap)	313-076014 406 F202-760-IP7	Smith-Blair JCM Industries Ford

8" x 2" Service Saddle, CI, DI AC FIP Threaded Outlet (double strap)	313-101014 F202-979-IP7 406	Smith-Blair Ford JCM Industries
10" x 2" Service Saddle, CI, DI, AC FIP Threaded Outlet (double Strap)	313-121214 F202-1212-IP7 406	Smith-Blair Ford JCM Industries
12" x 2" Service Saddle, CI, DI, AC	313-143214 B202-1438-IP7 406	Smith-Blair Ford JCM Industries
2" x 1" Bronze Service Saddle, AWWA CS threaded outlet, for use on PVC pipe 2.375" OD	H-13420 S70-204 327	Mueller Ford Smith-Blair
3" x 1" Bronze Service Saddle, AWWA CS threaded outlet, for use on PVC pipe 3.50" OD	H-13425 S70-304 327	Mueller Ford Smith-Blair
4" x 1" Bronze Service Saddle, AWWA CS threaded outlet, for use on PVC pipe 4.50" OD	H-13248 S70-404 327	Mueller Ford Smith-Blair
1" x 3/4" Brass Bushing, IP threads	C18-43NL 72206	Ford A.Y. McDonald
1" x 1/2" Brass Bushing, IP threads	C18-14 NL 72206	Ford A.Y. McDonald
3/4" x 1/2" Brass Bushing, IP threads	C18-13NL 72206	Ford A.Y. McDonald

2" & 3" Brass Nipples, length as specified, IP threads
on one end, 45 deg. Bevel on other end (AWWA C800 Red Brass Pipe)

1/2", 3/4", 1", 2", 3" Brass Nipples, length as specified
IP threads on each end (AWWA C800 Red Brass Pipe)

4.3.3 Corporation and curb stops shall conform to AWWA C800 (curb stops shall have a 360 deg. rotation of the Tee Head) and shall be those manufactured by the following companies or approved equal.

<u>Size and Description</u>	<u>Cat.No.</u>	<u>Manufacturer</u>
1" Corporation Stop, AWWA CC thread	H-1500N	Mueller

inlet x CF outlet	FB-1600NL 74701	Ford A.Y. McDonald
1" Corporation Stop, AWWA CC thread inlet x PJ (CTS) outlet	P15008N F-1000-4NL 74701-22	Mueller Ford A.Y. McDonald
1" Corporation Stop, AWWA CC thread inlet x FIP thread outlet	H-1500-1N FB-1500-1NL 73148B	Mueller Ford A.Y. McDonald
1" Curb Stop, AWWA PJ Inlet x FIP	P-25172-3N B41-444RNL 76112-22	Mueller Ford A.Y. McDonald
1" Curb Stop, round way, FIP inlet x FIP outlet (Oriseal Ball)	H-1500-1N B11-444RNL 76111	Mueller Ford A.Y. McDonald
1" Curb Stop Round Way, CF inlet x FIP outlet (Oriseal Ball)	H-1501-1N B21-444RNL 76112	Mueller Ford A.Y. McDonald
1" Curb Stop, Full Round Way FIP thread inlet x FIP outlet	H-10291NL B11-555RNL 76111	Mueller Ford A.Y. McDonald
1" Ball Valve, CF x CC	H-1502-1N BM22-444RNL 76110	Mueller Co. Ford A.Y. McDonald

4.3.4 Copper pipe fittings shall conform to AWWA C800 and shall be those manufactured by the following companies or approved equal.

<u>Size and Description</u>	<u>Cat.No.</u>	<u>Manufacturer</u>
3/4" PJ x PJ	P-15403N 74758-22 C44-33NL	Mueller Co. A.Y. McDonald Ford Meter Box
1" PJ x PJ	P-15403N 74758-22 C44-44NL	Mueller Co. A.Y. McDonald Ford Meter Box

3/4" PJ x FIP	P-15451N 74754-22 C14-33NL	Mueller Co. A.Y. McDonald Ford Meter Box
1" PJ x FIP	P-15451N 74754-22 C14-44NL	Mueller Co. A.Y. McDonald Ford Meter Box
3/4" PJ x MIP	P-15428N 74753-22 C84-33NL	Mueller Co. A.Y. McDonald Ford Meter Box
1" PJ x MIP	P-15428N 74753-22 C84-44NL	Mueller Co. A.Y. McDonald Ford Meter Box
2" PJ x MIP	P-15428N 74753-22 C84-77NL	Mueller Co. A.Y. McDonald Ford Meter Box

4.3.5 The following meter connection fittings shall conform to AWWA C800 and be manufactured by the following companies or equal.

<u>Size and Description</u>	<u>Cat.No.</u>	<u>Manufacturer</u>
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SINGLE SETS

5/8" Meter Setter	H-1558N	Mueller
1" MIP Vertical Inlet X	V71-81W-84-43NL	Ford
3/4" PJ Horiz. Outlet	739-107LXD233	A.Y. McDonald

IN AREAS WHERE WORKING PRESSURE EXCEEDS 150 PSI USE THE FOLLOWING:

B-2558N	Mueller
VB-71-81W-84-43NL	Ford
739-107BXD233	A.Y. McDonald

3/4" Meter Setter	H-1558N	Mueller
1" MIP Vertical Inlet X	V73-83W-84-43NL	Ford
3/4" PJ Horiz. Outlet	739-307LXD233	A.Y. McDonald

IN AREAS WHERE WORKING PRESSURE EXCEEDS 150 PSI USE THE FOLLOWING:

B-2558N	Mueller
VB73-83W-84-43NL	Ford
739-307BXD243	A.Y. McDonald

1" Meter Setter	H-1558N	Mueller
1" MIP Vertical Inlet X	V74-84W-84-44NL	Ford
1" PJ Horiz. Outlet	739-410LXM244	A.Y. McDonald

IN AREAS WHERE WORKING PRESSURE EXCEEDS 150 PSI USE THE FOLLOWING:

B2558N	Mueller
VB74-84W-84-44NL	Ford
739-410BXM244	A.Y. McDonald

DUAL SETS

5/8" Meter Setter	H-1558 N	Mueller
3/4" FIP Vertical Inlet X	V71-81W-14-33NL	Ford
3/4" PJ Horiz. Outlet	739-107LX0233	A.Y. McDonald

IN AREAS WHERE WORKING PRESSURE EXCEEDS 150 PSI USE THE FOLLOWING:

B2558N	Mueller
VB71-81W-14-33NL	Ford
739-107BXO233	A.Y. McDonald

3/4" Meter Setter	H-1558N	Mueller
3/4" FIP Vertical Inlet X	V73-83W-14-33NL	Ford
3/4" PJ Horiz. Outlet	739-307LX0233	A.Y. McDonald

IN AREAS WHERE WORKING PRESSURE EXCEEDS 150 PSI USE THE FOLLOWING:

B2558N	Mueller
VB73-83W-14-33NL	Ford
739-307BXO233	A.Y. McDonald

1" QB Coupling PJ	P-15076N	Mueller
	L04-44SNL	Ford
	74776S-22	A.Y. McDonald

1" Corporation Adapter PJ	P-15071N	Mueller
	C04044NL	Ford
	74755-22	A.Y. McDonald

2" Meter Setters with 1" Bypass	VV77-12B-11-77NL	Ford
	H-1423N	Mueller
	720b712HHFF775	A.Y. McDonald

1 1/2" Meter x 2" FIP, Angle Valve, w/ Support Bracket	FV13-676W-MSBNL	Ford
	74604B	A.Y. McDonald

2" Meter x FIP, Angle Valve, w/ Support Bracket	FV13-777W-MSBNL 74604B	Ford A.Y. McDonald
1 1/2", 2" Meter, Angle Valve, Plain	H-14286N FV13-676WNL	Mueller Ford
1 1/2" 2"	FV13-777WNL	Ford
1 1/2" Meter x 1 1/2" IP Flanged Meter Coupling, brass	926-190 CF-31-66NL 7610F	Smith-Blair Co Ford A.Y. McDonald
2" Meter x 2" IP Flanged Meter Coupling, brass	926-190 CF31-77NL 7610F	Smith-Blair Co Ford A.Y. McDonald
1" x 3/4" x 7 1/2" U Branch Straight	488-43NL H15364N 708UMM	Ford Mueller A.Y. McDonald
2" x 1 1/2" Meter Setter Adapter Pair	A67NL Pair 7410J67	Ford A.Y. McDonald

4.4 **Displacement Type Water Meters, 5/8" through 2"**

4.4.1 Meters shall be provided by Central Arkansas Water. **CONTRACTOR** shall install the meters in those meter settings previously installed by the **CONTRACTOR**.

4.5 **Pressure Reducing Valves**

4.5.1 Shall be Watts Series 223-HP - Only

5. GATE VALVES

5.1 **Gate Valves – Double Disc – 14" and Larger NO LONGER USED**

5.2 **Gate Valves – Resilient Seat – 2"**

5.2.1 Two (2") inch Resilient Seat Gate Valves shall be designed for a minimum working pressure of **250-psi**, including reduced wall thickness valves. Valves shall conform to **ANSI/AWWA C509 or C515 Standard, UL Listed, FM Approved, certified to**

ANSI/NSF 61 with non-rising stem, O-ring stem seals, and **2-inch T-HEAD operating nut** (a straight T-Head operator is preferred; a combination square nut with raised T-Head operator is acceptable **ONLY IF THE SQUARE NUT IS TOO SMALL TO BE OPERATED BY A STANDARD 2" SQUARE NUT WRENCH**). Valve shall open when operating nut is turned to the **LEFT** (counter clockwise). Valve ends shall be screw ends for standard 2-inch thread, F.I.P. The resilient wedge may be bonded or mechanically attached to gate. All interior and exterior metal surfaces shall be coated with a two part thermosetting epoxy meeting or exceeding the requirements of ANSI/AWWA C550 Standard and certified to meet ANSI/NSF 61 Standard. See Section 5.3.4 for approved manufacturers.

5.3 Gate Valves – Resilient Seat – 3” through 12”

5.3.1 Resilient seat gate valves 3-inch through 12-inch shall be designed for a minimum working pressure of **250-psi**, including reduced wall thickness valves. Valves shall conform to **AWWA C509 or C515** with non-rising stem, O-ring stem seals, **2-inch x 2-inch square operating nut**. Valves shall open when the operating nut is turned to the **RIGHT (clockwise)***. Three (3) inch valve ends shall be screw end for standard 3-inch threads, F.I.P. All other valve ends shall be as specified. The resilient seat may be bonded or mechanically attached to the gate. All interior and exterior metal surfaces shall be coated with a two-part thermosetting epoxy complying with ANSI/AWWA C550.

* **Note: NORTH OF THE ARKANSAS RIVER, valves will operate RIGHT or LEFT, as determined by existing zones (areas). SOUTH OF THE ARKANSAS RIVER, valves THREE (3)-INCHES AND LARGER will operate RIGHT. Two (2)-inch valves and all valves in the Wye Mountain service area and the Paron-Owensville service area will operation LEFT.**

5.3.2 Epoxy Coating in paragraphs 5.2.1, 5.3.1, and 5.4.1 shall be 8 mil D.F.T. and free of holidays.

5.3.3 Tapping valves shall have full size flow way accepting standard size shell cutter.

5.3.4.1 **2” through 10” – Resilient Seat Valves conforming to these specifications will be accepted from the following manufacturers:**

American Flow Control (Valve & Hydrant Co.), Birmingham, Alabama
Clow Corporation, Oskaloosa, Iowa
Kennedy Valve Manufacturing Company, Elmira, New York
Mueller Company, Decatur, Illinois
U.S. Pipe & Foundry Co., Birmingham, Alabama
Waterous, St. Paul, Minnesota
M & H Valve and Fitting Co.,
AVK, American AVK Co., Fresno, CA.
(2” and 3” AVK Model 35 are NOT approved)

5.3.4.2 **12” – Resilient Seat Valves conforming to these specifications will be accepted from the following manufacturers:** (12” valves shall have a maximum operating torque to-close of 180 ft-lbs.)

Mueller Company, Decatur, Illinois
U.S. Pipe & Foundry Co., Birmingham, Alabama
Clow Corporation, Oskaloosa, Iowa
AVK, American AVK Co., Fresno, CA – Series 25 and Series 45
American Flow Control (Valve & Hydrant Co.), Birmingham, AL – Series 2500

5.4 **Gate Valves – Resilient Seat – 14” and larger**

5.4.1 Resilient seat gate valves 14-inch through 24-inch shall be designed for a minimum working pressure of **250-psi**, including reduced wall thickness valves. Valves shall conform to **AWWA C509 or C515** with non-rising stem, O-ring stem seals, thermoplastic thrust washers, and 2-inch square operating nut. The disc may be gray or ductile iron, totally encapsulated with rubber, with thermoplastic bearing surfaces. **Valve shall open when the operating nut is turned to the RIGHT (clockwise)*.** Valve ends shall be as specified. All interior and exterior metal surfaces shall be coated with a two-part thermosetting epoxy in accordance with ANSI/AWWA C550. Valves shall have a maximum operating torque to-close of 180 ft-lbs.

* ***Note: NORTH OF THE ARKANSAS RIVER, valves will operate RIGHT or LEFT, as determined by existing zones (areas). SOUTH OF THE ARKANSAS RIVER, valves THREE (3)-INCHES AND LARGER will operate RIGHT. Two (2)-inch valves and all valves in the Wye Mountain service area and the Paron-Owensville service area will operate LEFT.***

5.4.2 **14” and larger - Resilient Seat Valves conforming to these specifications will be accepted from the following manufacturers:**

Mueller Company, Decatur, Illinois
U.S. Pipe & Foundry Co., Birmingham, Alabama
American Flow Control (Valve & Hydrant Co.), Birmingham, AL – Series 2500
Clow Corporation, Oskaloosa, Iowa

5.5 **Butterfly Valves**

Butterfly valves shall conform to **AWWA C504.**

- 5.5.1 Pressure Rating: butterfly valves that will be tested against or otherwise be subject to pressures in excess of 150-psi, shall be rated for 250-psi service; butterfly valves that will not be tested against and otherwise will not be subject to pressures in excess of 150-psi, shall be rated for 150-psi service.
 - 5.5.2 Suitable for complete buried service. Exterior of valve shall be epoxy coated.
 - 5.5.3 Disc may be made from any of the materials as specified in **AWWA C504**. However, discs made from materials other than bronze or stainless steel shall be coated with epoxy material in accordance with paragraph 5.5.10 below. All other interior surfaces which are not stainless steel or bronze shall also be coated with epoxy material.
 - 5.5.4 Valve resilient seats shall be **BUNA-N** bonded into a self-retaining recess in the body or a natural rubber molded to an 18-8, Type 304 S.S. retaining ring secured to the disc by self setting screws. If the set is attached to the disc, the mating surface to the resilient seat shall be Type 304 or 316 stainless.
 - 5.5.5 Stainless steel shafting
 - 5.5.6 O-Ring or split-V shaft seals
 - 5.5.7 Bronze, nylon or Teflon bearings
 - 5.5.8 Manual Operator totally enclosed for buried service
 - 5.5.8.1 2-inch x 2-inch operating nut
 - 5.5.8.2 **Open RIGHT (clockwise)***
- * Note: NORTH OF THE ARKANSAS RIVER, valves will operate RIGHT or LEFT, as determined by existing zones (areas). SOUTH OF THE ARKANSAS RIVER, valves THREE (3)-INCHES AND LARGER will operate RIGHT. Two (2)-inch valves and all valves in the Wye Mountain service area and the Paron-Owensville service area will operation LEFT.*
- 5.5.8.3 Operators of the traveling nut type shall **NOT** have u-joints to the reach rods
 - 5.5.8.4 On operators composed of worm gears, worm gears may be either bronze or ductile iron and the worms shall be composed of hardened steel.
 - 5.5.8.5 The operators shall satisfy the valve operating torque requirements for Class 150B valves and the operator input requirements of **AWWA C-504**.
- 5.5.9 Valve ends shall be as specified. If flange ends are specified, they shall conform to **Class 125, ANSI B16.1**.
- 5.5.10 Epoxy coating for Valve Disc. Before application of coating material, all surfaces of the disc shall be thoroughly cleaned to remove dirt, grease, oil and any other substances; all sharp angles, protrusions or irregularities which would interfere with proper coating coverage shall be removed and the entire surface grit blasted to white metal in accordance with **SSPC Specification SP5** resulting in an anchor pattern of at least one (1) mil. Thermo-set epoxy materials shall be applied to the sandblasted surfaces before the white

metal begins to oxidize (darken in color). The thermoset epoxy shall be approved by the Federal Food and Drug Administration for exposure to fluids for human consumption. The final film thickness shall be at least 8 mils DFT and free of holidays. The disc shall be post-cured for a sufficient period of time to assure full polymerization. Polymerization shall be checked by a direct impact test at 60-inch-lb with no cracking or chipping of the coating. The film thickness shall be checked using an accurate magnetic film thickness gauge. The entire coated surface shall be checked for holidays using a wet sponge type holiday detector. Any areas where the film thickness is found to be less than eight (8) mils or where holidays were detected shall be re-coated and re-checked. Valves shall be packed for shipment in such manner that the disc coating is protected from damage.

5.5.11 Butterfly Valves conforming to these specifications will be accepted from the following manufacturer:

Henry Pratt Company, Aurora, Illinois
150-psi butterfly valves shall be GROUNDHOG 150B series.
250-psi butterfly valves shall be TRITON HP-250 series.
M&H Valve Company
Style 4500 or 1450
DeZurik
BAW BF Valve

5.6 Air Release Valves

5.6.1 1-inch shall be ValMatic 25.6 or as specified.

5.7 Combination Air Valve

5.7.1 1-inch shall be ValMatic 201C.2 or as specified

5.7.2 2-inch shall be ValMatic 202C.2 or as specified

6. VALVE BOXES AND OPERATOR NUT EXTENSIONS

6.1 Valve boxes shall be the 6860 series, two piece, screw type, 5 ¼-inch shaft, Item #461-S, 19inch to 22-inch extension, or screw type, 5 ¼-inch shaft, Item #562-S, 27-inch to 37-inch extension, manufactured by Tyler/Union Utilities Company or East Jordon Iron Works 8550 series 462-s(8550 1922) and 562-s(8550 2737). All valve boxes must be constructed to accept a locking lid. All drop lids shall be marked "WATER."

6.2 For valves with operator nut located five (5) feet or more deep, an operator nut extension shall be installed. All components of the extension shall be Series 300 stainless steel. See **Section 18.4 of the Construction Specifications.**

6.3 A valve box alignment device shall be provided and installed for each valve box installation. The device shall be of HDPE or Glass Filled Polypropylene construction. It shall be furnished in two pieces that will lock together under the operating nut of the valve without requiring the removal of the operating nut. The device shall not affect the operation of the valve. The device shall be the BOXLOK as manufactured by Emma Sales, LLC, AFC Alignment Ring as manufactured by American Flow Control, or approved equal.

7. METER BOXES AND LIDS

7.1 Meter Boxes (round) for 5/8” thru 1” Meter Settings

7.1.1 Meter boxes shall be dimensioned as follows and shall be PVC. Meter boxes shall be cut from SDR 51 (80 psi), or better, Plastic Irrigation Pipe (PIP).

Box Size	Inside Diameter	Height
15"	15"	15"
18"	18"	15"
21"	21"	18"

7.1.2 **Meter Box Lids (round) for 5/8” thru 1” Meter Settings:** The iron shall be of such composition and the conditions of manufacture so maintained that the resulting castings are of compact, close grained, machinable metal. Castings shall be true to the patters and free from cracks, gas holes, flaws, and excessive shrinkage. Surfaces of the castings shall be free of burned on sand and shall be reasonably smooth. Runners, riser, and other cast-on pieces shall be removed. The metal used shall not contain more than 0.11% sulfur and no more than 0.90% phosphorous and shall have a tensil strength of at least 21,000-psi. Both sides of the lid shall have an even coating of bituminous paint. Meter box lid shall be East Jordan Iron Works Models 108P, 109P, and 110P for 15-inch, 18-inch and 21-inch meter boxes (respectively) or Neenah/Deeter Foundry meter box lids Models #1750 and #1751 or Vestal Manufacturing meter box lids Models 32-020/WM-15 and 96-357/WM-18.

7.2 Meter Boxes (round) for 1½”, 2”, 3”, and 4” Meter Settings

7.2.1 Meter boxes for 1 ½”, 2”, 3”, and 4” meter settings shall be provided complete with plastic box section, cast iron lid ring, CAW customized cast iron cover, and miscellaneous parts as shown in the standard detailed drawings. The meter box shall be linear medium and high density polyethylene of one piece molded construction. The meter box shall have 28” x 24” nominal dimensions with 28 5/8” I.D. at the top of the meter box and 24” length (height). The meter box must have a minimum wall thickness of 0.550” and have been tested to withstand a 20,000 pound vertical load freestanding, 200 pound horizontal load freestanding, and deflect not more than one inch in diameter. All edges shall be clean and smooth for safety during handling. Inner and outer wall are to be smooth with a bright white interior to ease meter reading. The exterior shall be black to retard UV degradation. Low temperature brittleness shall exceed -76° F. The meter box shall have a top flange for cover seating and an anti-settling flange on the bottom.

7.2.2 For the 30” meter boxes, the customized cast iron cover (lid) shall be Product No. 32143005 and the plastic box section (Product No. 38003024 as manufactured by DFW Plastics Inc.); cast iron lid ring, and miscellaneous parts shall be Product No. 32243002A01 as manufactured by East Jordon Iron Works, Inc.

8. FIRE HYDRANTS

8.1 Hydrants shall be NSF 61 certified and shall conform to AWWA C502, the following specifications, and shall be Traffic Model Fire Hydrants

8.1.1	Working Pressure	200 - psi
8.1.2	Size of Valve Opening	Minimum 5-inch
8.1.3	Diameter of Inlet Connection	6-inch
8.1.4	Type of Inlet Connection	Mechanical Joint
8.1.5	Number & Size of Hose Connection	2 - 2 ½-inch and 1 - 4 ½-inch unless otherwise designated 2 – 2 ½-inch and NO pumper nozzle in areas outside ETJ
8.1.6	Nozzle Arrangement	All in same plane
8.1.7	Nozzle Thread ASA	Standard
8.1.8	Nozzle Cap Chains	None
8.1.9	Nozzle Cap Washers	Rubber
8.1.10	Operating Threads	Oil/grease lubed w/o ring seals
8.1.11	Seat Rings	Bronze to Bronze
8.1.12	Direction of Turn to Open	RIGHT (Clockwise) Except in the City of Maumelle, Paron-Owensville, & Wye Mountain Which shall OPEN LEFT
8.1.13	Shape & size of Operating & Nozzle Cap Nut	5-sided, 1 ¼-inch flat to point
8.1.14	Operating Nut	Bronze or CI Weathercap
8.1.15	Color above ground - barrel and dome	Aluminum (CAW maintained) Red (privately maintained)
8.1.16	Color, nozzle caps, top nut and shield	Aluminum (CAW maintained) Red (privately maintained)
	Aluminum paint shall be FLYNT Aluminum paint, Flynt Paint Products, P.O. Box 28, Greenville, TX 75403, (1.800.473.5968).	
	Red paint shall be standard “fire hydrant red” enamel paint provided by the hydrant manufacturer.	
8.1.18	Weep hole location	Side
8.1.19	Maximum depth of bury	6-feet
8.1.19.1	8" main- minimum depth of bury	3 ½-feet
8.1.19.2	12" main - minimum depth of bury	4-feet
8.1.19.3	16" main - minimum depth of bury	4 ½-feet

8.2 Seat shall be removable, using a short light weight wrench which will fit all depths of bury.

8.3 **Fire hydrants conforming to these specifications will be accepted from the following manufacturers**

Centurion Model by - Mueller Company, Decatur, Illinois

Medallion by - Clow Valve Company, Oskaloosa, Iowa

Model B-62-B by - American Valve & Hydrant Co., Birmingham, Alabama

9. POLYETHYLENE TUBING MATERIAL FOR PIPE ENCASEMENT

- 9.1 Polyethylene material for the encasement of ductile pipe, fittings, taps, sleeves, valves, etc. shall conform to **ANSI A21.5 (AWWA C - 105)**, and shall be installed as per the Polyethylene Encasement Installation Guide published by DIPRA. Minimum material thickness shall be 8 mm. Adhesive tape (duct tape or other approved tape) or plastic tie straps shall be used to secure the PE material folds and overlaps as directed in the Installation Guide.
- 9.2 Tape for field tapping of polywrapped pipe, fittings, etc. or field repair of missing polyethylene encasement material shall be Polyken #900, Scotchrap #50 or equal, at least 2-inches wide, and installed as per the Polyethylene Encasement Installation Guide published by DIPRA.

10. TRACE WIRE FOR NON-METALLIC PIPE

- 10.1 Trace wire shall be provided with all non-metallic pipe and shall be designed and manufactured for direct burial service. Trace wire insulating jacket shall be BLUE in color. Typical THHN or nylon coated electrical wire is not allowed. Trace wire for open trench installation shall be 12-gauge, insulated solid copper wire. The insulating jacket shall be a minimum of 30 mil polyethylene complying with ASTM-D-1248, 30 volt rating. Trace wire for directional bore or jacked installation shall be 12-gauge, (CCS) insulated copper-clad solid steel core hard drawn high strength horizontal drill tracing wire, average tensile break strength of at least 1000#, with minimum of 45 mil polyethylene jacket complying with ASTM-D-1248, 30 volt rating. At the **CONTRACTOR'S** option, CCS wire can be used for open trench installation.
- 10.2 All tracing wire splices shall be encased with a 3M Gel Pack Model No. 054007-09053.

REVISIONS :

4/26/04 Section 5.2.1. revised to exclude square nut operators on 2" valves that are large enough to be operated by a 2" square nut wrench.

4/26/04 Section 5.3.4.2. revised to require 12" gate valves have a maximum closing torque of 180 ft-lbs.

4/26/04 Section 8.1.16 revised to require CAW maintained fire hydrants to be painted aluminum in color and privately maintained fire hydrants to be painted red in color.

4/26/04 Section 4.1 revised to include HARCO 2" and 3" ductile iron fittings, domestic only.

5/27/04 Section 4.1.6 revised to clarify that long-bodied reducers are "full" bodied reducers ("**long-bodied**" changed to "**long/full-bodied**").

10/25/04 Section 3.5.7 revised to include Vulcan Plastics as approved provider of PVC water pipe.

10/25/04 Section 4.3 revised to include Cambridge Brass as approved provider of brass service fittings.

7/18/05 Section 8.3 revised to include **Metroflow/M-03** - by U.S. Pipe, Birmingham, Alabama, as approved fire hydrant.

7/18/05 Section 3.3.3 revised to indicate acceptable and un-acceptable restrained joint types.

11/3/05 Section 5.3.4.2. revised to include CLOW as acceptable manufacturer of 12-inch gate valves.

1/26/05 Section 3.5.9 this section added to designate applicable areas for installation of 4" through 12" PVC water main.

1/26/05 Section 8.1.5 revised to indicate applicable areas for installation of two-way fire hydrants.

3/20/06 Section 7 METER BOXES AND LIDS - section revised to detail new specification for 2" meter boxes as provided by East Jordan Iron Works.

6/12/06 Section 3.8 STEEL ENCASUREMENT PIPE - section revised to include ASTM A283 specification and Spiral Welded pipe allowed size 26" diameter and larger.

6/12/-6 Section 4.3.2 SERVICE FITTINGS - section revised to remove Cat. No. 381 Ford Meter Box service saddles and add Cat. No. 381 Smith-Blair service saddles.

6/12/06 Section 7.2 1½", 2", 3", and 4" METER BOXES - section revised to remove PIP box meter box construction and add manufactured meter box and customized cover as manufactured by East Jordan Iron Works.

6/12/06 Section 9 POLYETHYLENE TUBING MATERIAL FOR PIPE ENCASUREMENT - revised to include installation shall be in conformance with DIPRA installation guide.

10/20/06 Section 3.7 POLYETHYLENE SERVICE TUBING - this section added to allow that polyethylene service tubing may be installed for temporary items and shall be completely disconnected from the system and removed from the ground prior to project approval. Any tap on a main shall be 1" or larger; direct tap on ductile iron pipe; saddle tap on PVC pipe.

11/15/06 Section 6.3 added to require installation of a valve box alignment device for every valve box installation.

2/28/07 Section 4.3.5 corrected Ford Cat. No. for ¾" Meter Setter to V73-83W-84-43.

6/28/07 Section 5.3.4.1 - 12" Gate Valves - section revised - two new 12" gate valve manufacturers added to the approved list: AVK Series 25 and Series 45 and American Flow Control Series 2500.

6/28/07 Section 6.3 - Valve Box Alignment Device - section revised - new manufacturer added to the approved list: American Flow Control Alignment Ring.

7/2/07 Section 4.3.5 Meter Settings - section revised to include approved A.Y.McDonald 1" coppersetter part number 39-410LXM244.

7/10/07 Section 3.3 - section revised to state gaskets shall be manufactured in the United States and/or Costa Rica.

7/23/07 Section 3.8.2 - section added as follows: A Series 300 stainless steel wire rope cable, 3/8" diameter, shall be provided threaded through the encasement pipe along with the carrier pipes of 6-

inch diameter and larger. Splices should be avoided, but if necessary shall be made with Series 300 stainless steel wire rope cable clamps.

7/14/08 Section 10.1 - section revised to allow thicker copper or Series 300 stainless steel trace wire for pipe placed by trenchless excavation methods.

10/11/08 Section 3.8 - section revised to include minimum encasement size and wall thickness.

03/26/09 Section 4.3.5 - section revised to include 2" Mueller Co. meter setter.

06/11/09 Section 3.5.7.1 - section revised to include CertainTeed Certa-Lok Yelomine as acceptable PVC pipe.

03/16/10 Section 4.1.1 - section revised to include Uni-Flange Series 1400 as manufactured by Ford Meter Box.

03/16/10 Section 8.3 - Metroflow/M-03 fire hydrant is no longer in manufacture and is removed from the specifications.

03/16/10 Section 10.2 - 3M Gel Pack kit added to specification for tracing wire splicing.

03/22/10 Section 4.3 - section revised to include service fittings manufactured by Cambridge Brass, Inc.

04/12/10 Sections 5.2, 5.3, and 5.4 - sections revised to include AWWA C515 gate valves.

04/11/11 Section 5.4.2 - section revised to include American Flow Control Series 2500 resilient seat gate valve.

04/12/11 Section 4.3.2 - JCM service saddles changed from model 402 to epoxy coated model 406.

04/12/11 Section 4.1.1 - domestic Star Grip added as approved retainer gland.

05/10/11 Revised to require miscellaneous stainless steel to be Series 300.

03/26/12 Section 3.5.7.1 - Northern Pipe Products added as approved PVC pipe supplier.

03/26/12 Section 5.4.2 - section revised to include Clow Corporation large diameter resilient seat gate valve.

03/26/12 Section 10.1 - section revised to require 12-gauge tracing wire.

03/26/12 Section 7.1.2 - Neenah/Deeter Foundry meter box lids models #1750 and #1751 added as approved equal.

03/26/12 Section 7.2.1. - dimensions corrected on the meter box size.

03/26/12 Section 4.3. - numerous product numbers and manufacturer information corrected, primarily to reflect no lead brass requirements.

05/22/13 Section 7.1.2 - two Vestal Manufacturing model numbers added for 15" and 18" meter lids.

5/29/13 Section 4.3.5 - numerous product numbers added for meter setters located in areas where working pressure exceeds 150 psi.

5/29/13 Section 3.5.10 - specification amended to disallow use of PVC pipe where the working pressure exceeds 125 psi.

7/8/13 Section 5.5.11 - specification amended to allow M&H Valve Company butterfly valves, Style 4500 and 1450.

10/1/13 Section 3.5.7.1 - specification amended to allow PipeLife Jet Stream PVC pipe.

10/1/13 Section 5.5.11 - specification amended to allow DeZurik butterfly valves.

10/1/13 Section 8.1 - specification amended to require NSF 61 certification on fire hydrants.

02/20/2014 Section 10.1 - specifications regarding tracing wire modified to require polyethylene jacket and disallow usage of nylon coated wire.

02/20/2014 Section 4.3.5 - Cambridge Brass 2" meter setter with 1" bypass removed from specifications due to its length not fitting inside standard meter box.

06/01/2014 Section 4.1.1 - specification amended to allow TUFgrip Series domestic retainer glands by Tyler Union.

12/30/15 Section 4.3.5 - specification amended to allow A.Y. McDonald 2" Meter Setter with 1" Bypass Model 720b712HHFF775.

09/23/16 Section 3.8.3 - Link-Seal added for sealing of encasement ends.

09/23/16 Section 4.3 - revised to exclude Cambridge Brass fittings

04/02/21 Section 8.1.12 - revised to require fire hydrants located in the City of Maumelle to OPEN LEFT.

05/31/21 Section 4.1 - qualified push-on fittings to be restrained joint push-on fittings.

05/31/21 Section 5 - updated valve opening directions based on service area.

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SPECIFICATIONS - CONSTRUCTION

MAY 2021

1 - SCOPE, DESCRIPTION & WORK INCLUDED

- 1.1 The protection of the public water supply against contamination or pollution is of the essence of this **Work** and is of more importance than any other single feature herein; and the **CONTRACTOR** shall insure the protection thereof. Any contamination or pollution resulting from acts or omission of the **CONTRACTOR** shall, in addition to other remedies, be cause for termination of any **Contract** without notice.
- 1.2 The design, materials, and construction of water facilities shall conform to the latest revision of the Ten States Standards except as overridden and/or modified by the **Contract Documents**. These general and detailed specifications form a part of the **Contract Documents** and shall govern the handling and installation of the pipe and appurtenances. These general and detailed specifications are subject to revision from one project to another. The **CONTRACTOR** shall make himself familiar with the current revision. These general and detailed specifications, **MATERIAL** and **CONSTRUCTION**, may be modified by the **SPECIAL CONDITIONS** contained within the **Contract Documents**. Within this document, the terms **ENGINEER**, **INSPECTOR**, and **OWNER** shall both be considered to be **CENTRAL ARKANSAS WATER**.
- 1.3 The work intended to be performed under this **Contract** shall include the furnishing and the installation of pipes, fittings, valves, hydrants and appurtenances, including wet and tapping connections and other structures, all as described on the **Bid Form** and **Plans** and to perform all other work incidental thereto. Items of construction work and/or materials not specifically addressed herein, but nonetheless required for a complete, operating, and acceptable installation of the work, shall be considered subsidiary to the principal bid item requiring such work and/or materials, and the cost thereof shall be considered to be included in the bid price for the principal items. All work shall be performed in a professional manner, consistent with good workmanship practices, and shall meet total satisfaction and approval of the **ENGINEER**. The **ENGINEER** or his designated representative (**INSPECTOR**) may not be on the job site every hour that the **CONTRACTOR** is performing work. During the days the **CONTRACTOR** is allowed to perform **WORK** per the **Contract Documents**, the **CONTRACTOR** shall start **WORK** after dawn each day and complete the day's **WORK** by dusk each day. If the **City** in which the **WORK** is performed has a more restrictive work or noise ordinance, that requirement shall be followed. Some **WORK** may be required to be performed at night, weekends, or low water usage times as directed by the **Contract Documents**, **Construction Plans**, or the **ENGINEER**. Certain work, including but not limited to placement of reinforcement steel, placement of concrete, valve operation, pressure and leakage tests, cut and plugs, etc., must be inspected and approved by the **ENGINEER** before start, completion, or backfill. The **CONTRACTOR** shall coordinate the inspection of this type of work with the **ENGINEER**. The **CONTRACTOR** shall notify the **ENGINEER** sufficiently in advance of backfilling or concealing any **WORK** or facilities to permit proper observation. If the **WORK** or facilities are concealed without approval or consent of the **ENGINEER**, the **CONTRACTOR** shall uncover for observation and recover such facilities all at his own expense, when so requested by the **ENGINEER**. Unsatisfactory work or materials shall be removed and replaced at the **CONTRACTOR'S** expense. Penalties will be assessed against the **CONTRACTOR** and/or **DEVELOPER** for failure to conform or comply with the specifications as detailed in **Section 40** of this specification.
- 1.4 The approximate quantities are shown in the **Plans** and on the **Bid Form**.

1.5 The **OWNER** will perform the following work:

NONE

1.6 The **OWNER** will furnish the **CONTRACTOR** the following materials for installation:

WATER SERVICE METERS

at the **OWNER'S storage yard, 5300 Shackleford Road**, or other designated points.

1.7 The **CONTRACTOR** shall furnish all materials for concrete, mortar or masonry, lumber for bracing trenches, shoring obstructions, blocking, barricading and bridging the work as it progresses, temporary road resurfacing materials, pipes and materials for repair or replacement of sewers, drains, and other utility structures and all other materials, necessary for satisfactory completion of the project as specified, except those materials furnished by the **OWNER** and listed in **Section 1.5 above**.

1.8 The **CONTRACTOR** shall, unless otherwise specified in **Sections 1.4 or 1.5 above**, furnish all materials, labor, tools, and equipment necessary to complete the project. The **CONTRACTOR** shall clear the pipe line right-of-way; remove pavement as necessary; excavate the trench and pits to the required dimensions; construct and maintain all approaches required for traffic control; sheet, brace, and support adjoining ground or structures where necessary; handle all drainage or ground water; guard the site; load, unload, haul, distribute, lay and test the pipes, fittings, valves, hydrants, and appurtenances; rearrange branch connections to main sewers, conduits, ducts, culverts, or pipes where necessary; replace all damaged drains, sewers, culverts, or other structures; backfill the trench and pits; restore the roadway surface unless otherwise stipulated; remove surplus excavated material; clean the site of the work; and maintain the street or other surface over the trench until final acceptance of the completed project.

1.9 **Record Drawings** – The **CONTRACTOR** shall keep one set of construction plans as a “Record Drawing” set. The **CONTRACTOR** shall accurately identify and document the locations of all aboveground, underground, and/or concealed work that is performed/installed and/or affected by the work. This shall include all equipment, conduits, pipes, valves, fittings, and other appurtenances and underground structures that are a part of the **CONTRACTOR'S** work and their proximity to existing underground structures and utilities to the extent known. The **CONTRACTOR'S** work shall be documented on the Record Drawings in an on-going manner. Distances, offsets, depths, etc. shall be accurately measured from permanent fixed objects so that the **OWNER** can expose any item of the work in the future with a minimum of effort. All such measurements shall be made before the items of work are covered or backfilled. The **CONTRACTOR** shall be required to expose and recover/backfill the work at his own expense if, in the **OWNER'S** opinion, the measurements need to be verified. The Record Drawings shall be stored and maintained in good condition at all times by the **CONTRACTOR** and shall be made available to the **OWNER** at the work site at all times. All writing, notes, comments, dimensions, etc. shall be legible. The Record Drawings shall be submitted to the **OWNER** before the project will be accepted.

2 - INSPECTION OF MATERIAL

2.1 All materials whether furnished by the **OWNER** or the **CONTRACTOR** are subject to inspection and approval at the plant of the manufacturer at the discretion of the **OWNER**.

- 2.2 During the process of loading or unloading, all materials shall be inspected by the **CONTRACTOR** for damage. Rail shipments unloaded by the **CONTRACTOR** shall be inspected and any damaged material set aside.
- 2.3 Inspection of material at the manufacturer's plant, at the point of delivery, on the job site, or in place shall not relieve the **CONTRACTOR** of his responsibility and the material may be subject to rejection until final acceptance of the completed project.
- 2.4 Material contaminated with diesel exhaust or other contaminants will not be accepted.

3 - CONTRACTOR'S RESPONSIBILITY FOR MATERIAL FURNISHED BY OWNER

- 3.1 The **CONTRACTOR'S** responsibility for material furnished by the **OWNER** shall begin at the point of delivery by the manufacturer, or **OWNER**, and upon acceptance of the material by the **CONTRACTOR**.
- 3.2 All materials removed from the **OWNER'S** yard or from designated cars or trucks must be shown out on a ticket furnished by the **OWNER**.
- 3.3 Any materials left over shall be returned to the material yard and shown in on a turn-in slip. All returned pipes shall be straight cut and beveled as specified in **Section 13.7**.
- 3.4 Any materials charged out by the **CONTRACTOR** and not used or not returned will be charged to the **CONTRACTOR**.
- 3.5 Materials may be checked out from the warehouse or returned **Monday through Friday, between 8:30 a.m. and 3:30 p.m.**
- 3.6 The **CONTRACTOR** shall be responsible for the safe storage of all material after delivery to him by the manufacturer or **OWNER** and until it has been incorporated in the completed project.
- 3.7 Any material furnished by the **OWNER** that becomes damaged after acceptance by the **CONTRACTOR** shall be replaced by and at the expense of the **CONTRACTOR**, and the **CONTRACTOR** shall promptly remove all such damaged and defective material from the job site.
- 3.8 All demurrage charges on carloads of materials, which are unloaded by the **CONTRACTOR**, shall be paid by the **CONTRACTOR**. The **CONTRACTOR** shall also pay any storage charges for unloaded material. When a car is unloaded, the **CONTRACTOR** shall notify the railroad concerned and make a record of the time and person notified.
- 3.9 Materials shall be hauled by the **CONTRACTOR** and the expense of such transportation and handling shall be included in the bid price.

4 - HANDLING PIPELINE MATERIALS

- 4.1 The **CONTRACTOR** shall handle the material with the utmost care and in a manner to prevent damage to the materials, material coating and lining during loading, hauling, unloading, and installation operations. Material damaged shall be replaced or repaired at the **CONTRACTOR'S expense**.
- 4.2 **Hooks shall not be in contact with the pipe interior.**

- 4.3 The interior of the pipeline materials shall be kept free from dirt and foreign matter at all times. Any pipe or appurtenances contaminated by sanitary sewer and/or hazardous liquid or debris shall be removed from the project area and not used for potable water facility construction; decontamination is not an alternative for use of the pipe or appurtenance for potable water facility construction.
- 4.4 Pipe line materials, especially valves, hydrants and fittings shall be drained and stored in a manner to protect them from damage by freezing.

5 - LOCATION, ALIGNMENT AND GRADE

- 5.1 The **CONTRACTOR** shall clear a construction right-of-way as narrow as possible and avoid unnecessary removal or damage to trees, shrubs, and other landscaping. The **CONTRACTOR** shall remove from the area and properly dispose of all trees, stumps, limbs, piles of excess excavation, rubble, trash, and other debris.
- 5.2 The pipe, fittings, valves, hydrants, meter settings, and all other appurtenances shall be located and maintained to conform closely to the location, lines and grades specified or as shown on the Plans. An attempt has been made on the Plans to depict the improvements in their proposed locations, however, the actual location may be different than depicted. When running generally parallel, potable water facilities shall have a ten (10) foot minimum horizontal separation from sanitary sewer facilities at all times.
- 5.3 Valves and hydrants shall be set with operating stem and nut plumb. There shall be no sharp and sudden breaks, requiring extra fittings and no joint shall be located underneath a sub-structure without the consent of the **ENGINEER**. The minimum cover over the pipe shall be **three feet (3')** and deeper if otherwise indicated on the Plans. **When pipeline locations parallel a street, road, or highway and where the top of ground elevation is higher than the road surface, the minimum cover over the water pipe shall be as required to place the top of the water pipe two (2) feet below the elevation of the parallel road ditch flow line.** The minimum cover over the pipe laid under ditch and creek crossings shall be **four feet (4')** or as otherwise indicated on the Plans. Minimum cover shall be measured from the ground surface or the surface of the permanent improvement to the top of the barrel of the pipe, whichever is greater. Maximum cover shall not exceed **five feet (5')** without approval of the **OWNER**. Cover over the pipe will exceed the minimum requirement of three feet (3') in the area of air release valves, vacuum valves, and certain other fittings and appurtenances. **Extra trench depth required for the proper installation of these fittings and appurtenances will not be paid for separately.**
- 5.4 Horizontal and vertical (where required) control points will be established along or adjacent to the construction area. It shall be the responsibility of the **CONTRACTOR** to make necessary measurements from these control points in order to maintain the proper alignment and grade of the structures. The **CONTRACTOR** shall preserve all stakes and markers established by the **ENGINEER**. Failure of the **CONTRACTOR** to preserve such stakes and markers will result in the **OWNER'S** cost for re-establishment being deducted from amounts due **CONTRACTOR**. The use of bends shall be kept to an absolute minimum. If miscalculation of required pipe depth is made by the **CONTRACTOR**, the pipe shall be excavated and re-laid to the proper elevation.
- 5.5 In new subdivision construction and along new streets, roads, and highway construction, the easement and/or right-of-way of the water line shall be graded to within 0.1 foot of finished grade **BEFORE** installation of any water pipe.

6 - PUBLIC TRAVEL

- 6.1 The **CONTRACTOR** shall plan and execute the work so that interference with the flow of traffic and the passage of pedestrians will be the minimum possible.
- 6.2 The **CONTRACTOR** shall be responsible for making provisions for the safe and free passage of persons and vehicles by, over, or around the work while it is in progress. Such provisions shall be satisfactory with the **ENGINEER** and State, County and local authority having jurisdiction within the area of work.
- 6.3 The **CONTRACTOR** shall notify applicable State, County or local authority before closing or obstructing any public highway, street, or road.
- 6.4. When street cuts are required:
- 6.4.1 **Arkansas State Highway Department** - When state highways are to be cut, crossed, blocked, obstructed, and/or when an excavation in or under a highway right-of-way is required, the **OWNER** shall obtain a permit for the work at each specific location. The **CONTRACTOR** shall keep a copy of the permit(s) onsite at all times during work hours.
- 6.4.2 **City of Little Rock** - When City of Little Rock streets are to be cut, crossed, blocked, and/or obstructed, the **CONTRACTOR** shall prepare a barricade plan(s) and a street cut permit plan(s) for the work. Each separate excavation must be a separate permit request. The **CONTRACTOR** shall submit the plan(s) to the City of Little Rock Traffic Engineering Specialist (501-340-4854) at the City of Little Rock Traffic Control Office located at 7th Street and Broadway and obtain approval of the barricade plan(s) and street cut permit plan(s), and obtain "B" (barricade) number(s) for the work to be performed. The **CONTRACTOR** shall keep a copy of the permit(s) and "B" number approval(s) onsite at all times during work hours. The **CONTRACTOR** must provide the permit number to the **OWNER'S** Inspector before beginning excavation at a particular location. Barricade plans, street cut permit plans, and execution of **WORK** shall be performed per City of Little Rock Ordinance No. 21,641.
- 6.4.2.1 For street cut permits within the City of Little Rock, the **CONTRACTOR** is responsible for payment for the permit(s). The **OWNER** will not reimburse the **CONTRACTOR** for the cost of street cut permits or barricade plan approvals obtained from the City of Little Rock.
- 6.4.3 **City of North Little Rock** - When City of North Little Rock streets are to be cut, crossed, blocked, and/or obstructed, the **CONTRACTOR** shall prepare a barricade plan(s) for the work. The **CONTRACTOR** shall submit the plan(s) to the City of North Little Rock Traffic Division and obtain approval of the barricade plan(s). It will then be necessary for the **CONTRACTOR** to obtain a street cut permit(s) for the work from the City of North Little Rock Department of Public Works - Engineering. The **CONTRACTOR** shall keep a copy of permit(s) onsite at all times during work hours. The **CONTRACTOR** must provide the permit number to the **OWNER'S Inspector** before beginning excavation at a particular location. Barricade plans, street cut permit plans, and execution of **WORK** shall be performed per City of North Little Rock Ordinance No. 8,588.
- 6.4.3.1 For street cut permits within the City of North Little Rock, the **CONTRACTOR** is responsible for payment for the permit(s). The **OWNER** will not reimburse the **CONTRACTOR** for the cost of street cut permits or barricade plan approvals obtained from the City of North Little Rock.

- 6.4.3.2 The **OWNER** will provide signs (without any additional hardware) to the **CONTRACTOR** as needed to satisfy the North Little Rock city ordinance requiring the posting of signs at all street cut locations. The **CONTRACTOR** will be responsible for locating and placing the signs as required by the City. Signs provided by the **OWNER** to the **CONTRACTOR** shall be returned to the **OWNER** upon completion of the **WORK**. No additional or separate payment will be made to the **CONTRACTOR** for placement, relocation, and/or handling of the signs. **HOWEVER**, if the **CONTRACTOR** is under contract with a developer and not under contract with Central Arkansas Water, CAW will not provide any signs.
- 6.4.3.3 The City of North Little Rock requires signs to be placed around a job site informing the general public as to who is performing work. Central Arkansas Water will provide the necessary signs. The **CONTRACTOR** shall place and maintain the signs until the completion of the **WORK**. Upon completion of the **WORK**, the **CONTRACTOR** shall remove the signs and return them to the **ENGINEER**. **HOWEVER**, if the **CONTRACTOR** is under contract with a developer and not under contract with Central Arkansas Water, CAW will not provide any signs
- 6.4.4 **City of Sherwood** - When City of Sherwood streets are to be cut, crossed, blocked and/or obstructed, the **CONTRACTOR** shall prepare permit request(s) with a MUTCD traffic control plan(s) designed for the designated work zone ~~for the work~~. The **CONTRACTOR** shall submit the plan(s) to the City of Sherwood Engineering Department and obtain approval before any work commences (including Traffic Control). ~~approved permit(s) for the work~~. The only exception is a true emergency where life or property is in immediate danger. Permits should be obtained no later than the next business day after said emergency. The **CONTRACTOR** shall keep a copy of permit(s) onsite at all times during work hours. The **CONTRACTOR** must provide the permit number to the **OWNER'S Inspector** when requested and before excavation commences. ~~before beginning excavation at a particular location~~. The **CONTRACTOR** shall place signs at the construction location indicating the name of the **CONTRACTOR** and phone number that shall be on site until completion of work. The **CONTRACTOR** shall take every necessary step to control sediment loss offsite and take immediate steps to clean up such discharge before sediment enters the City owned drainage system.
- 6.4.4.1 For street cut permits within the City of Sherwood, the **CONTRACTOR** is responsible for payment for the permit(s). The **OWNER** will not reimburse the **CONTRACTOR** for the cost of street cut permits obtained from the City of Sherwood.
- 6.4.5 **Pulaski County** - A permit is required before a cut can be made to a right-of-way of any public county road located in Pulaski County. When Pulaski County roads are to be cut, crossed, blocked, obstructed, and/or any excavation in or under a county road right-of-way a permit is required, the **CONTRACTOR** shall submit ~~prepare permit request(s) with~~ traffic control plan(s) for the work. The **CONTRACTOR** shall submit the traffic control plan(s) ~~request(s) and plan(s)~~ to the County at 3200 Brown Street, Little Rock, and obtain approval ~~approved permit(s) for the work~~. The **CONTRACTOR** shall keep a copy of permit(s) onsite at all times during work hours. The **CONTRACTOR** must provide the permit number to the **OWNER'S Inspector** before beginning excavation at a particular location. Three (3) unsuccessful bore attempts on size four (4) inch and smaller pipe must have been made in the vicinity before any road cuts will be permitted. Road cuts of any pipe greater than four (4) inch will be to the discretion of the Pulaski County Road & Bridge director. When a paving cut is made in an emergency situation, a reasonable effort

shall be made to inform Pulaski County Road & Bridge directly, either before or after repairs begin.

6.4.5.1 For street cut permits within the Pulaski County jurisdiction, the **OWNER** is responsible for payment for the permit(s).

6.4.6 **Cammack Village** - When Cammack Village streets are to be cut, crossed, blocked and/or obstructed, the **CONTRACTOR** shall appear at the Cammack Village City Hall to apply for and sign permit(s). Drawing(s) of the proposed work are not required. Address location(s) of the proposed work are required. The **CONTRACTOR** shall keep a copy of permit(s) onsite at all times during work hours. The **CONTRACTOR** must provide the permit number to the **OWNER'S Inspector** before beginning excavation at a particular location.

6.4.6.1 For street cut permits within Cammack Village, the **CONTRACTOR** is responsible for payment for the permit(s). The **OWNER** will not reimburse the **CONTRACTOR** for the cost of street cut permits obtained from Cammack Village.

6.4.7 **City of Alexander** - When City of Alexander streets are to be cut, crossed, blocked and/or obstructed, the **CONTRACTOR** is not required to obtain a permit from the City of Alexander.

6.4.8 **City of Wrightsville** - When City of Wrightsville streets are to be cut, crossed, blocked and/or obstructed, the **CONTRACTOR** shall prepare permit request(s) with traffic control plan(s) for the work. The **CONTRACTOR** shall submit the request(s) and plan(s) to Pulaski County at 3200 Brown Street, Little Rock, and obtain approved permit(s) for the work. The **CONTRACTOR** shall keep a copy of permit(s) onsite at all times during work hours. The **CONTRACTOR** must provide the permit number to the **OWNER'S Inspector** before beginning excavation at a particular location.

6.4.8.1 For street cut permits within City of Wrightsville, the **CONTRACTOR** is responsible for payment for the permit(s). The **OWNER** will not reimburse the **CONTRACTOR** for the cost of street cut permits obtained from the City of Wrightsville.

6.4.9 **City of Maumelle** – When City of Maumelle streets are to be cut, crossed, blocked and/or obstructed, the **CONTRACTOR** is required to submit to and obtain from the Maumelle Street Department a permit prior to performing any work inside a city street or alley right or way. The **CONTRACTOR** shall keep a copy of permit(s) onsite at all times during work hours. The **CONTRACTOR** must provide the permit number to the **OWNER'S Inspector** before beginning excavation at a particular location.

6.4.10 All street and road repairs shall be performed by the **CONTRACTOR** in accordance with the Standard Details.

6.5 When required by the State, County or local authority having jurisdiction thereof, that traffic be maintained over any construction work in a public highway, street or road, and such traffic cannot be maintained on the alignment of the original roadbed or pavement, the **CONTRACTOR** shall, at his own expense, construct and maintain a detour around the work. Such detours shall be satisfactory with the **ENGINEER** and State, County or local authority.

6.6 The **CONTRACTOR** shall provide and maintain necessary barricades, signs, torches, lights, and markers around the work in order to protect persons from injury and avoid property damage. The

CONTRACTOR shall also provide qualified flagmen to direct traffic while working upon a highway, street, or road over which traffic must pass.

- 6.7 Excavated areas within the traffic lanes of highways, streets or roads and pedestrian walkways shall be backfilled as soon as possible and the area opened to traffic. When heavy steel road plates are used in lieu of immediate backfill or used to cover and protect fresh concrete or flowable fill, all edges of the road plates shall be filleted and ramped with cold mix asphalt. The purpose of the asphalt shall be to both hold the plate in place and provide a smooth transition for vehicular traffic.
- 6.8 The **CONTRACTOR** shall make the same provisions as described in **Section 6.2 herein** for the passage of vehicular and pedestrian traffic between private property and public highways, streets and roads or other provisions that are satisfactory to the **ENGINEER** and the property owners involved.
- 6.9 **DUST CONTROL & CLEANING OF STREETS** - The **CONTRACTOR** shall take steps to eliminate dust and mud along streets during the construction period. If, in the opinion of the **ENGINEER, dust or mud is excessive, the CONTRACTOR** shall immediately take action to resolve the problem. Dust, mud, dirt, and other debris tracked onto paved streets shall be removed daily. The **OWNER** will furnish unmetered water (where available) necessary for the control of dust and mud. Backflow Preventers shall be furnished and installed by the **OWNER** between the water source and the hose to be used for washing. Removal or relocation of the Backflow Preventers is prohibited except by and in the presence of the **ENGINEER**. The **CONTRACTOR** shall remove all dirt and debris from paved areas by **WASHING DAILY**. The **CONTRACTOR** shall be responsible for and shall remedy any blockages of storm drains caused by dirt, mud, or other debris washed from his job site.
- 6.10 **MAIL BOXES** – The **CONTRACTOR** shall be responsible for maintaining U.S. mailboxes within the project limits in such a manner that the public may continue to receive mail service. No additional payments will be made for this work and should be considered subsidiary to the various Bid items.

7 - LOCATION & PROTECTION OF SURFACE & SUBSURFACE STRUCTURES

- 7.1 The approximate locations of subsurface structures known to the **OWNER** are shown on the Plans. This information is shown for the guidance of the **CONTRACTOR** and the **OWNER** does not guarantee the accuracy or correctness of the locations of such structures as shown. Furthermore, there may be structures that are not shown. It shall be the responsibility of the **CONTRACTOR** to satisfy himself as to the actual location and nature of subsurface structures. The **CONTRACTOR** shall comply with the Arkansas One-Call provisions. No excavations shall be made prior to calling Arkansas One-Call and giving proper notification. Not all utility companies are members of the Arkansas One-Call system. Therefore, the **CONTRACTOR** is advised to contact all non-member utilities and arrange to have their utilities located on within the project area. The **CONTRACTOR** shall maintain all utility markings until they are no longer needed.
- 7.2 The **CONTRACTOR** shall make necessary exploratory excavations to determine the location of underground structures such as pipes, drains, conduits, and other structures. He shall be responsible for contacting the owners of such structures before excavating in the vicinity of these facilities and shall be guided by their instructions.
- 7.3 The **CONTRACTOR** shall provide adequate protection and support for all surface and subsurface structures or other facilities encountered during the progress of the work. Whenever such structures or facilities are in the same location as the proposed pipe line or appurtenances thereto, the **CONTRACTOR** shall relocate or reconstruct or cause to be relocated or reconstructed, the

structure or facility to the satisfaction of the **ENGINEER** and utility facility owner. Whenever requested by the **ENGINEER** or utility owner, the **CONTRACTOR** shall provide drawings and other plans for supporting or otherwise safeguarding surface and subsurface structures or other facilities which, in the opinion of the **ENGINEER**, or utility or facility owner, may be damaged as a result of the **CONTRACTOR'S** work.

- 7.4 The **CONTRACTOR** shall not stop or impede the flow in any pipe, sewer, surface drain, or subsurface drain without making provisions for diverting the flow to the satisfaction of the **ENGINEER**.
- 7.5 If any utility facility or structure is damaged during the progress of the work, the **CONTRACTOR** shall immediately notify the appropriate owner. Repairs shall not be made by the **CONTRACTOR** without the prior approval of the utility facility or structure owner. All repairs to sewer facilities or the construction of sewer facilities shall conform to the latest standards of the Wastewater Utility having jurisdiction. The **CONTRACTOR** shall pay utility owners for the cost of repairing, relocating or replacing any facilities damaged by the **CONTRACTOR**. In addition, the **CONTRACTOR** shall provide all assistance available to the utility involved in making repairs under emergency conditions.
- 7.6 The **CONTRACTOR** shall not operate a valve in the existing distribution system without the approval of the **ENGINEER**.
- 7.7 All existing fire hydrants and bends shall be blocked or tied in such manner so as to prevent displacement before excavating behind these appurtenances.

8 – PROTECTION AND RESTORATION OF VEGETATION

- 8.1 The **CONTRACTOR** shall not remove or disturb any vegetation except that required for the execution of the work.
- 8.2 Unless otherwise specified in these specifications, in the Plans, or directed by the **ENGINEER** the **CONTRACTOR** shall replace all sod, grass, shrubs, bushes, trees, and flowers, and landscaped areas disturbed or removed, that are located upon public and private property. Trees removed for timber clearing and grubbing of easements shall not be replaced. All debris from clearing and grubbing shall be removed from the job site and properly disposed. The **CONTRACTOR** shall replant vegetation and re-landscape or cause such to be performed throughout the work area as soon as possible after the pipe lines and appurtenances have been installed. All vegetation damaged during or after removal shall be replaced with healthy vegetation of the same kind or type. All plants shall be replanted in the original location. The **CONTRACTOR** shall maintain all such replanted vegetation by the application of water, fertilizers, and topsoil. The vegetation shall be cultivated to prohibit the growth of foreign vegetation until a well-developed root system has been established and transplanted vegetation has overcome the "shock" resulting from transplanting. All vegetation that dies or becomes unhealthy shall be replaced by the **CONTRACTOR**. The contour of the ground shall be left as near the original contour as possible as determined by the **ENGINEER**.
- 8.3 In undeveloped areas that have not been landscaped, it is not necessary to replace trees and shrubs unless otherwise specified in these specifications, in the Plans, or directed by the **ENGINEER** (seeding of the disturbed area is still required). The **CONTRACTOR** shall dispose of the vegetation removed to the satisfaction of the **ENGINEER**.
- 8.4 The **CONTRACTOR** shall stabilize all areas where ground surface has been disturbed and erosion is likely to occur. The method of stabilization shall be approved by the **ENGINEER**.

- 8.5 The **CONTRACTOR'S** attention is called to the fact that not all trees, shrubs, and vegetation are shown on the Plans. All trees within eight feet (8') of all water main trenches shall be removed unless otherwise shown on the Plans or directed by the **ENGINEER**. All stumps shall be removed. Stump holes shall be backfilled to three (3") to six (6") inches below finished grade with suitable material from trench excavation, then finished to grade with suitable top soil. In certain areas, the **ENGINEER** may direct the **CONTRACTOR** to avoid damaging or removing any trees EXCEPT for those that are required to construct the water facilities.
- 8.6 In developed areas, vegetation shall be established in all disturbed areas by either seeding or sodding as directed by the **ENGINEER**.
- 8.6.1 Thickness of topsoil shall be three (3") to six (6") inches.
- 8.6.2 The **CONTRACTOR** shall provide high quality sandy loam topsoil with no rocks or noxious weeds. The topsoil shall be approved by the **ENGINEER** prior to application.
- 8.6.3 The **CONTRACTOR** shall prepare a loose surface seed bed in the area of replacement, to ensure a minimum depth of two inches (2").
- 8.6.4 Areas to be seeded and mulched shall be accomplished by seeding with permanent lawn grass(es), do not use or place fescue or wheat. Seed shall be placed on a loose surface seedbed. Fertilizer (equivalent analysis 10-20-10) shall be applied to these areas at the rate of 250 lbs. per acre. Seeding and mulch shall be performed in conformance with Section 620 of the Standard Specifications for Highway Construction, Arkansas State Highway and Transportation Department, current edition, as modified by this **Section 8**. Grass mixture shall be as approved by the **ENGINEER**. Do not use FESCUE or WHEAT seed. **SEEDING AND MULCH SHALL BE OF THE HYDRO-SEEDING METHOD/OPTION**. Mulch shall be finely chopped. Mulch shall be applied at the rate of 3000 lbs. per acre. Emulsified asphalt shall be applied to mulch at the rate of 0.05 gallons per square yard on all slope areas that are 3:1 or steeper. Payment for seeding and mulch shall be as per **Section 39 herein**.
- 8.6.5 Areas designated to be sod do not require fertilizer and straw mulch. New sod shall be of the same species as the existing turf. Sodding shall be performed in conformance with Section 624 of the Standard Specifications for Highway Construction, Arkansas State Highway and Transportation Department, current edition, as modified by this **Section 8**. Payment for sodding shall be as per **Section 39 herein**.
- 8.7 Ornamental trees and shrubs having a diameter of two inches (2") or less (measured 6-inches from the ground) shall be removed and replaced. The **CONTRACTOR** shall hand dig around the tree or shrub to be replaced. The entire root system shall be removed (minimum 2-foot diameter root ball), wrapped in burlap, moistened and protected.
- 8.7.1 The **CONTRACTOR** shall replant/replace any tree or shrub removed within 48-hours of removal.
- 8.7.2 A hole shall be excavated sufficient to accommodate the entire root system. The hole shall be filled with rich topsoil. This material shall be compacted below and around the root system.
- 8.7.3 Trees or shrubs shall be guaranteed to live for one year after being replanted/replaced. Dead or dying trees or shrubs shall be replaced **within thirty (30) days** of written notification at the **CONTRACTOR'S** expense.

8.7.4 The maximum root size that may be cut on any tree or shrub shall be as set forth in the following table.

	Tree trunk dia.	Distance to face	Maximum size root to be cut
	2" – 4"	4.0'	1"
	4" – 12"	6.0'	3"
	12" – 24"	8.0'	6"
	24" +	8.0'	8"

- 8.8 In undeveloped areas disturbed during construction, the **CONTRACTOR** shall place additional topsoil, if needed, to assure a minimum depth of 2-inches. Vegetation shall be established by seeding and mulch.
- 8.9 The **CONTRACTOR** shall thoroughly water all planted and sodded areas and maintain them by application of additional water and additional fertilizer until an average of 80% of the ground has "established" vegetation.
- 8.9.1 Restoration of permanent summer lawn grass will be considered complete when the grass has a well-developed root system showing vigorous runners in all directions and blending with the undisturbed grass adjacent to the area being re-established.
- 8.8.1 The **OWNER** will furnish unmetered water necessary for the establishment of vegetation. Backflow Preventers shall be furnished and installed by the **OWNER** between the water source and the hose to be used. Removal or relocation of the Backflow Preventer(s) is prohibited.
- 8.10 All lawns and maintained grass areas, pastures and meadows, and wooded areas disturbed by construction shall be restored to a condition equal to or better than that existing prior to construction. In general, all surfaces shall be graded smooth and shall be free of rock, clumps, sticks, or other items. Wooded areas cleared and grubbed of trees shall be only seeded and mulch unless otherwise directed by the **ENGINEER**.
- 8.11 Sodding and seeding work shall commence within one month of the installation of a water main segment. Transplantation of vegetation shall be immediate after installation of pipe.
- 8.12 Failure to begin vegetation restoration in a timely manner or failure to complete vegetation restoration to the satisfaction of the property owner and **ENGINEER** shall result in the **ENGINEER** securing a licensed landscaping service to perform the work. The cost of the landscaping work will be deducted from monies due the **CONTRACTOR**.
- 8.13 The **CONTRACTOR** shall use suitable equipment for fine grading and landscape work. Heavy equipment normally associated with utility work is not deemed satisfactory. Equipment of the size and nature normally associated with landscape work shall be used.
- 8.14 All other work associated with the restoration of vegetation shall be subsidiary to the various pay items and will not be paid for separately.

9 - CLASSIFICATION OF EXCAVATION

- 9.1 Rock excavation is defined as all solid rock formations of limestone, sandstone, granite, or similar rocks in solid beds or masses in original or stratified position which, in the opinion of the **ENGINEER**, can be removed only by continuous drilling or blasting, or with the use of pneumatic or hydraulic tools, and which, in majority, consistently produces boulders or pieces of detached rocks of at least 1.0 cubic yard in volume. It shall include boulders or pieces of detached rock of at least 1.0 cubic yard in volume and solid rock formations which are interspersed with strata of clay or other material provided that the solid rock constitutes at least **seventy-five percent (75%)** of the total volume of the particular formation. Folded shale, slate, or other hard rock-like material that can be excavated without, in majority, consistently producing boulders or pieces of detached rock of at least 1.0 cubic yard in volume will not be classified as "rock excavation". The **CONTRACTOR** is reminded that blasting, barring, drilling, ramming, hammering, or wedging before an attempt to excavate is made does not necessarily qualify the material to be excavated as "**rock excavation**" and no payment for "**rock excavation**" will be made unless the material excavated can conform to the above definition. Rock exterior to the nominal trench width which falls into the excavation will not be measured for payment.
- 9.2 All other excavation shall be *unclassified* regardless of the nature of materials encountered.
- 9.3 **If rock excavation is not a bid item on the Bid Form, all excavation shall be considered unclassified.**

10 - EXCAVATION & PREPARATION OF TRENCH

- 10.1 Unless bound herein or shown on the Plans, information related to soil conditions obtained by preliminary soil borings is not furnished by the **OWNER**. Any information furnished by the **OWNER** related to soil conditions is not guaranteed to represent actual conditions which the **CONTRACTOR** will encounter and is to be used at the **CONTRACTOR'S** risk; therefore, the **CONTRACTOR** shall take whatever action he feels necessary to satisfy himself as to the actual subsurface soil conditions.
- 10.2 The trench shall be excavated to the alignment and grade specified and only so far in advance of the pipe laying as the **ENGINEER** shall permit. Typical minimum cover over newly laid water main shall be 36-inch unless otherwise directed by the **ENGINEER** or shown in the Plans. Trenches along public streets or roads shall be limited to **300 feet or less, or as permitted by the governmental authority having jurisdiction**. This limit may be reduced by the **ENGINEER** in congested areas.
- 10.3 The trench width may vary and depend upon the depth and the nature of the excavated material encountered. The trench shall be of ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly. The minimum width of a trench shall be at least **one foot (1')** greater than the nominal diameter of the pipe, except for **2-inch and 3-inch pipe which can be laid in a twelve (12) inch wide trench**. Exception to previously stated minimum trench width shall be trenches excavated within paved areas of Pulaski County roads. **Pulaski County Road Department requires minimum trench width to be pipe diameter plus twenty-four inches (24"), (12" each side of pipe)** to facilitate better compaction of crushed stone backfill. Ledge rock, boulders, large stones, and other rock formation shall be removed to provide a clearance of at least **six inches (6") on each side of pipe line and appurtenances up to and including 24-inches in diameter**. For pipelines and appurtenances **over 24-inches in diameter, nine inch (9") clearance shall be provided**. Trench width will not be a factor in the measurement and payment of special surface repairs. Measurement and payment of special surface repairs is based on nominal diameter of the pipe as detailed in **Section 39.3** of this Specification.

- 10.4 The bottom of the trench shall be prepared so as to provide a uniform and continuous bearing and support for the pipe on solid undisturbed or compacted soil.
- 10.5 The trench shall be excavated to at least the depth specified as follows beyond the specified grade when the following described conditions exist:
- 10.5.1 **Nine inches (9") when Type 4 or Type 5 Bedding is specified.**
- 10.5.2 **Six inches (6") for pipelines and appurtenances 24-inches in diameter or less and nine inches (9") for pipe lines and appurtenances larger than 24-inches in diameter whenever ledge rock, boulders, large stones, or other rock formation exist in the trench bottom.**
- 10.5.3 Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces of inorganic material, that, in the judgment of the **ENGINEER**, should be removed, the **CONTRACTOR** shall remove all such material to the extent required by the **ENGINEER**.
- 10.6 When the excavation is carried below or beyond that specified or required or whenever the excavation is carried below or beyond that specified due to conditions described in **Section 10.5 above**, the **CONTRACTOR** shall backfill the trench to the proper grade, unless permitted by the **ENGINEER** to install the pipe lines and appurtenances at the undercut grade. The backfill shall be accomplished in accordance with that specified **for Type 4 or Type 5 Bedding, elsewhere herein**.
- 10.7 The use of trench-digging machinery will be permitted except in places where operations of same will cause damage to trees, buildings, or other existing structures above or below the ground; in which case hand methods shall be employed.
- 10.8 Blasting for excavation will be permitted only after the **CONTRACTOR** secures the approval of the **ENGINEER** and only when proper precautions are taken for the protection of persons and property. The hours of blasting will be fixed by the **ENGINEER**. Any damage caused by blasting shall be repaired by the **CONTRACTOR** at his expense. The method of transporting, handling, and storage of explosives and blasting procedure shall conform to Federal Regulations, local and state laws and municipal ordinances.
- 10.9 The **CONTRACTOR** shall comply with all federal, state and local laws or ordinances with respect to obtaining permits, the deposit of bonds and all other provisions of such laws and ordinances.
- 10.10 Whenever necessary to prevent caving, excavation in sand, gravel, sandy soil, or other unstable material shall be adequately sheeted and braced or otherwise prepared as per the OSHA Standard for Excavation and Trench Safety System, 29 CFR 1926, Subpart P. Where sheeting and bracing is used, the trench width may be increased accordingly. Trench sheeting shall remain in place until the pipe has been laid and jointed. Where slides or cave-ins occur, the **CONTRACTOR** shall, at his expense, provide proper bedding and support for the pipe.
- 10.10.1 **EXCAVATION AND TRENCH SAFETY** - The **CONTRACTOR** shall comply with all parts of the current edition of Occupational Safety and Health Administration Standard For Excavation and Trench Safety System, 29 CFR 1926, Subpart P, which is specifically incorporated herein by reference. The **CONTRACTOR** shall employ a "COMPETENT PERSON" (as defined in 29 CFR 1926, Subpart P) "capable of identifying existing and predictable hazards" and "who has authorization to take prompt corrective measures to eliminate them". The **CONTRACTOR'S** "COMPETENT PERSON" shall perform inspections (as required in 29 CFR 1926, Subpart P) and shall be responsible for determining when Excavation

or Trenching Safety Protective Systems are required and how they are to be performed. When so directed by the **ENGINEER**, the “COMPETENT PERSON” shall provide, to the **ENGINEER**, documentation, including: date, specific location, condition and depth of trench, specific reasons for protective system and detailed description of the type of protective system employed and design specifications as required in 29 CFR 1926, Subpart P. The **CONTRACTOR** shall present the name(s) of its **COMPETENT PERSON** to the **ENGINEER** prior to beginning work, and any changes in the above personnel shall be reported to the **ENGINEER**. The **OWNER’S** or **ENGINEER’S** inspection of the **CONTRACTOR’S WORK** shall not be construed to mean, or constitute, acceptance or correctness of the **CONTRACTOR’S** safety efforts.

- 10.11 All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions shall be made for street drainage. If local conditions permit their re-use, all surface materials suitable for re-use in restoring the surface shall be kept separate from the general excavation material. Excess material and debris shall be removed promptly.
- 10.12 The **CONTRACTOR** shall remove the minimum amount of street, driveway, sidewalk, parking lot, or other pavement required to permit installation of the pipelines or appurtenances. The payable width on special surface repair may not be as wide as the width removed for the work. See **Section 39 herein** for payable width of special surfaces. All pavement surfaces shall be scored in straight lines with suitable equipment before removal. Concrete surfaces shall be scored with a suitable concrete saw unless all material is removed between existing construction joints. Asphalt and concrete surface edges shall be saw cut for final repair.
- 10.13 No excess material shall be disposed in any protected area or in any controlled floodway / floodplain area. The **CONTRACTOR** is responsible for locating and securing disposal areas.

11 - INSTALLATION - GENERAL

- 11.1 All ductile iron pipes, fittings, taps, sleeves, valves, etc. shall be encased in polyethylene (polywrapped) upon installation (see **Section 21 herein** for specifics). Rock with any dimension exceeding 2-inches shall not be placed against ductile iron pipe.
- 11.2 All ductile iron mains shall end with a full joint of mechanical joint pipe with a mechanical joint plug and anchor collar.
- 11.3 All PVC main shall be bedded in sand, ASTM C144, or crushed stone, ASTM C33 #67 (modified with 0% retained on ¾” sieve). Rock with any dimension exceeding ¾-inch shall not be placed against PVC pipe. Bedding shall be a minimum of four inches (4”) below and three to six inches (3” – 6”) above the pipe in non-hard rock trench conditions. In hard rock trench conditions, place a minimum of six to nine inches (6” – 9”) below the pipe. **PVC pipe shall not be placed in areas with working pressures exceeding 125 psi.**
- 11.4 Before installation of pipe and appurtenances, the trench bottom shall be graded so that uniform support of the pipe and appurtenances is provided. Shallow depressions shall be made in the trench bottom to accommodate bell ends.
- 11.5 Proper implements, tools, and facilities shall be provided and used by the **CONTRACTOR** for the safe and convenient execution of the work. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
- 11.6 All foreign matter or dirt shall be removed from the inside of the pipe and appurtenances before lowering into the trench and the pipe interior shall be kept clean during and after laying. At **all**

times when pipe laying is not actively progressing (i.e. extended delays during the work day, overnight cessation, weather delays, difficult trenching conditions, etc.), the open ends of the pipe shall be closed and made watertight by installing a plug or cap of sufficient design to prevent trench water, mud, foreign matter, and dirt from entering the pipe line. Plastic sheeting, wood sheeting, tape, steel plate, etc. shall not be used to attempt plugging or capping of the pipe. **Plugs and caps shall be true fittings of ductile iron or PVC construction, with gaskets, and they shall be securely fastened to or inserted into the pipe.** In less than ideal laying conditions, the **ENGINEER** may require that a super-chlorinated swab be kept in a pipeline as long as the pipe is being laid. The swab shall be hand pulled through each joint of pipe laid. Care shall be taken to prevent dirt from entering the joint space. **ANY PIPELINE, REGARDLESS OF SIZE, FOUND NOT PROPERLY PLUGGED OR CAPPED AT ANY TIME DURING THE INSTALLATION PROCESS SHALL BE PIGGED ITS FULL DIAMETER AND LENGTH AND SHALL BE PIGGED AS MANY MULTIPLE TIMES AS NECESSARY TO SHOW THAT IT IS ABSOLUTELY CLEAN AND CLEAR OF DEBRIS. THE FINAL PIGGING MUST BE WITNESSED BY THE CAW ENGINEER OR HIS REPRESENTATIVE BEFORE CONSIDERED ACCEPTABLE.** Any costs associated with the pigging of any line shall be the **CONTRACTOR'S** responsibility. Refer to Section 32 for pigging requirements.

- 11.7 Cutting of the pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or pipe lining. Torch cutting is not permitted. All pipes shall be **cut at an angle of 90° to the pipe centerline.** Cutting at other angles to provide greater deflections at the joints shall not be permitted. Field welding or welding except by the pipe manufacturer shall not be permitted. The **CONTRACTOR** shall field verify all pipe and fitting dimensions. Dress cut ends of pipe to remove sharp edges, burrs, or other projections.
- 11.8 Unless otherwise approved or directed by the **ENGINEER**, pipe shall be laid with bell ends facing the direction of laying; and for lines on an appreciable slope, bells shall, at the direction of the **ENGINEER**, face upgrade.
- 11.9 No pipe shall be laid in water, or when the trench condition or the weather is unsuitable for such work, except by permission of the **ENGINEER**.
- 11.10 **All thread rods shall be used for temporary restraint only unless otherwise approved by the ENGINEER on a case-by-case basis. Concrete thrust blocks and/or collars shall be poured to provide permanent thrust restraint.** All thread rods and nuts used for TEMPORARY restraint shall be 30 ksi Series 300 stainless steel. All thread rods, nuts, washers, and couplings used for PERMANENT restraint shall be 30 ksi Series 300 STAINLESS STEEL and shall be polywrapped. The required minimum number of restraining rods for 225 psi test pressure is shown in the Standard Details; the minimum number of restraining rods for higher pressures shall be calculated by the **ENGINEER** on a case-by-case basis.
- 11.11 A continuous TRACING wire shall be installed with ALL NON-METALLIC pipe, including through encasement pipe. The wire shall be laid along the length of the pipe. The tracing wire shall not be wrapped or spiraled around the pipe as this will degrade the signal and stress the wire. The tracing wire can be attached along the top of the pipe with plastic ties or polyethylene tape or laid in the backfill within six (6) inches of the top of the pipe. The tracing wire shall be looped around valves, saddles, curb stops, and other appurtenances in such a manner that there is no interference with the operation of the appurtenance. The tracing wire shall be looped up to the ground surface at all valve boxes and pipeline marker signs. Wire shall be brought up the outside of the valve box and not threaded through the inside length of the box. The valve box shall have a hole drilled through it approximately six (6) inches below its top and the tracing wire inserted through the hole with six (6) inches of wire left inside the valve box. Splices of the tracing wire shall be bare-wire twisted and crimped together and shall then be encased with a 3M Gel Pack. **AFTER BACKFILLING, THE CONTRACTOR SHALL PROOF-TEST, IN THE PRESENCE OF THE**

ENGINEER, THE CONTINUITY OF THE TRACING WIRE FROM END TO END BEFORE FINAL APPROVAL OF THE PIPELINE IS MADE.

11.11.1 Electronic Marker. In addition to **Section 11.11 above**, a ScotchMark™ Electronic 4” Ball Marker for WATER ("Blue Sphere") shall be placed immediately above all dead-end mains, above all buried curb stops on stub services, and other locations as noted on the Plans. Maximum depth of ball marker below finished grade shall be two (2) feet. Ball Makers shall be provided by **OWNER** and installed by **CONTRACTOR**.

11.12 During the pipe laying operation, deflections at joints shall not exceed the amounts indicated in the following tables for the various types of joints and pipe.

11.12.1 MECHANICAL JOINT PIPE (Iron Pipe)

Size of Pipe	Degrees
4-6-8-10-12	5°
16-20-24-30	2°30'
36-42-48	2°

11.12.2 PUSH-ON JOINT PIPE (Iron Pipe)

Size of Pipe	Degrees	Maximum Deflection (Inches)		Approx. Radius of Curve Produced by Succession of Joints (Feet)	
		18-ft. Length	20-ft. Length	18-ft. Length	20-ft. Length
3-4-6-8-10-12	5°	19	21	205	230
14	3°	11	12	340	380
14	5°	19	21	202	230
16	3°	11	12	340	380
16	5°	19	21	205	230
18	3°	11	12	340	380
18	5°	19	21	205	230
20	3°	11	12	340	380
20	5°	19	21	205	230
24	3°	11	12	340	380
24	5°	19	21	205	230
30	3°	11	12	340	380
30	5°	19	21	205	230
36	3°	11	12	340	380
36	4°	15	17		285

11.12.3 PRESTRESSED CONCRETE PIPE & PVC PIPE

11.12.3.1 The deflection shall not exceed the maximum deflection recommended by the pipe manufacturers.

11.13 Encasement pipe shall be placed as provided in **Section 22** of these specifications. Any joints within the length of encasement pipe installed shall be watertight. Do not use/install “storm sewer/drainage” type pipe as encasement pipe if any joints will be made for the placement of the encasement pipe; joints of storm sewer or drainage type pipes are not considered water tight for the purposes of these Specifications. Installation of pipe in encasement structures shall be accomplished in such manner that neither the pipe or encasement structure is damaged. Care must be exercised to assure that the joints of the pipe are not over deflected or pulled out during the process. The pipe shall be jointed and pulled or jacked through the encasement structure. Cables, chains, jacks or other equipment or devices used shall not be in direct contact with the pipe unless thoroughly padded. Spacers shall be provided as per **Section 3.8.1** of the **Material Specifications** and as shown on the Standard Details to provide stability during installation and after the pipe is in place. If, after installation of the pipe, adequate stability has not been provided, in the opinion of the **ENGINEER**, the pipe shall be removed or the annular spaces between the pipe and encasement structure shall be filled with sand, if approved by the **ENGINEER**. Unless otherwise designated by the **ENGINEER** or unless specifically indicated on the construction plans, **All carrier pipe installed inside encasement pipe shall be restrained joint, for each joint inside the encasement and at least one joint immediately outside both ends of the encasement.** If non-restrained joint carrier pipe is approved by the **ENGINEER**, then as shown in the Standard Details, a 3/8" Series 300 stainless steel cable shall be pulled into the encasement pipe and left in place for future use. The cable is not required if the pipe installed within the encasement is restrained joint pipe. The ends of the encasement pipe around the carrier pipe shall be sealed with Link-Seal or approved equal.

11.14 **Installation of Service Meter Settings** – Water service meter settings shall be installed as per the Standard Details. While installing new service corporation taps, prior planning shall be made to ensure that proper alignment between the new corporation stop, new meter setter, and existing customer service line can be accomplished with a minimum of bends in the copper tubing. In instances where bends must occur, all bends shall be made with a manufactured pipe bender of appropriate size to reduce the chances of kinking or flattening of the copper tubing. Hand bending is not allowed. Copper tubing that is kinked or flattened shall be replaced at the contractor’s expense from the corporation stop to the new meter setter. Splicing in sections will not be accepted. Tops of meter boxes shall be flush with the finished grade. **All service lines (up to the curb stop located near the meter setter) shall be included in the pressure testing and sterilization work.** Installation and connection of meter settings shall commence within one week after successful pressure and bacteriological testing of the water main and be completed within a reasonable period of time. The **CONTRACTOR** shall have a **licensed plumber** connect the meter connection “tail piece” to the customer’s private line (house line). All such work and expense shall be included in the Bid Price for meter installations.

11.14.1 The **CONTRACTOR’S plumber** shall investigate the existing service to determine the existence of a pressure reducer. If a pressure reducer is located on the existing service line, then the existing pressure reducer shall be connected to the new meter service installation. If more convenient, the **CONTRACTOR’S plumber** may install a new pressure reducer. All work and materials associated with the reconnection of an existing pressure reducer or installation of a new pressure reducer shall be included in the Bid Price for meter installations. Any damage caused by the failure to reconnection or install a pressure reducer in the service line will be the responsibility of the **CONTRACTOR**.

11.14.2 “Short side” meter settings are meter settings located on the same side of the street/road/highway as the water main. For water mains located inside the paved surface of a street/road/highway, the meter setting will be considered “short side” if the water main is on the meter side of the pavement centerline.

- 11.14.3 “Long side” meter settings are meter settings located on the opposite side of the street/road/highway from the water main. For water mains located inside the paved surface of a street/road/highway, the meter setting will be considered “long side” if the water main is on the opposite side of the pavement centerline from the meter setting.
- 11.14.4 For “long side” meter settings, the **CONTRACTOR** has the option of cutting and replacing the paved surface (if allowed by the governing street/road/highway department) or boring and pulling the service line under the pavement, unless otherwise directed in the construction plans or Special Conditions of the Contract Documents.
- 11.14.5 After completion of the meter setting installation, the **CONTRACTOR** shall remove the abandoned meter setting (meter, setter, meter box) and repair and/or restore all disturbed areas, including filling the abandoned meter setting with topsoil and placing sod as directed. Sod is typically required around meter installations. Seed and mulch shall be placed only if so directed by the **ENGINEER**.
- 11.15 The **OWNER** shall provide the necessary meters. The meters may be provided new or the meters in existing meter services may be reused as directed by the **ENGINEER**. Meters to be reused from existing meter services shall be removed by the **CONTRACTOR**. The **CONTRACTOR** shall install the new or reused meters in the new meter settings.
- 11.16 Water mains crossing sanitary sewer services or mains must clear the sanitary sewer at least eighteen inches. When a water main crosses under a sanitary sewer **main** or over a sanitary sewer **main** with less than eighteen inches of clearance, either the sanitary sewer main or the new water main shall be encased in twenty (20) feet of watertight encasement pipe. The ends of the encasement pipe shall be sealed watertight. Encasement spacers are not required for an encasement of this circumstance. When a water main crosses under a sanitary sewer **service** or over a sanitary sewer **service** with less than eighteen inches of clearance, the sanitary sewer service pipe shall be removed and replaced with ductile iron pressure pipe as shown in the Standard Details.
- 11.17 Pipe damaged before installation shall not be used. Pipe damaged or leaking after installation shall be repaired by cutting out the effected section and be replaced with new pipe. The use of repair clamps, wrap-around repair sleeves, bell joint repair clamps, or other repair fittings will not be allowed.
- 11.18 In new development construction, other buried utilities such as electrical, gas, TV, and communication lines shall be no closer than five (5) feet horizontal to the water mains. Buried utilities crossing water mains shall be at right angles thereto and shall clear the water pipe at least 18-inches.. Electrical lines crossing water mains shall be placed in conduit extending five (5) feet each side of the water main.
- 11.19 Any polyethylene service tubing installed during the work shall be disconnected from the system and physically removed from the ground prior to final approval of the project. The corporation stop shall be closed water-tight, left in place, and shown (located) on the construction As-Built drawings. A blue marking sphere shall be placed over the abandoned corporation stop prior to final backfill of the excavation.
- 11.20 Private fire service lines shall begin with one full joint of ductile iron pipe. Any PVC pipe used for a fire service main shall be rated for at least twice the working pressure anticipated for the main.
- 11.21 Short pipe belled to fittings should be a minimum of five (5) feet in length; no bell or mechanical joints within five (5) feet of an adjacent mechanical joint.

- 11.22 On new main installation, use tapped tees in lieu of tapping saddle for 2-inch and 3-inch branch runs.
- 11.23 On new main installation, use anchor tees for branch line valves (for branch lines and for fire hydrants).
- 11.24 Copper service lines installed under pavements shall be continuous and not segmented (jointed).

12 - JOINTING MECHANICAL JOINT PIPE & FITTINGS

- 12.1 Prior to jointing the pipe and/or fittings, the plain ends of the pipe and the bells of the pipe and fittings shall be thoroughly cleaned using a soapy water and cloth, removing all foreign materials from the bells, especially the gasket seats.
- 12.2 The cast or malleable iron follower rings shall be placed on the plain end of the pipe or fittings, followed by the rubber gasket which has been thoroughly cleansed and lubricated with the soapy water.
- 12.3 The plain end of the pipe shall be placed in the bell, to which connection is to be made, and shouldered in back of the bell. The rubber gasket shall be advanced into the bell and seated in the gasket seat; the follower ring shall next be brought into contact with the rubber ring, and all bolts entered and nuts started. The pipe may then be given a maximum deflection as prescribed in the preceding table.
- 12.4 Joints shall be made tight by advancing the nuts with a wrench 180° apart until a tight joint is made.
- 12.5 The **CONTRACTOR** shall provide a torque wrench suitable for measuring tension on bolts for at least such a time as the workmen making the joints have gotten the "feel" of the required tension. At no time should handles longer than those supplied by the wrench manufacturer be permitted. The torque range shall be as follows:

5/8" Bolts	45- 60 ft. lbs.
3/4" Bolts	75- 90 ft. lbs.
1" Bolts	85-100 ft. lbs.
1 1/4" Bolts	105-120 ft. lbs.

After the workmen have become accustomed to this torque, a socket wrench with a 10-inch handle may be used.

- 12.6 The rubber gasket and joint bolts of mechanical joint retainer glands shall be installed in accordance with above. Setscrews shall be tightened evenly to approximately 75 foot-pounds.
- 12.7 The entire follower or retainer gland and all bolts shall be encased in polyethylene material in accordance with **Section 21 herein**.

13 - JOINTING PUSH-ON JOINT PIPE & FITTINGS

- 13.1 Prior to jointing the pipe and/or fittings, the plain ends of the pipe and the bells of the pipe and fittings shall be thoroughly cleaned using a soapy water and cloth, removing all foreign materials

from the bells, especially the gasket seats. Any burrs or imperfections in that part of the plain end or bell that will be in contact with the gasket shall be removed.

- 13.2 The clean rubber gasket shall be inserted in the bell and a thin film of lubricant shall be applied to the inside surface of the gasket.
- 13.3 The cleaned plain end shall initially be entered in the bell straight.
- 13.4 The plain end shall be forced inside the gasket and bell until it strikes the end of the interior of the bell, after which the end of the pipe shall be moved sideways or up eight inches (8") to move it slightly away from home to allow for expansion and to provide flexibility to the completed line. The pipe may then be deflected as prescribed in the preceding table.
- 13.5 Lubricants shall be supplied by the pipe manufacturer in sufficient quantities. No substitutes shall be made.
- 13.6 The **CONTRACTOR** shall furnish such jacks, or other devices as are necessary for forcing the pipe into the bell and gasket. Care shall be exercised to avoid damage to the pipe where the pushing device or machine parts contacts the pipe. A wood block or suitable pad shall be placed between the pipe and that part of the pushing device that contacts the pipe.
- 13.7 All plain ends that enter a push-on bell shall be beveled at 30° for at least 1/8-inch.

14 - JOINTING FLANGED PIPE & FITTINGS

- 14.1 The faces of all flanges shall be thoroughly cleaned and all burrs or imperfections removed and brushed with a steel brush.
- 14.2 Gaskets between flanges shall be SBR rubber of 1/16-inch minimum thickness.
- 14.3 Care shall be taken to prevent strain of the flanges. All bolts and nuts shall be cleaned and lubricated prior to tightening. Bolts on opposite sides shall be tightened alternately to the torque listed in **Section 12.5 herein**.

15 - JOINTING PVC PIPE

- 15.1 Both bell and plain end of pipe shall be thoroughly cleaned before attempting to joint the pipe.
- 15.2 Lubricate the plain end (do not lubricate the bell end) with approved lubricant and insert plain end into bell until stop mark on plain end is flush with the end of the bell. In the case of pipe that has two marks on the plain end, insert plain end into bell so that only one mark is visible.
- 15.3 When the pipe is cut, the plain ends must be beveled similar to the bevel on full lengths. After beveling, stop marks must be applied to the ends. Use the plain end of another piece of pipe or fitting to determine the location of the stop mark and mark the piece of pipe that has been cut.
- 15.4 The joints shall be inserted as far as possible on each side of valves that are inserted in the line.

16 - JOINTING CONCRETE PRESSURE PIPE & FITTINGS

- 16.1 The **CONTRACTOR** shall furnish to the **ENGINEER**, for approval, four (4) copies of shop drawings and laying schedules as prepared by the pipe manufacturer for all pipe, fittings and appurtenances required for the work specified herein. The shop drawings shall depict full details of reinforcement, concrete, and joint dimensions for the pipe, fittings, and appurtenances. The laying schedule shall include, as a minimum, the sequence of installation by piece of material; deflections; station number of each piece and the elevation (flow line or centerline) to which each piece is to be installed; the pressure class of each piece; and the station number for all outlets and appurtenances.
- 16.2 The pipe shall be installed in accordance with the Plans and the laying schedule furnished by the pipe manufacturer and as approved by the **ENGINEER**. The **CONTRACTOR** is reminded of the fact that the maximum joint deflection of concrete pressure pipe is generally less than other types of pipe and that standard pipe cannot be field cut; therefore, care should be exercised to assure that the pipe is installed to the grade and alignment specified. To assist in preparing the trench bottom on which the pipe is to be installed, the **CONTRACTOR** shall utilize a laying square of proper design and batter boards or other approved devices or procedures to assure that the proper grade and alignment is achieved. Final grading of the trench bottom shall be accomplished by hand tool methods.
- 16.3 The bell of the previous piece of pipe installed and the spigot ring of the pipe being installed shall be well cleaned. All surfaces of the bell shall be free of burrs or other surface defects.
- 16.4 The spigot end of the length of pipe being installed and the bell end of the previously installed length of pipe shall be thoroughly lubricated with vegetable soap. The gasket shall be immersed in vegetable soap before it is placed on the spigot of the pipe. The gasket shall be placed in the spigot recess in such manner that it is under uniform tension. Extreme care shall be exercised to assure that the vegetable soap does not become contaminated with dirt, debris, or other contaminants during its use or storage. Contaminated soap shall be discarded.
- 16.5 Before jointing pipe 20-inches in diameter or smaller, the bell recess of the previously installed piece of pipe or fitting shall be "battered" with stiff cement mortar mix described in **Section 16.8.1 herein**. The quantity of cement mortar placed on the bell recess should be adequate to completely fill the interior joint after the pipe is pushed "home". An alternate to the use of cement mortar mix is the use of rope mastic compound placed on the bell recess in lieu of the cement mortar. A quantity of the rope mastic adequate to completely fill the joint recess shall be used. Both the mastic and any priming compound required shall be applied as recommended by the manufacturer; shall be approved by the National Sanitation Foundation for use in potable water vessels and the **ENGINEER**; shall be flexible after curing; and shall not contain constituents which cause the rubber gasket or any part of the pipe material to deteriorate.
- 16.6 The **CONTRACTOR** shall check the gasket of each joint after the joint has been pushed or pulled partially home to assure proper positioning of the gasket. The feeler gauge furnished by the pipe manufacturer, or a gauge fabricated by the **CONTRACTOR** to the exact dimensions of that recommended by the pipe manufacturer, shall be used. The piece of pipe being installed shall be carefully lowered into the trench and the spigot end inserted into the bell end of the piece of pipe or fitting previously installed. The following procedure shall apply with respect to checking the joint gaskets:
- 16.6.1 **24-inch Diameter Pipe and Larger**. Temporary inserts, 5/8-inch thick, shall be placed between the tip of the spigot and the seat of the bell on the inside of the pipe to provide space for inserting the feeler gauge. The piece of pipe being installed is then pushed or pulled until the inserts prohibit further insertion. The feeler gauge shall be passed around the entire interior circumference of the joint. If the gasket cannot be "felt" around the entire

circumference, the piece of pipe being installed shall be withdrawn and the gasket examined. If the gasket is damaged, it shall be replaced. If undamaged, the gasket shall then be lubricated before re-use. After proper gasket positioning has been achieved, the inserts shall be removed and the piece of pipe being installed shall be pushed or pulled "home".

- 16.6.2 **20-inch Diameter Pipe and Smaller.** The piece of pipe being laid shall be pushed or pulled completely "home", after which the feeler gauge is passed around the entire exterior circumference of the joint. If the gasket cannot be "felt" around the entire circumference, the procedure outlined in **Section 16.6.1 above** shall apply.
- 16.7 After each piece of pipe or fitting has been installed, the grade, alignment, and joint opening shall be checked by the **CONTRACTOR**. If the proper grade and alignment has not been achieved, the piece of pipe or fitting shall be adjusted to the proper position. "Blocking" pipe up that is too low shall not be permitted. If the pipe is too low, it shall be removed and well-compacted backfill, as specified in **Section 10.6 herein** shall be placed in the trench bottom to sufficient depth to attain the proper grade. Joints that are to be deflected shall be pushed "home" and then deflected. The joint opening after final positioning shall not exceed that recommended by the pipe manufacturer. Such backfill shall be provided at no additional cost to owner.
- 16.8 Joint protection shall be applied in accordance with the following procedures, at least two pipe lengths, except where noted, behind final positioning of the pipe in the trench.
- 16.8.1 **Inside.** Mortar for application to the interior of joints shall consist of one (1) part Portland cement and one and one half (1½) parts clean washed sand and clean water of sufficient quantity to provide a stiff mix.
- 16.8.1.1 **20-inch Diameter Pipe and Smaller.** The mortar placed on the bell recess, as described in **Section 16.5 above**, shall be smoothed, cleaned and excess mortar removed before the mortar begins to harden using a suitable swab or by pulling an inflated rubber sewer plug through the pipe. The outside diameter of the swab or plug shall be only slightly smaller than the inside diameter of the pipe. Alternate methods may be used on approval of the **ENGINEER**. If rope mastic, described in **Section 16.5 above**, is used, the interior of the pipe shall be visually inspected. If excess material extends below the interior surface of the pipe, the smoothing procedures described above shall be followed.
- 16.8.1.2 **24-inch Diameter Pipe and Larger.** Mortar shall be placed in the inside of the joint recess and finished smooth from inside the pipe using hand tools.
- 16.8.2 **Outside.**
- 16.8.2.1 All soil and other material shall be removed from the joint recess and from the pipe on each side of the joint. A suitable cloth, reinforced paper or plastic wrapper, at least seven (7) inches in width and of sufficient length to reach around the exterior circumference of the pipe, shall be placed around the pipe, centered on the joint opening, and secured to the pipe with wire or steel strapping on each side of the wrapper. The ends of the wrapper shall meet the top of the pipe in an opening provided for the introduction of cement grout. All wrappers shall be those furnished by the pipe manufacturer.
- 16.8.2.2 A cement grout mixture consisting of one (1) part Portland cement and two (2) parts clean washed sand and clean water of sufficient quantity to provide a pourable mix, shall be poured into the opening and vibrated and rodded or

puddled until the grout completely fills the recess around the entire circumference of the pipe. Care must be exercised to assure that there is adequate space between the pipe and trench bottom where the wrapper is located to permit the grout to flow around the bottom of the pipe. The wrapper shall be re-positioned or the wire or steel bands tightened if the grout escapes around the wrapper. The opening at the top of the pipe, where the grout was poured, shall be filled with a stiff mortar mix described in **Section 16.8.1 above**.

- 16.8.2.3 Grout and cement mortar shall be protected to prohibit freezing during the curing period. Any joint showing excess shrinkage or cracking after curing shall be cleaned and remade. Backfill shall not be commenced before grout achieves initial set.
- 16.8.2.4 When installed inside encasement structures where space restrictions prohibit access to the exterior of the joints after final placement of the pipe, rope mastic compound, described in **Section 16.5 above**, or a continuous loop of polyurethane foam impregnated with dry Portland cement, equal to FLEX-PROTEX, shall be placed in the joint recess in sufficient quantity to completely fill the recess.
- 16.8.2.5 All exposed steel parts of pipe and fittings shall be coated with cement mortar, described in **Section 16.8.1 above**, or completely encased in concrete. The cement mortar or concrete shall be at least two inches (2") thick. The cement mortar used around closure pieces and other fittings having large areas of exposed steel shall be reinforced with suitable wire mesh.

17 – METER SETTINGS

- 17.1 Meter settings shall be installed where shown on the Plans and/or as directed by the **OWNER**. Installation shall be as per the Standard Details. Meter settings shall be installed at a location that is outside areas of vehicular traffic and still accessible to Central Arkansas Water personnel. Meter settings shall be installed in a horizontal and plumb position within the meter box and at a depth to provide the required space between the top of the meter and the bottom of the meter box lid.

18 - INSTALLATION OF VALVES

- 18.1 Valves shall be jointed in accordance with the methods of jointing pipe as specified elsewhere herein. Valve stems shall be plumb and there shall not be any obstructions that will prohibit the installation of valve boxes directly over the stem. Concrete anchor collars shall be provided around an adjoining length of pipe for all valves 16-inches in diameter or larger and for smaller valves when specified on the Plans. Mechanical joint retainer glands shall be installed on all valves with mechanical joint ends 12-inches in diameter or larger when ductile iron pipe is specified and for smaller valves when specified. All valves shall be firmly supported from below with compacted dry soil, compacted crushed stone, or concrete.
- 18.2 After installation of the valve and before backfilling, an Electronic Water Marker ("**Blue Sphere**") shall be placed one foot (1') north and even with the top of the operator on those valves which are specified in the Plans or as directed by the **OWNER**. Blue Spheres shall be provided by the **OWNER**.
- 18.3 Valve boxes shall be installed over the operating nut of each valve and be of adequate length to reach the finished ground or paved surface. Valve boxes shall be installed with a HDPE Valve Box Alignment Device of the proper size and manufacture to fit the valve and the valve box. Boxes

shall be firmly supported, plumb, and centered over the valve operating nut. No part of the box shall rest on the valve. The box cover shall be flush with the finished surface.

18.3.1 In order to assist in future locating, **valve boxes located in undeveloped areas** shall have a 2.0' x 2.0' x 0.5' (thick) Class "A" or "B" concrete pad, reinforced with #4 reinforcement steel, constructed around the top of the valve box, flush with the **settled/compacted finished grade**.

18.4 When the distance between the valve operating nut and the finished surface exceeds five feet (5'), a valve stem extension shall be provided. The valve stem extension shall be of sufficient length to leave the top of the extension (2-inch square nut) 12 to 24 inches below finished grade. All components of the extension shall be epoxy painted 36 ksi carbon steel. The stem shall be round steel pipe of the dimensions shown below with a 2-inch square bar steel operating nut attached to the upper end. A box wrench, 2 1/8" I.D. square, made from steel 3/16-inches thick shall be welded to the lower end of the stem extension which will fit over the valve operating nut. Two-inch valves with a tee-head operating nut will require a rectangular shaped box wrench on the end of the valve stem extension. A round center guide made from 3/16-inch or 1/4-inch steel plate shall be placed on the valve stem extension approximately 6-inches from the upper end. The diameter of the guide shall be slightly less than the inside diameter of the valve box. The guide shall be affixed to the stem extension in such a way that it can rotate freely on the stem. Nominal dimensions for the valve stem extensions for various size valves shall be as follows:

Valve Size and Type	Stem Size (Sch 40)	Maximum (Depth of Bury)
2" Gate	3/4"	10'
3" – 6" Gate	1"	13'
8" – 12" Gate	1 1/4"	13'
14" & Larger Gate	1 1/2"	21'
12" – 18" Butterfly	1 1/4"	13'
20" & Larger Butterfly	1 1/2"	21'

Note: *Welds on stem extensions (top and bottom nut) shall be 1/8" - 3/16" fillet weld around full circumference.

18.4.1 Shop drawings shall be submitted to the **ENGINEER** for approval prior to installing the stem extension pieces.

18.4.2 All steel components of the valve stem shall be painted with two (2) coats of high-build epoxy paint, as approved by the **OWNER**.

19 - INSTALLATION OF TAPPING SLEEVES & TAPPING SADDLES

19.1 The pipe shall be free of dirt and other debris before attaching tapping sleeve or tapping saddle. That part of the pipe barrel, other than concrete pipe, which will be in contact with the gasket of tapping saddles, shall be smooth. All rough areas on the pipe barrel shall be smoothed. The **CONTRACTOR** shall field verify all pipe and fitting dimensions. **Tapping sleeve, tapping**

saddle, or direct tap shall be installed at least twenty-four (24) inches from bell joints, fittings, end of pipe joint, or another tap.

- 19.2 Tapping saddles or sleeves shall be bolted securely to the pipe. The face of the outlet shall be plumb. Mechanical joint glands for tapping sleeves shall be installed in accordance with **Section 12** herein. The strap bolts for tapping saddles shall be alternately tightened "snug" and then alternately tightened to a torque of 100 foot-pounds.
- 19.3 The tapping valve shall be bolted securely to the tapping sleeve or tapping saddle outlet flange. The tapping valve shall be adequately supported from beneath. The weight of the tapping valve shall not be supported by the tapping sleeve/saddle. A concrete "mud slab" at least six (6) inches thick shall be poured under the location of all tapping valves 14 inches and larger and the weight of the valve shall be supported by the mud slab. The tapping machine shall be bolted securely to the valve.
- 19.4 After installation of the tapping sleeve or saddle and the tapping valve and before drilling through the pipe, the assembly shall be hydrostatically tested at the pressure specified in **Section 33**, herein, by introducing water through the sleeve or saddle test tap.
- 19.5 The pilot drill and shell cutter shall be in good condition. **The pilot, shell cutter, and any other component of the tapping machine that will or may come into contact with the interior of the tap valve, tap saddle, or potable water pipe, shall be thoroughly sterilized with straight bleach or super-chlorinated solution.** The shell cutter shall be the size required to cut the full opening specified.
- 19.6 Only qualified operators shall operate the tapping machine. The "coupon" shall be withdrawn and be given to the **ENGINEER** for inspection. Care shall be exercised to avoid drilling or cutting the backside of the pipe by carefully assuring the engagement of the pilot drill and shell cutter shaft.
- 19.7 Openings in the pipe barrel for tapping saddles installed on dry pipe shall be cut with a pilot drill and shell cutter. Torch cutting is not permitted.
- 19.8 Tapping operations must not commence before inspection by the **ENGINEER** or his authorized representative. Tapping operations must not commence before the tapping assembly has passed a pressure test as detailed in **Section 33.4.1 herein**.
- 19.9 A thick coat of coal tar epoxy or other approved bituminous material shall be applied to the straps and bolts of saddles after installation and cleaning or by enclosing polyethylene material in accordance with **Section 21 herein**.
- 19.10 Tapping saddles and sleeves with a run size 2" or larger shall be thrust blocked with concrete, sized as per the corresponding branch main size.

20 - SETTING HYDRANTS

- 20.1 Hydrants shall be color coded as specified in **Section 8.1** of the **Material Specifications**. Hydrants shall be painted with a minimum of two coats of paint. Hydrants shall be thoroughly cleaned before setting, removing all dirt and foreign matter from the barrel and bottom section up to the main valve. The main valve shall be in the "closed" position and the waste outlet shall be free of any obstructions.
- 20.2 Hydrants shall be located a safe distance from driveways, roadways and narrow type sidewalks and in a manner to provide complete accessibility, and they shall stand plumb with nozzles at proper

elevation. The hydrant's "bury line" shall be set at or no more than four (4) inches above the finished grade elevation; therefore the bottom of hydrant nozzles shall be 18 to 22 inches above the finished grade elevation.

- 20.3 Unless otherwise directed, the large diameter nozzle shall be **no less than twenty-four inches (24")** from back of the curb.
- 20.4 The **CONTRACTOR** shall, if necessary, rotate the hydrant barrel or nozzle section at the flanged joint to obtain the desired nozzle position as specified by the **ENGINEER**. The pumper nozzle shall be at a right angle to and face the street unless otherwise directed by the **ENGINEER**.
- 20.5 The bowl or bottom of the hydrant shall be supported firmly on the bottom and shall be well braced against unexcavated earth on the backside of the hydrant. Stone slabs, concrete blocks, or other suitable material may be used to block the hydrant. If considered necessary by the **ENGINEER**, the hydrant shall be tied to the branch pipe with suitable Series 300 STAINLESS STEEL rods or clamps. These rods or clamps shall be furnished by the **CONTRACTOR** without additional compensation.
- 20.6 A drainage bed shall be provided under and around the base of the hydrant of at least six (6) cubic feet in volume and extending at least six inches (6") above the drain outlet and shall consist of gravel or broken stone mixed with coarse sand and thoroughly compacted. Under no circumstances shall the drain outlet on the hydrant or the drainage bed be connected to a sewer.
- 20.7 Backfilling and tamping around hydrant barrels shall be continuous in operation.
- 20.8 If a fire hydrant is not located inside a concrete paved area, then a 2.0' x 2.0' x 1.0' (deep) Class "A" concrete pad, reinforced with #5 reinforcement steel shall be poured just below the break-away joint of the fire hydrant barrel.
- 20.9 Fire hydrants, immediately after installation, shall be covered and wrapped with a heavy cloth, water-resistant sack, or black polyethylene sheeting, well taped in place around the hydrant, to identify the hydrant as being "not in service". After the hydrant is tested and placed into service, the identifying cover shall be removed.

21 - INSTALLATION OF POLYETHYLENE PROTECTION MATERIAL

- 21.1 Polyethylene material, either in tubing form or in the form of flat sheet or rolls, as specified herein, shall be placed around all buried mechanical joints of pipe and fittings, valves, fire hydrants, and all saddles, sleeves, and couplings, tapping saddles, and any other appurtenance with exposed bolts. Any and all iron or steel components installed below ground shall be wrapped with the polyethylene material.
- 21.2 Ductile iron and steel pipe and appurtenances shall be completely encased in polyethylene tubing material. It is not the intent that the material form an enclosure that is absolutely air or water tight, but to prevent pipe to soil contact.
- 21.3 Polyethylene tubing shall be applied to pipe by one of the following methods:
- 21.3.1 Method "A": Cut polyethylene tube to a length approximately two feet (2') longer than the length of the pipe section. Slip the tube around the pipe, centering it to provide a one foot (1') overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate

installation of the polyethylene tube. After assembling the pipe joint, take bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place. Then slip the end of the polyethylene from the new pipe section of the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points with tape.

- 21.3.2 Method "B": Cut polyethylene tube to a length approximately one foot (1') shorter than the length of the pipe section. Slip the tube around the pipe, centering it to provide six inches (6") of bare pipe at each end. Make polyethylene snug, but not tight; secure ends. Before making up a joint, slip a three foot (3') length of polyethylene tube over the end of the preceding pipe section, bunching it accordion fashion lengthwise. After completing the joint, pull the three foot (3') length of polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least one foot (1'); make snug and secure each end.
- 21.4 Pipe-Shaped Appurtenances. Bends, reducers, offsets, and other pipe-shaped appurtenances shall be covered with polyethylene in the same manner as the pipe.
- 21.5 Odd-Shaped Appurtenances. Valves, tees, crosses and other odd-shaped pieces which cannot practically be wrapped in a tube, shall be wrapped with a flat sheet or split length of polyethylene tube. The sheet shall be passed under the appurtenance and brought up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Slack width and overlaps at joints shall be handled as described in **Section 21.3.1 above**. Tape polyethylene securely in place at valve stem and other penetrations.
- 21.6 Openings in Tubing Material. Openings for branches, service taps, blowoffs, air valves, and similar appurtenances shall be made by making an "X" shaped cut in the polyethylene and temporarily folding the film back. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene with tape.
- 21.7 Junctions Between Wrapped and Unwrapped Pipe. Where polyethylene wrapped pipe joins a pipe that is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least two feet (2') and secure the end.
- 21.8 The polyethylene material shall be secured around the pipe and appurtenances by at least three (3) circumferential wraps of tape (**see Section 9 of the Material Specifications**).
- 21.9 All tongs, cables, or chains that are used for lifting pipe and appurtenances that have been encased in polyethylene material shall be adequately padded to prevent damage to the material.
- 21.10 Repair any rips, punctures, or other damage to the polyethylene with tape or with a short length of polyethylene tube cut open, wrapped around the pipe and secured in place.
- 21.11 Polyethylene material shall be stored on the job site in such a manner that it is not exposed to direct sunlight. Exposure during installation shall not exceed forty-eight (48) hours.
- 21.12 Backfill material shall be the same as specified for pipe without polyethylene wrapping. Special care shall be taken to prevent damage to the polyethylene wrapping when placing backfill. Backfill material shall be free from cinders, refuse, boulders, rocks, stones, and/or other material that could damage polyethylene.

22 - TUNNELING, BORING and INSTALLATION OF ENCASEMENT STRUCTURES

- 22.1 The **CONTRACTOR** shall inspect the location where encasement structures are to be installed and familiarize himself with the conditions under which the work will be performed and with all necessary details as to the orderly prosecution of the work. The omission of any details in the Plans and Specifications for the satisfactory installation of the work in its entirety, which may not appear herein, shall not relieve the **CONTRACTOR** of full responsibility.
- 22.2 The **CONTRACTOR** shall satisfy himself of soil conditions by means he deems necessary, i.e. exploratory boring or exploratory pit excavations at tunnel ends. All such exploratory work shall be done in such a manner as to not jeopardize highway or railroad fill, and shall be satisfactorily backfilled and cleaned up.
- 22.3 The size structure as shown on the Plans is considered as the "minimum acceptable size". If the **CONTRACTOR** deems that it would be to his advantage to install a larger structure, he may do so subject to the approval of the **ENGINEER**. If the **CONTRACTOR** elects to use larger structures, the unit bid price as stated in the Bid for the size structure specified will be considered the unit bid price for the larger structure. In no case will the **OWNER** be liable for extra payment for structures larger than the size specified.
- 22.4 Encasement structures shall be installed at the grades and alignment shown on the Plans or directed by the **ENGINEER**. Maximum vertical deviation shall not exceed 0.5 foot from the elevations shown on the Plans or directed by the **ENGINEER**. Maximum horizontal deviation shall not exceed 0.5 foot from the alignment shown on the Plans or directed by the **ENGINEER**. Deviations exceeding the maximums must be pre-planned by the **CONTRACTOR** and approved in writing by the **ENGINEER**.
- 22.5 Where open cut is not practical or permitted, the encasement structure shall be installed by **simultaneous dry auger bore and encasement jacking**, unless some other method is approved in writing by Central Arkansas Water. Timber or steel guide rails shall be used. The grade, slope, and alignment of the guide rails shall be carefully set in order to attain the specified grade and alignment.
- 22.6 Pits and trenches shall be sheeted and braced in accordance with **Section 10 herein**.
- 22.7 Damage to the pipe coating during shipment or handling shall be repaired.
- 22.8 The excavation and backfill of encasement pipe installed in open cuts shall be in accordance with the provisions contained elsewhere herein for other pipe.
- 22.9 Smooth wall steel pipe shall be connected by full penetration butt-welding.
- 22.10 Steel liner plates shall be installed immediately after excavation has proceeded sufficiently to accommodate another section. All bolts shall be securely tightened.
- 22.11 The construction of encasement structures by tunneling or boring shall be carried out in such manner that settlement of the surface above the structure does not occur. The excavation shall be performed so that voids around the structures are held to a minimum. Voids around the periphery of the structures shall be filled by pressure grouting. The grout shall be **one (1) part Portland cement and two (2) parts sand** with water adequate to permit pumping on encasement structures 24-inches in diameter and larger. The grout shall be introduced through suitable fixtures and placed through the structure wall at intervals adequate to completely fill all voids. The fixtures shall have pressure tight caps that shall be closed after the grouting operations have been completed. The grouting pressure shall be sufficient to completely fill all voids without causing upheaval of

overburden above the encasement structure but shall not exceed five (5) psi. If voids exist around structures smaller than 24-inches in diameter, the **CONTRACTOR** shall introduce grout to completely fill the voids through suitable borings made from the surface.

- 22.12 For carrier pipe lines 6-inch diameter and greater, a Series 300 stainless steel wire rope cable, 3/8" diameter, shall be threaded through the encasement along with the carrier pipe, the purpose of the cable is to aid in the removal of the carrier pipe if removal is ever required. The cable ends shall extend ten (10) feet past each end of the encasement pipe and the ten (10) foot cable ends shall be wrapped loosely around the carrier pipe and secured in place before backfilling; wrap around the outside of polyethylene encasement if present. Splices in the cable shall be avoided, but if necessary shall be made with a minimum of three (3) Series 300 stainless steel wire rope cable clamps per splice. After the carrier pipe has been pulled through the encasement pipe, the ends of the encasement pipe shall be sealed with Link-Seal as shown in the Standard Details. A vent at each end of the encasement pipe shall be constructed as shown in the Standard Details unless otherwise deleted by the **ENGINEER**.
- 22.13 Moleing and other installation methods may be considered and approved by the **ENGINEER** for installation of un-encased main and service pipe.

23 - CONCRETE THRUST BLOCKS & ANCHOR COLLARS

- 23.1 Concrete thrust blocks and anchor collars shall be provided along the pipeline in accordance with the construction details, plan sheets, or as directed by the **ENGINEER**. The concrete mix (as defined in **Section 24 herein**) shall be Class "A" for anchor collars and Class "B" for thrust blocks. All bends, tees, caps, plugs, and fire hydrants shall be thrust blocked unless specifically detailed in the construction plans that no thrust blocking is required. **Anchor collars shall be constructed on ductile iron (or approved steel) pipe only**; if the pipeline being restrained is primarily PVC or other non ductile iron pipe, at least one full joint of ductile iron (or approved steel) pipe shall be inserted in the pipeline run to receive the concrete anchor collar.
- 23.2 Concrete for thrust blocks and anchor collars shall be placed against undisturbed soil. The excavation shall be hand shaped and free of loose material. Forms shall be used to confine the concrete in areas other than that part that is in contact with undisturbed soil in the direction of the thrust.
- 23.3 No concrete shall be placed around any part of a joint or placed so that it interferes with the removal of any joint accessories such as bolts, followers, threads, collars, couplings, etc. Fire hydrant drains shall not be restricted.
- 23.4 The top of the concrete thrust block or anchor collar shall be struck off with a wood straight edge or float.
- 23.5 Concrete shall not be placed when the temperature is below 40°F and dropping or below 35°F if the temperature is rising, unless approved by the **ENGINEER**. Placement shall be in accordance with **Sections 25.5.1 through 25.5.4 herein**.
- 23.6 Admixtures are not to be used without the approval of the **ENGINEER**.
- 23.7 All reinforcement shall be inspected by the **ENGINEER** prior to placement of concrete. All placement of concrete must be in the presence of the **ENGINEER** or his representative. The **CONTRACTOR** is cautioned that he may be required to remove, without compensation, any concrete placed in the absence of the **ENGINEER** or his representative.

- 23.8 Backfill over concrete thrust blocks or anchor collars shall not be placed before the concrete has attained initial set.
- 23.9 No thrust blocks shall be less than twelve inches (12”) thick between the pipeline or appurtenances and undisturbed soil in the direction of thrust on pipes 12-inch diameter and smaller. On larger pipes, the thickness of thrust blocks shall be as directed by the **ENGINEER**. A thrust block with any component of its length to width to depth ratio exceeding two (2) shall be reinforced with steel reinforcement bars as directed by the **ENGINEER**. The **ENGINEER** will consider the size of the thrust block, the size of the water main, and the system pressure in the determination of the size and spacing of the steel reinforcement.
- 23.10 The excavation shall be free of water before concrete is placed. Steel reinforcement, as specified on the plans, shall be placed in accordance with **Section 25.2 herein**.
- 23.11 The pipe or appurtenances to be in direct contact with concrete shall be cleaned before placing the concrete.
- 23.12 The area of contact of the thrust blocks and anchor collars shall be sufficient to resist the thrust. This will vary depending on the safe bearing value of the soil. Suggested safe soil bearing values are as follows:

TYPE OF SOIL	SUGGESTED SAFE BEARING VALUES (TONS \ SQ. FT.)
Solid Rock	25.0 TONS / SQ. FT.
Hard Shale	6.0
Medium Shale	4.0
Soft Shale	2.0
Dry Clay Gravel	4.0
Soft Clay	1.125
Dry Sand or Loam	2.0
Wet Clay	0.55

The above values are approximate, will vary considerably, and are intended to be used only as a guide. The **CONTRACTOR** is responsible for determining the soil bearing value or taking other action to assure that the bearing area is adequate to restrain the pipe or appurtenances.

- 23.13 Where the soil is unstable or in the case of recent fill areas, the following procedures shall apply either singly or in a combination:

23.13.1 Thrust blocks shall be of adequate size to restrain pipe or appurtenances by mass alone without depending on horizontal bearing of the soil.

23.13.2 The excavation shall extend deep enough to contact firm soil and the thrust block concrete brought up to the pipe or appurtenances. The thrust block shall be constructed so that the block acts as a beam and will provide the restraint required. Such block shall be reinforced with steel reinforcing bars.

23.13.3 Anchor blocks shall be constructed in a firm soil and tie rods extended to the pipe or appurtenances. Tie-rods shall be used only for temporary restraint. Concrete thrust blocks and/or anchor collars must be placed for permanent restraint.

23.14 Thrust blocks for vertical bends shall be adequate to resist the thrust by mass alone when the thrust is upward.

23.15 Thrust blocks and anchor collars shall be adequate to restrain the pipeline and appurtenances at the specified test pressure. The following table lists the resultant thrust at certain fittings at a pressure of 100 psi. In order to determine the thrust at the test pressure, these values are to be multiplied by a factor equal to the test pressure divided by 100.

Thrust per 100 psi Pressure

Fitting/Bend	Thrust (TONS)									
	6"	8"	12"	16"	20"	24"	30"	36"	42"	48"
11 1/4°	0.3	0.5	1.1	2.0	3.1	4.4	6.9	10.0	11.7	13.6
15°	0.4	0.7	1.5	2.6	4.1	5.9	9.2	13.3	18.1	23.6
22 1/2°	0.6	1.0	2.2	3.9	6.1	8.8	13.8	19.9	27.0	35.3
30°	0.7	1.3	2.9	5.2	8.1	11.7	18.3	26.3	35.9	46.8
45°	1.1	1.9	4.3	7.7	12.0	17.3	27.1	39.0	53.0	69.2
90°/Tee	2.0	3.6	8.0	14.2	22.2	32.0	50.0	72.0	98.0	128.0
Plug (dead-end)	1.4	2.5	5.7	10.1	15.7	22.6	35.3	50.3	69.3	90.5

The above numbers are per one-hundred (100) PSI

23.16 Concrete thrust blocks and anchor collars on **12-inch and smaller pipelines** shall have a minimum curing time of **three days** (72 hours) before any pressure is placed against the block or collar. Concrete thrust blocks and anchor collars on **14-inch and larger pipelines** shall have a minimum curing time of **seven days** before any pressure is placed against the block or collar.

23.17 Concrete thrust blocks or anchor collars that fail to restrain the pipe or appurtenances shall be replaced by the **CONTRACTOR** at his expense.

23.18 Reducers receiving an anchor collar shall be long bodied fittings.

23.19 All anchor collars are to be assumed to have two-way thrust and shall have two identical "A"/"B" reinforcement steel mats as shown in the Detailed Drawings. Anchor collars for 24" and smaller diameter pipe shall have two (2) Mega-Lug or Uni-Flange retaining glands placed back-to-back, spaced just inside the two reinforcing steel mats. Anchor collars for 26" and larger diameter pipe shall have two weld-on thrust rings, spaced just inside the two reinforcing steel mats.

24 - CONCRETE MIX

24.1 Class "A" concrete shall have a 28-day compressive strength of at least 3,500 psi and shall contain not more than six (6) gallons of water per sack of cement, including the water in the aggregates, and

not less than six (6) sacks of cement per cubic yard of concrete. Volumes of concrete greater than 1/3 cubic yard shall be mixed at a batch plant.

24.2 Class "B" concrete shall have a 28-day compressive strength of at least 2,500 psi and shall contain not more than seven (7) gallons of water per sack of cement, including the water in the aggregates, and not less than five (5) sacks of cement per cubic yard of concrete. Volumes of concrete greater than 1/3 cubic yard shall be mixed at a batch plant.

24.3 Uses of Concrete by Classification.

24.3.1 Class "A" Concrete shall be used for the following:

24.3.1.1 Sidewalks, street surfaces, curbing, gutters, ditch paving and driveways

24.3.1.2 Structures such as vaults, buildings, retaining walls, protective slabs over pipelines and other facilities, footing pipe supports and anchor collars.

24.3.2 Class "B" Concrete shall be used for thrust blocking.

24.4 Portland cement conforming to ASTM C150, Type 1, shall be used unless the **ENGINEER** approves the use of another type.

24.5 Water used shall be clean and free from injurious amounts of oil, acids, alkalis, salt, organic matter, or other deleterious substances.

24.6 Fine aggregate shall consist of clean, sound, properly graded sand conforming to ASTM Standard C33 uniformly graded from 100% passing the 3/8-inch sieve to not more than 8% passing the No. 100 sieve. Colorimetric tests shall show not darker than very light amber for aggregate to be used in pavement, sidewalks, curbs, and gutters.

24.7 Coarse aggregate shall consist of crushed stone, gravel, or other inert material of similar characteristics, having clean, hard, strong, durable, uncoated particles with not more than five (5) percent by weight of soft fragments, one-fourth (1/4) percent by weight of clay lumps, and one (1) percent by weight of material removed by decantation, except that when the material removed by decantation consists essentially of crushed dirt the maximum amount permitted may be increased to one and one-half (1 1/2) percent by weight. Rocks shall conform to ASTM Standard C131 and C535. Coarse aggregate may be either of two sizes, 1 1/2-inch and smaller or 3/4-inch and smaller, and shall be graded within the following requirements.

PERCENT RETAINED BY WEIGHT	
Maximum size mesh screen (sq. mesh)	0 - 3 %
Half-Maximum size mesh screen (sq. mesh)	30 - 65 %
No. 4 Sieve	94 - 100 %

In no case shall the maximum size aggregate exceed one-third (1/3) of the design thickness of any part of a structure. Coarse aggregate for exposed aggregate surfaces shall be as follows:

Total Retained on 1 1/2" Sieve	0 %
Total Retained on 3/4" Sieve	25 - 60 %
Total Retained on 3/8" Sieve	70 - 90 %
Total Retained on No. 4 Sieve	95 - 100 %

24.8 Concrete Proportions and Consistency.

24.8.1 The proportions of the concrete shall produce a mixture that will work readily, with the placement method most used, into the corners and angles of the forms and around reinforcement. Segregation of materials in the mixture shall not be permitted nor the collection of excess free water on the surface.

24.8.2 The slump of the concrete shall be the minimum that is practicable. When vibrators are used to consolidate the concrete, the slump shall not exceed 4-inches; otherwise, the slump shall not exceed 6-inches.

24.8.3 The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked. Measurement of materials for ready-mixed concrete shall conform to Specifications for Ready-Mixed Concrete (ASTM C94).

24.9 Mixing and Hauling Concrete. Concrete shall be mixed in a batch mixer of a type designed to insure uniform and thorough distribution of the materials throughout the mix. Its size shall be such as to produce a volume of concrete consistent with demands of each pour. It shall be equipped with a water-metering device for accurate measurement of water. Charges of cement shall be by full sacks of cement; the use of fractional sacks, or reclaimed cement, will not be acceptable. All concrete shall be mixed for a period of not less than five (5) minutes after all materials, including the mixing water, have been placed in the drum. The entire contents of each batch shall be discharged from the drum before any material for the succeeding batch is placed therein. When the mixing operation for each period is completed, the mixer drum shall be cleaned thoroughly. Concrete shall be deposited within forty-five (45) minutes after it is mixed.

24.10 If the **CONTRACTOR** elects to use a central mixing plant, he shall provide sufficient hauling equipment, properly designed to prevent segregation and loss of mortar, and to permit discharge without segregation. When the hauling and placing operation for each period is completed, the hauling equipment shall be cleaned thoroughly.

24.11 Ready-mix concrete may be used at the option of the **CONTRACTOR** if acceptable concrete is delivered. Ready-Mix concrete shall conform to ASTM Standard C94 and to applicable portions of these specifications for on-site mixing. The concrete shall be delivered and placed within forty-five (45) minutes after all materials, including mixing water, shall have been placed in the mixing drum. The **CONTRACTOR** shall obtain from the supplier of the ready-mixed concrete, the supplier's agreement to inspection by the **ENGINEER**, to the full extent deemed necessary by the **ENGINEER**.

24.12 Testing Concrete. As the placement of concrete progresses, the **ENGINEER** may take samples of the concrete for testing. The **CONTRACTOR** shall provide whatever assistance required by the **ENGINEER** in collecting and preparing samples for testing. Sampling shall be in accordance with **ASTM Standard C172**.

24.12.1 Slump tests shall be made in accordance with ASTM Standard C143.

- 24.12.2 Compression test specimen shall be prepared and cured in accordance with ASTM Standard C31. Specimens shall be tested in accordance with ASTM Standard C39.
- 24.13 All reinforcing bars shall be "Deformed Carbon-Steel Bars for Concrete Reinforcement" conforming to ASTM Designation A615. Deformed bars shall be intermediate grade with minimum yield point of 40,000 psi, or greater if otherwise specified.
- 24.14 Lapping of reinforcement bars shall be a minimum of 30 diameters in length. Welding of reinforcing bars is not allowed unless specifically approved by the CAW **ENGINEER**. Welding of reinforcement bars must conform to applicable ANSI/ASTM/AWS standards and requirements.
- 24.15 When the volume of concrete required at the work site is less than one-third (1/3) cubic yard, mixing may be accomplished by hand tool methods. The concrete shall be mixed in a clean, watertight vessel to the extent necessary to assure that the cement, aggregate, and water are thoroughly integrated. The mix shall be at least one (1) part Portland cement to two (2) parts coarse aggregate, as specified in **Section 24.7 above and two (2) parts sand, as specified in Section 24.6 above**. Only that amount of water required to provide a stiff, workable mix shall be used. The strength requirements specified in **Sections 24.1 and 24.2, herein**, apply.

25 - PLACEMENT & FINISHING CLASS "A" CONCRETE

- 25.1 Forms shall be constructed before placement of any concrete unless otherwise authorized by the **ENGINEER**.
- 25.1.1 Forms shall conform to shapes, lines, and dimensions of the members as specified on the Plans, or as required to conform to the original shape and dimensions in the case of replacement structures, and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape. They may be constructed of any material with sufficient strength which will provide the finished work a satisfactory surface; however, metal forms will not be permitted for concrete which will be exposed on any of the completed work, except upon the specific approval of the **ENGINEER**.
- 25.1.2 In those cases in which paved surfaces are being replaced such as sidewalks, driveways, curb, gutter, etc., the edge of adjacent existing surfaces must be cut straight and smooth using a concrete saw or other suitable tool. The forms shall be constructed in such manner that a smooth concrete surface is produced which matches the existing surfaces on each side.
- 25.1.3 Forms shall be removed in such a manner as to insure the complete safety of the structure. When the structure is supported on shores, the removable floor forms, beams and girder sides, and column and similar vertical forms may be removed after 96 hours, providing the concrete will not be damaged. In no case shall supporting forms or shoring be removed until members have acquired sufficient strength to support their weight and imposed loads safely.
- 25.1.4 Forms shall be coated with oil before placement of reinforcing steel or concrete. Excessive coating material shall not be allowed to form or stand in puddles in the forms nor allowed to come in contact with concrete against which fresh concrete will be placed.
- 25.2 Placement of Reinforcement.

- 25.2.1 At the time concrete is placed, metal reinforcement shall be free from rust scale or other coatings that will destroy or reduce the bond. All bars shall be shop bent, unless otherwise permitted by the **ENGINEER**. No bar partially embedded in concrete shall be field bent except as shown on Plans or as specifically permitted by the **ENGINEER**. Field bonding of rail steel bars will not be permitted.
- 25.2.2 Metal reinforcement shall be accurately placed according to the Plans, or as specified herein, and adequately secured in position by concrete, metal, or other approved chairs, spacers or ties.
- 25.2.3 No splices of reinforcement shall be made except as shown on the Plans, or as specified, or as authorized by the **ENGINEER**. All welding shall conform to the American Welding Society's Recommended Practices for Welding Reinforcing Steel, Metal Inserts, and Connections in Reinforced Concrete Construction (AWS D12.1), unless otherwise authorized by the **ENGINEER**. All laps and splices shall be in accordance with ACI 318, using $f'_c = 3000$ psi and $f_y = 60,000$ psi unless otherwise shown on the Plans.
- 25.2.4 The reinforcement shall be protected by the thickness of concrete indicated in the Plans. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:
- 25.2.4.1 Where concrete is deposited against the ground without the use of forms--not less than 3-inches, except wire mesh reinforcement for concrete slabs which may be within 1 ½-inches of the ground.
- 25.2.4.2 Where concrete is to be exposed to the weather or to the ground but placed in forms--not less than 2-inches for bars larger than No. 5 and 1 ½-inches for No. 5 bars or smaller.
- 25.2.4.3 In slabs and walls not exposed to the ground or to the weather--not less than ¾-inch.
- 25.2.4.4 In all cases--at least equal to the diameter of the bars.
- 25.2.5 Reinforcement for Curb and Gutter. Reinforcement shall consist of #3 bars spaced at 6-inch centers longitudinally with #4 transverse tie bars spaced at 2-foot centers. The bars shall be firmly held in place by wiring bars together. Bar chairs or other suitable steel devices shall be used to support the bars at a level 3-inches above the bottom of the concrete.
- 25.2.6 Reinforcement for Sidewalk, Ditch Paving, Slope Protection and Driveway Surfaces. Reinforcement shall consist of 6-inch x 6-inch mesh, #6 gauge for driveways and #9 gauge for ditch paving, slope protection and sidewalks.
- 25.3 Joints and Joint Filler
- 25.3.1 Water stops shall be installed at no additional cost to the **OWNER** for construction joints in walls and slabs below finished ground elevation, and in all water bearing structures. Where a joint is to be made, the surface of the concrete shall be thoroughly cleaned and all laitance removed. In addition, vertical joints shall be thoroughly wetted and slushed with a coat of neat cement grout immediately before placement of new concrete.
- 25.3.2 Expansion and contraction joints shall be provided as shown on the Plans, or if not shown on the Plans, shall be provided as follows:

- 25.3.2.1 For replacement sidewalk, driveway, curb, and gutter sections, transverse joints shall be spaced in accordance with the spacing of the adjacent surfaces. Longitudinal expansion joints shall be provided where the section being replaced abuts another structure. Contraction joints in sidewalks shall be shaped similar to existing adjacent joints.
- 25.3.2.2 The spacing of joints for other structures such as ditch paving, protective slabs, etc. shall be as directed by the **ENGINEER**.
- 25.3.3 Joint Filler.
 - 25.3.3.1 Pre-molded joint filler shall be the non-extruding type, 3/4-inch to 1-inch thick, conforming to AASHTO Designation M33 or ASTM D994, and shall be of sufficient dimension to extend through the full depth of the paved surface.
 - 25.3.3.2 Poured joint filler shall be bituminous material conforming to ASTM Designation M18 or rubber-based compound conforming to Federal Specification SS-F-336.
- 25.4 Embedded items, wall fittings and anchor bolts shall be installed as shown on the Plans. Embedded items shall be worked-out in advance of the concrete pour, giving the **ENGINEER** ample time for inspection of all items to be embedded.
- 25.5 Placing Concrete.
 - 25.5.1 All placement of concrete must be in the presence of the **ENGINEER** or his representative. The **CONTRACTOR** is cautioned that he may be required to remove, without compensation, any concrete placed in the absence of the **ENGINEER** or his representative.
 - 25.5.2 Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of materials. All concrete in walls and columns shall be poured through tremies unless otherwise permitted by the **ENGINEER**. The free fall of concrete shall be held to a minimum.
 - 25.5.3 Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. The placing of concrete shall be carried on at such a rate that concrete is at all times plastic and flows readily into the spaces between the bars. No concrete that has been contaminated by foreign material shall be used, nor shall retempered concrete be used.
 - 25.5.4 When placing is once started, it shall be carried on as a continuous operation until placement of the panel or section is complete. When construction joints are necessary, they shall be made in accordance with **Section 25.3.1 herein**.
 - 25.5.5 In placing concrete, care shall be taken that the freshly placed mass is so placed and vibrated that there is no tendency for the coarse aggregate to segregate from the mortar, that no rock pockets are left, that the concrete flows readily around the steel and into the extremities of the forms, and the whole freshly-placed mass becomes a plastic jelly-like mass but without free water in appreciable quantity on its surface. **No Class "A" concrete shall be poured without vibration with mechanical or magnetic internal vibrators.**

25.5.6 Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the **ENGINEER**. Before depositing concrete on or against concrete that has taken its initial set, the surface of the hardened concrete shall be broken off down to coarse aggregate and wire brushed to remove foreign matter and laitance. A layer of grout of the same cement-sand ratio as the concrete without coarse aggregate shall be placed to a thickness of one (1) to two (2) inches on the brushed surface after which the new concrete shall be placed immediately.

25.5.7 Concrete placed directly on the ground shall be placed in the forms on a compacted wetted subgrade and shall be tamped and spaded until mortar covers the entire surface. Tamping and spading shall be given special attention in order to prevent voids in the concrete.

25.5.8 Curb and Gutter Section. The cross section of the curb and gutter shall conform to that of adjacent sections or as directed by the **ENGINEER**. The surface shall be struck off smooth between templates, shaped to the required cross section, and it shall be finished with a wooden float and steel trowel and broomed to produce a uniform finish to match that of adjacent sections. The curb and gutter shall be grooved with an approved grooving tool at intervals equal to those of adjacent sections where applicable.

25.5.9 Flat Surfaces.

25.5.9.1 After the concrete has been deposited, it shall be approximately leveled and struck off to such depth below the finish grade as required to place reinforcing mats or wire mesh, and shall be properly consolidated prior to placing the reinforcing mats or mesh, when applicable, as the case may be. Additional concrete shall be deposited and struck off to a depth above the finish grade that when properly consolidated, the surface shall conform to the line and grade required to match adjacent surfaces. The strike-off board shall be straight, free from warp, and shod on the striking surface with a steel strip. The strike-off board shall be moved forward with a combined longitudinal and transverse motion and without raising either end above the side forms during the strike-off process. A slight excess of material must be kept in front of the cutting edge at all times.

25.5.9.2 Immediately following screeding and compaction operations, the slab surface shall be tested for trueness with a straightedge. Any depressions found shall be filled with freshly mixed concrete, struck off, consolidated, and refinished. Longitudinal floating shall be done in conjunction with checking with the straight edge. The float shall not be less than 12-inches in length for walls and 48-inches in length for slabs, and from 8-inches to 10-inches in width, and shall be properly stiffened to prevent flexibility and warping. The straight-edge testing and floating operation shall continue until the entire surface is found to be free from observable departures from the straight edge, and until the surface of the slab has the required grade and contour.

25.6 Concrete Finishing.

25.6.1 Replacement Surfaces.

25.6.1.1 The concrete shall be worked with suitable tools until a finish, which matches that of adjacent surfaces, is achieved.

25.6.1.2 Exposed aggregate finish. Scrubbed finish shall be produced on green concrete. The surface shall be thoroughly wetted and scrubbed with stiff fiber or wire brushed, using water freely, until the surface film of mortar is removed and the

aggregate is uniformly exposed. The surface shall then be rinsed with clean water. If portions of the surface have become too hard to scrub in equal relief, dilute hydrochloric acid (commercial muriatic acid diluted with 4 to 10 parts water) shall be used after the concrete is at least two (2) weeks old to facilitate the scrubbing. The acid shall be removed within fifteen (15) minutes from the finished surface with clean water. This operation may be facilitated by casting the concrete against form faces that have been coated with a chemical retarder to keep the mortar adjacent to the form from setting. Every effort must be exerted to assure that the new surface matches any existing adjacent surfaces.

- 25.6.2 All exposed inner and outer (above grade) walls of structures shall be finished as follows: Forms shall be removed from such surface as soon as structurally possible and when approved by the **ENGINEER**. All imperfections and depression shall then be immediately filled with mortar. The concrete surfaces shall then be machine or hand rubbed until the entire surface has a smooth, homogenous, pleasant-appearing finish of uniform texture and color. Any delay in patching or rubbing such surfaces shall be cause for rejection of the entire structure. No mortar or wet cement shall be used in finishing except the mortar necessary to fill imperfections. Edging tools shall be used on all exposed joints and edges. All exposed corners shall be chamfered as shown on the Plans.
- 25.6.3 All other wall surfaces of structures shall be finished as follows: Forms shall be removed from such surfaces as specified in **Section 25.6.2 above**. All imperfections and depressions shall then be immediately filled with mortar and rubbed with a wooden float or steel trowel to give a uniform appearance. Spurs shall be removed from the concrete surface. No over-all machine or hand rubbing is required.
- 25.6.4 Floors of structures and ditch pavement shall be trowel finished.
- 25.7 Curing, after placement and finishing, concrete shall be protected from damage while curing. Provisions shall be made for maintaining concrete in moist condition for a period of at least ten (10) days after placement. A tinted spray-on curing compound shall be used unless otherwise approved by the **ENGINEER**.
- 25.8 After removal of forms and finishing, as specified elsewhere herein, backfill shall be placed around the structure and thoroughly compacted.
- 25.9 Cold-Weather Requirements.
- 25.9.1 Concrete shall not be placed when the ambient temperature is below 40°F, nor when the concrete is likely to be subjected to freezing temperatures before final set has occurred. Concrete footings or slabs shall not be placed over frozen ground. The temperatures of the concrete when placed shall not be less than 45°F. Heated materials shall be free of ice, snow, and frozen lumps before entering the mixer. Methods and equipment for the heating of materials shall be subject to the **ENGINEER'S** approval. Suitable means shall be provided for maintaining the concrete at a temperature of at least 45°F for not less than 96 hours after placing.
- 25.9.2 Special methods shall be used to protect concrete floor slabs in cold weather to prevent frost from entering the concrete (or fill under floor slabs) until the building or structure is enclosed and heat is provided. Methods shall include covering of slabs with hay or other insulating material, protection of insulation from wetting with tarpaulins, introduction of heat, construction of enclosures, or other methods, depending upon the severity of the weather. The housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heating is discontinued.

Methods to be used shall be proposed in advance of the work and shall be approved by the **ENGINEER**. Salt, calcium, chloride, or other chemicals shall not be mixed with the concrete to prevent freezing.

25.9.3 Any and all concrete damaged by freezing shall be removed to the satisfaction of the **ENGINEER**, and replaced, all at the expense of the **CONTRACTOR**.

25.10 Hot Weather Requirements.

25.10.1 In hot weather, suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays, or other devices shall be provided as directed by the **ENGINEER**.

25.10.2 Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperatures shall be less than 90°F unless the **ENGINEER** permits higher temperatures.

25.11 The use of setting compounds, retarding compounds, or other additives shall be prohibited unless approval of its use has been secured, in advance, from the **ENGINEER**.

26 - BACKFILL & BEDDING

26.1 All trenches and other excavations shall be backfilled as soon as possible after installation of the pipelines and appurtenances. It may be necessary to backfill only a portion of the trench in order to allow adequate curing of concrete. The **CONTRACTOR** shall limit all open trenches to a maximum of 300 linear feet along public streets/roads/highways and shall completely backfill all trenches daily. Temporary road plating of open trenches in paved areas is allowed if so approved by the street/road/highway department. **To ensure that proper materials and/or workmanship have been utilized, the OWNER/ENGINEER/INSPECTOR may require that trenches and other excavations not be backfilled until direct observation/inspection of the work has been made.**

26.2 Backfilling under the pipe shall be in accordance with **Section 10, herein**.

26.3 Donafill or wet and/or frozen material shall not be used for backfilling.

26.4 Unless Type 4 or Type 5 Bedding is specified (**Section 27 herein**), backfill shall be in accordance with **Section 26.5 and 26.6 herein below**.

26.5 When trenches pass through areas of special surfaces, backfill shall be as follows:

26.5.1 When trenches pass through **EXISTING** paved roads, streets, alleys, driveways, and/or parking lots, the trench shall be backfilled from trench bottom to an elevation three (3) inches below the finished surface with compacted Class 7 crushed stone. The first layer of crushed stone shall be placed loose up to the springline of the pipe (not exceeding nine (9) inches per layer), and be carefully tamped and haunched around the bottom half of the pipe. Subsequent crushed stone shall be placed in loose lifts up to nine (9) inches thick and compacted to 95% modified proctor density before placement of the next loose lift of crushed stone. The trench shall be capped with a minimum of three (3) inches of compacted asphaltic concrete cold mix to serve as a temporary driving surface until permanent repairs are made.

- 26.5.2 When trenches pass through **PROPOSED** paved roads, streets, alleys, driveways, and/or parking lots (when such proposed improved surfaces are shown in the plans), the trench shall be backfilled from its bottom to the proposed finished grade with compacted Class 7 crushed stone. Backfill and compaction shall proceed as specified in **Section 26.5.1** above, except the temporary cap of cold mix is not required.
- 26.5.3 When trenches pass through existing sidewalks, the trench shall be backfilled from trench bottom to an elevation three (3) inches below the finished surface with compacted select native material. Backfill and compaction of the select material shall proceed as specified in **Section 26.5.1** above, except the temporary cap shall be three (3) inches of compacted Class 7 crushed stone or asphaltic concrete cold mix.
- 26.6 When trenches are not located within areas of existing or proposed improved or special surfaces, backfill shall be with native material. From the bottom of the trench (or top of special backfill) to an elevation at least twelve (12) inches above the top of the pipe, backfill shall be select native material with no rocks or clogs exceeding 2 1/2 inches in any dimension. Additional native material shall be placed as backfill in the trench and compacted before reaching the top of the trench either by flooding with water or rolled by passing the wheel or track of a heavy piece of equipment along the trench line in order to attain some degree of consolidation. Excess native material shall be windrowed along the trench line to provide material for future consolidation of the backfill. After complete consolidation of the backfill is achieved, any excess material shall be removed or leveled along the trench line. Backfill shall not be pushed or dumped into trench in a manner to permit free fall of material until at least two feet of cover is achieved over the top of the pipe.
- 26.7 The **CONTRACTOR** shall fill and re-fill trenches with suitable material where settlement has occurred during the warranty period of the project.
- 26.8 In areas where sod, trees, shrubs, flowers or other vegetation has been removed and is to be replanted, the top three (3") to six (6") inches of backfill shall be of suitable bottom land top soil.
- 26.9 Concrete pipe closures and other fittings or appurtenances designated by the **ENGINEER** shall not be backfilled until the hydrostatic pressure and leakage tests have been completed.

27 - TYPE 4 AND TYPE 5 BEDDING

- 27.1 Where Type 4 or Type 5 bedding is specified, the trench shall be excavated to a depth nine inches (9") below plan grade. The trench width shall conform to the requirements of **Section 10.3 herein**. Nine inches (9") of granular material (described in **Section 27.5 below**) shall be placed in the bottom of the trench in two (2) equal lifts. Each lift shall be consolidated by slicing with a shovel and compacted using mechanical or pneumatic tampers. Where the soil in the bottom of the trench is wet or soft enough to intrude into the voids of granular material placed on it, a layer of coarse sand four inches (4") thick shall be placed in the trench bottom and consolidated, followed by at least five inches (5") of granular material.
- 27.2 Type 4 Bedding. After the pipe is placed on the consolidated granular material in the bottom of the trench, at least six inches (6") of granular material shall be deposited on each side of the pipe and thoroughly tamped and rammed around the pipe using hand, mechanical, or pneumatic tampers. A layer of firmly bedded plywood or sheeting, to be left in place, shall be placed along the sides of the trench whenever the soil is wet and soft. The sheeting shall extend to a height of four feet (4'), or six inches (6") above the pipe, whichever is greater. The trench, from the top of the granular material to a point six inches (6") above the pipe, shall be backfilled with select material consisting of fine loose earth or sand free from clods or rocks larger than 2 1/2-inches in any dimension and of proper moisture content for maximum consolidation. This material shall be deposited in layers not

to exceed four inches (4") on both sides of the pipe and thoroughly and carefully tamped and rammed around the pipe using hand, mechanical or pneumatic tampers. Compaction shall continue until 90 percent of maximum density as determined by the Modified Proctor Compaction Test has been achieved.

- 27.3 Type 5 Bedding. After the pipe is placed on the consolidated granular material in the bottom of trench, additional granular material shall be deposited in lifts not to exceed six inches (6") on both sides of the pipe and thoroughly tamped and rammed around the pipe using hand, mechanical, or pneumatic tampers until the material has been brought up to a point a minimum of six inches (6") above the top of the pipe. A layer of firmly bedded plywood or sheeting, to be left in place, shall be placed along the sides of the trench whenever the soil is wet and soft. This sheeting material shall extend to a height of four feet (4'), or six inches (6") above the pipe, whichever is greater.
- 27.4 The remainder of the backfill shall be in accordance with **Section 26 herein**.
- 27.5 The granular material shall be pea gravel or crushed stone conforming to ASTM C33, Size No. 67 (modified), having the following grade by weight:

Sieve Size	Percent Retained
3/4 inch	0 %
1/2 inch	0 – 10 %
3/8 inch	30 – 60 %
No. 4	85 – 100 %
No. 8	95 – 100 %

- 27.6 All Type 4 and Type 5 Bedding shall be inspected and measured by the **ENGINEER** or his representative before backfilling the trench.

28 – REPLACEMENT OF SPECIAL SURFACES

- 28.1 The **CONTRACTOR** shall replace or repair all special surfaces removed or disturbed during the progress of the work as shown in the detailed drawings.
- 28.2 All replacement or repairs of special surfaces within the right-of-way of public streets or roads must conform to requirements of and be approved by the state, county or local authority having jurisdiction. Concrete surfaces, except street pavement, shall be constructed in accordance with **Sections 24 and 25 herein**, unless otherwise directed by state, county or local authorities having jurisdiction.
- 28.3 The materials used shall be of the same type as that removed or be approved by the **ENGINEER** or state, county, or local authority having jurisdiction.
- 28.4 The following shall be considered minimum requirements with respect to replacing asphaltic concrete pavement other than public road, street, or alley pavement.
 - 28.4.1 The trench shall be backfilled in accordance with **Section 26 herein**.

- 28.4.2 The pavement thickness shall be at least as thick as adjacent pavement but in no case shall it be thinner than two inches (2”).
- 28.4.3 Before placement of new surface material, all excess material (temporary cold mix asphaltic concrete, crushed stone, soil, etc.) shall be removed to a depth at least equal to the specified thickness of the replacement surface. The bottom surface on which the replacement material is to be placed shall be finished smooth and any wet material and debris removed.
- 28.4.4 Preparation and Priming. No bituminous material shall be placed upon a surface having excess moisture or when general weather conditions are not suitable. The edges of existing pavement surface shall be cut smooth and vertical along a horizontal straight line. After removal of excess material from the trench, the bottom surface shall be finished smooth and rolled with a flat-wheel, pneumatic tired roller or other equipment which will compact the uppermost portion of the trench. Paved areas adjacent to the trench shall be cleaned by broom sweeping. The prime coat shall be applied at a rate of 0.40 gallons per square yard. The vertical edges of existing pavement shall be primed.
- 28.4.5 Application of Surface Course. Restrictions relative to moisture and weather conditions cited in **Section 28.4.4 above** apply. The mixture shall be transported to the work site in tight vehicles with canvas cover over the cargo compartment to retard heat loss. The mixture shall be delivered at a temperature of 275°F to 325°F. The mixture shall be spread by hand or suitable machine immediately after delivery to the work site to a depth that will match adjacent pavement surfaces after rolling. The mixture shall be thoroughly compacted by passing a steel wheel roller over the surface course immediately after being spread. The mixture shall be continuously rolled until all roller marks are eliminated and no further compaction is possible. The final surface shall match adjacent pavement surfaces and there shall not be any depressions or raised surfaces across the trench.
- 28.4.6 All preparatory work must be inspected by the **ENGINEER** before placement of asphaltic concrete.
- 28.5 **SIDEWALKS** – Sidewalks removed shall be reconstructed as per the requirements of the state, county, or municipal authorities have jurisdiction. Sidewalks at intersections and designated mid-block crosswalks shall be reconstructed with handicapped ramps.
- 28.6 The **CONTRACTOR** shall replace any traffic markings removed during the **WORK**.
- 28.7 Calculation of the total payable width of surface repair shall be based on the minimum payable widths as stated in **Section 39 herein**. Damage and repair of special surfaces beyond the payment limits specified shall be made by the **CONTRACTOR** at his expense. All special surface repairs must meet the approval of the agency having jurisdiction.

29 - TEMPORARY REPAIRS TO SPECIAL SURFACES

- 29.1 Unless permanent repairs to paved street/road/highway surfaces can be started **immediately** after backfilling the trench, the **CONTRACTOR** shall place suitable asphalt material in the trench. The surface shall match the surfaces on each side of the trench and shall be in accordance with applicable state, county, or local requirements and be a minimum of three inches (3”) thick as specified in **Section 26 herein**. When heavy steel road plates are used in lieu of immediate backfill or used to cover and protect fresh concrete or flowable fill, all edges of the road plates shall be filleted and ramped with cold mix asphalt. The purpose of the asphalt shall be to both hold the plate in place and provide a smooth transition for vehicular traffic.

- 29.2 The above provisions shall apply to driveways, sidewalks, parking lots, or other paved areas whenever the backfill will not adequately support vehicular traffic, whenever dust from the trench creates a nuisance, or whenever the trench is a hazard.
- 29.3 Detours shall have a gravel, crushed stone, or asphalt surface. Dust shall be controlled by the application of asphalt or water.
- 29.4 The **CONTRACTOR** shall maintain all temporary surfaces in good condition until permanent repairs are complete.
- 29.5 Immediately following any significant rain or snowfall event, the **CONTRACTOR** shall check all temporary repairs and place additional material as needed to maintain a passable and acceptable surface.

30 - CONNECTIONS TO DISTRIBUTION SYSTEM

- 30.1 All connections to the existing distribution system must be accomplished in the presence of the **ENGINEER** or his representative.
- 30.2 In cases where completing the connection will disrupt service to customers, the **CONTRACTOR** shall notify the **ENGINEER** at least two (2) days in advance of the work. The customers whose service will be disrupted shall be notified by the **OWNER** with the assistance of the **CONTRACTOR**. The **CONTRACTOR** shall plan the work so that disruption of service is held to a minimum. The plan must be satisfactory to the **ENGINEER**.
- 30.3 After connections have been completed, the valves shall remain tightly closed until all testing and sterilization is complete. The **ENGINEER** shall place a locking lid on the valve box. Connecting valves shall remain closed until otherwise directed by the **ENGINEER**.

31- FILLING PIPELINES

- 31.1 After the pipelines and appurtenances have been installed, all concrete thrust blocking has cured adequately and upon approval of the **ENGINEER**, the pipelines shall be filled with water.
- 31.2 In order to prevent circulation of water through the new pipelines back into the distribution system, new pipeline shall only be filled through approved “**fill connections**” installed and constructed by the **CONTRACTOR** as shown in the Standard Details or as directed by the **ENGINEER**.
- 31.3 Valves other than fill connection valves shall not be used to fill new pipelines without the specific approval of the **ENGINEER**. Any such valve shall be operated only in the presence of the **ENGINEER** and shall be slowly and only partially opened.
- 31.4 All air shall be expelled from the pipeline by opening fire hydrants and/or other openings installed at the pipe line crests by the **CONTRACTOR**. The location and number of such openings shall be as shown on the Plans or as directed by the **ENGINEER**. Water draining from the openings shall be directed to adequate drainage structures so as not to create a nuisance and to avoid damage to other facilities, structures, and/or property. The **CONTRACTOR** shall be responsible for any damages.
- 31.5 Fill assemblies, blowoffs, and sampling point assemblies shall be disassembled to their below ground configuration within one week of final use. Or at the **ENGINEER’S** direction, the

connection shall be closed at the corporation stop/valve at the main and the entire assembly shall be removed.

32 - CLEANING LARGE PIPELINES

- 32.1 Before disinfection and hydrostatic pressure and leakage testing (**see Section 33 herein**), pipelines **16-inches in diameter and larger** shall be cleaned by forcing a resilient high density polyurethane foam "**cleaning pig**" through each segment of the pipeline by water pressure to remove any dirt or other foreign matter from the pipeline. The "**pig**" shall be **Style III, Type C (blue, plain criss-cross)**, manufactured by Knapp, Inc., Houston, Texas, or equal, in good condition and shall be at least two (2%) percent larger in diameter than the inside diameter of the pipe line being cleaned.
- 32.2. The "**pig**" shall be inserted in the first length of pipe installed in each segment of pipeline. After installation of the pipeline segment to be cleaned, the pipeline shall be filled at a point downstream of the "**pig**". The "**pig**" shall be forced through the pipeline by applying water pressure to the rear of the "**pig**" and opening blowoff valves or fire hydrants downstream of the "**pig**". Valve at blowoff points shall be closed immediately prior to the "**pig**" passing.
- 32.3 Based on past experience, the "**pig**" will negotiate bends and tees in the pipeline and may also be forced through the pipeline backwards after a pass forward. Openings in the pipeline, as shown on the Plans for removing the "**pig**", are based on this assumption. If the **CONTRACTOR** is unable to clean the pipeline, utilizing the openings provided, additional openings shall be provided by the **CONTRACTOR**, upon approval of the **ENGINEER**, at the expense of the **CONTRACTOR**.
- 32.4 If the need for more than one pass of the "**pig**" through the pipeline is indicated, the **CONTRACTOR** shall make additional passes as directed by the **ENGINEER**.
- 32.5 Drainage at blowoff points shall be provided so as not to create a nuisance and to avoid damage to other facilities, structures, and/or property. The **CONTRACTOR** shall be responsible for any damages.

33 - HYDROSTATIC PRESSURE and LEAKAGE TESTS

- 33.1 Testing shall begin within five (5) days after the completion of the installation of the water main (on a per main or per section/area basis). Once pressure testing is begun, it shall be vigorously pursued until complete. After the pipelines or isolated sections of the pipeline have been filled with water and air purged, the pressure shall be increased to the test pressure by means of a pump.
- 33.2 The **CONTRACTOR** shall furnish a pump and appurtenances as described in **Section 34 herein**. The **OWNER** will furnish the meter and pressure gauge **after** the **CONTRACTOR** has satisfied himself that the line will pass the test. The **CONTRACTOR** shall furnish all labor for conducting the tests.
- 33.3 The test pressure shall be **225 psi at the highest point of the pipeline segment being tested or as otherwise specified by the ENGINEER**. All pipelines, service lines, and appurtenances shall be tested. The pressure test shall be documented on the Central Arkansas Water PRESSURE AND LEAKAGE TEST form.
- 33.4 The duration of the hydrostatic leakage test shall be **two (2) hours** or as specified by the **ENGINEER**.
- 33.4.1 The duration of the hydrostatic leakage test on **tapping sleeves/saddles** shall be **thirty (30) minutes at 225 psi with zero leakage**.

- 33.5 The source of water for the pump suction shall be potable water from the **OWNER'S** distribution system. The vessel used must be approved by the **ENGINEER**.
- 33.6 All interior valves including guardian valves on fire hydrants and other appurtenances shall be open during all tests.
- 33.7 After the specified test pressure has been applied the entire pipeline shall be checked in the presence of the **ENGINEER** giving particular attention to that part of the pipeline and those appurtenances that are exposed.
- 33.8 If leaks are apparent, the **CONTRACTOR** shall, at his own expense, perform whatever work and/or replace whatever material that is required in order to remedy the defect and stop the leaks. All corrective work shall be approved by the **ENGINEER**. See **Section 11.17** herein.
- 33.9 After the **CONTRACTOR** has taken the necessary action to repair or replace any part of the pipeline or appurtenances where leaks were apparent or if no leaks were apparent, the pipelines shall be subjected to a leakage test at the pressure specified with a meter inserted in the test pump discharge line.
- 33.10 A. The maximum leakage per hour for **jointed pipe** (ductile iron, PVC, concrete pipe, etc.) shall be as calculated from the following formula:

All rubber gasket or O-ring joints

$$Q = \frac{LD \sqrt{P}}{148,000}$$

Q = Quantity of makeup water (gallons per hour)

L = Length of pipe section being tested (feet)

D = Nominal pipe diameter (inches)

P = Test pressure (psi); 225 psi or as specified by the ENGINEER

- B. The maximum leakage per hour for non-jointed pipe (welded steel, welded PVC, welded HDPE, etc., and containing gasket-jointed connections for fittings, valves, etc.) shall be as calculated from the following formula:

$$Q = \frac{ND \sqrt{P}}{7,400}$$

Q = Quantity of makeup water (gallons per hour)

N = Summation of mechanical and push-on gasket joints in length of pipe tested

D = Nominal pipe diameter (inches)

P = Test pressure (psi); 225 psi or as specified by the ENGINEER

- 33.10.1 The test pressure shall not vary by more than plus zero (0) psi to minus five (5) psi for the duration of the test. During the duration of the two-hour test, if the test pressure drops more than 5.0 psi from the start pressure, the test shall be terminated and considered failure due to assumed leaks in the tested pipe section. If the pressure rises beyond the

allowed zero (0) psi variance, the test shall be terminated and remaining air shall be purged from the pipeline.

33.10.2 Upon completion of a two-hour test where the test pressure did not vary by more than the plus zero psi to minus five (5) psi, the **CONTRACTOR** shall determine the leakage amount by measuring the amount of “make-up” water necessary to restore the original starting pressure.

33.11 If any test of pipe laid discloses leakage greater than the allowable leakage as calculated from the above formula(s), the **CONTRACTOR** shall, at his expense, locate the leak or leaks and perform whatever work and/or replace whatever material that is required in order to remedy the defect(s) and stop the leak(s). All corrective work must be approved by the **ENGINEER**. Tests on tapping sleeves/saddles must have zero leakage to be considered successful.

34 - TEST PUMP

34.1 The **CONTRACTOR** shall provide a water pump for testing the mains hydrostatically. The pump shall have the following features:

34.1.1 Designed so that the required test pressures can be attained.

34.1.2 RESERVED

34.1.3 The pump discharge shall be equipped with the following, in the order listed from the pump outward (see Standard Detail Sheet):

- (a) Check valve arranged so as to prevent flow back toward pump.
- (b) Adjustable pressure regulating device capable of maintaining discharge pressure at a constant level.
- (c) Valved exhaust outlet.
- (d) Section of flexible hose - length sufficient that ends of hose rests on ground.
- (e) Outlet for pressure gauge. Outlet shall be equipped with valve and surge dampening device. Connection for gauge shall be 1/4" F.I.P. The pressure gauge will be furnished by the **OWNER**.

34.1.4 The pump suction shall be equipped with the following from the pump outward (see Standard Detail Sheet):

- (a) Suction pipe.
- (b) Straight meter coupling - 1/2" M.I.P. x 5/8" Meter Nut.
- (c) 5/8" meter - furnished by owner
- (d) Straight meter coupling - 1/2" M.I.P. x 5/8" Meter Nut.
- (e) End screen to prohibit entry of foreign matter if pump suction is connected to a vessel instead of on a water main.

34.2 The **CONTRACTOR** shall provide all other necessary connections for connecting pump from the suction source and to the main being tested.

35 - DISINFECTING PIPE LINES & APPURTENANCES

35.1 Testing shall begin within five (5) days after the completion of the pressure testing of the water main (on a per main or per section/area basis). Blowoff and sample points shall be constructed by

- the **CONTRACTOR** as shown on the Plans or as directed by the **ENGINEER**. Fire hydrants shall be utilized as blowoff points whenever possible. Fire hydrants are not satisfactory for sample points. Openings for sample points shall be 1" copper riser pipe that extends well above the surface, as shown on the Standard Details. A flushing plan shall be so designed so that all samples may be taken on each trip. The lines shall not be considered acceptable until two (2) consecutive samples taken twenty-four (24) hours apart are negative. Sampling may commence only Monday through Thursday. First samples may not be collected on Fridays, Saturdays, Sundays, and official holidays.
- 35.2 There are two acceptable methods of disinfecting: continuous feed method using liquid chlorine or calcium hypochlorite and the slug method using liquid chlorine or calcium hypochlorite. The slug method applies to large mains and shall be used only on approval of the **ENGINEER**. Liquid chlorine shall be used only when the **CONTRACTOR** has suitable equipment available and employees who are familiar with the physiological, chemical and physical properties and who are properly trained and equipped to handle any emergency that may arise. If, in the opinion of the **ENGINEER**, the equipment is inadequate or the personnel are not qualified, this method shall not be used.
- 35.3 When the continuous feed or slug method is to be used, the pipelines and appurtenances shall be thoroughly flushed prior to disinfecting. The flushing plan shall be approved by the **ENGINEER**. The **ENGINEER** may halt or reduce flushing if the distribution system pressures are reduced by the flushing operations.
- 35.4 The operation of valves shall be in accordance with the provisions of **Section 31, herein**.
- 35.5 The **CONTRACTOR** is reminded that chlorine is a powerful oxidant and reacts readily with foreign substances. All chlorine compounds shall be handled and stored in accordance with manufacturer's recommendations. Breathing of chlorine gas can be fatal. Hypochlorite solutions should not come into contact with skin or clothing. Containers used for mixing hypochlorite solution shall be clean and dry.
- 35.6 When the continuous flow method is used, the final concentration of chlorine inside the main shall be 50 parts per million. When the slug method is used, the concentration of chlorine entering the pipeline shall be at least 300 to 400 parts per million (ppm) and be of sufficient size/length to provide a minimum of two (2) hours of contact time as it flows through the pipeline. The strength/concentration of the slug shall be monitored as it flows through the pipeline and at no time shall it be allowed to drop below 100 ppm. If at any time the concentration of the slug nears 100 ppm, the flow shall be stopped, chlorination equipment shall be relocated to the head of the slug, and as flow resumes, chlorine shall be applied to restore the chlorine concentration of the slug to at least 300 ppm.
- 35.7 Calcium hypochlorite shall contain at least 60% available chlorine by weight in granular form.
- 35.8 When the continuous feed or slug method is used and the source of the chlorine is calcium hypochlorite, a solution of hypochlorite and water shall be prepared by mixing thoroughly in a suitable container. The mix shall contain one (1) pound of calcium hypochlorite per gallon of water. A suitable pump shall be provided for pumping this solution into the pipelines to be disinfected. This pump shall be equipped with a flow-measuring device.
- 35.9 When liquid chlorine is used, the equipment for injection shall consist of a solution feed chlorinator in combination with a booster pump for injecting the chlorine-gas water solution into the pipeline. Introduction of chlorine-gas directly from the supply cylinder shall not be permitted. The pump shall be equipped with a flow-measuring device.

- 35.10 During application of any chlorine solution, care shall be taken to assure that the solution does not flow back into the distribution system.
- 35.11 The procedure for disinfecting by the continuous flow method shall be as follows:
- 35.11.1 The flow through the pipeline and the solution flow shall be regulated so that the required concentration of chlorine is attained. The flow through the main shall be measured by using a pitot gauge or meter.
- 35.11.2 The introduction of the solution shall be continuous until the desired concentration is attained throughout the pipe line system. The concentration shall be checked by the Drop Dilution Method.
- 35.11.3 After the required concentration has been attained all internal valves shall be operated in order to assure that the solution comes in contact with all appurtenances.
- 35.11.4 The solution shall remain in the pipe line system for twenty-four (24) hours after which the pipelines shall be thoroughly flushed. The chlorine concentration shall be checked before flushing. If the concentration is less than 25 parts per million, the disinfecting procedure shall be repeated if directed by the **ENGINEER**.
- 35.12 The procedure for disinfecting by the slug method shall be the same as the continuous flow method except that the flow rates shall be regulated so that the specified concentration of chlorine shall be in contact with all parts of the pipe line for at least two (2) hours.
- 35.13 Disinfecting by the tablet method is not allowed by the Arkansas Department of Health.
- 35.14 After final flushing, samples of water shall be collected from the sample points provided by the **CONTRACTOR** and tested by the **OWNER**. The **CONTRACTOR** shall provide any assistance required in collecting the samples.
- 35.15 If any of the samples collected are positive, the disinfecting procedures shall be repeated as directed by the **ENGINEER** until negative samples are collected. Only the continuous flow or slug method may be used.
- 35.16 The cost of water used for flushing after positive samples have been collected shall be deducted from amounts due the **CONTRACTOR**. The amount used shall be determined by measurements of flow using a pitot gauge. Payment shall be based on the lowest prevailing water rate.
- 35.17 Payments to the **CONTRACTOR** (or **DEVELOPER** if a **SPECIAL CONTRACT**) shall be reduced by **\$30.00 per sample** for each positive sample collected to cover the cost of collecting and testing the samples.
- 35.18 Any chlorinated water release that would cause a chlorine residual above 0.10 ppm in a body of water containing any aquatic life forms shall be de-chlorinated as needed to prevent the resultant chlorine level from exceeding the 0.10 ppm limit. Chemicals used in the de-chlorination process shall not also produce other water qualities that would be harmful to the aquatic life forms in a receiving body of water; harmful water qualities such as, but not limited to, changes in pH, dissolved oxygen concentrations, etc.
- 35.19 Water draining from the sampling points and flushing shall be directed to adequate drainage structures so as not to create a nuisance and to avoid damage to other facilities, structures, and/or property. The **CONTRACTOR** shall be responsible for any damages.

36 - WORK PERFORMED BY OWNER

- 36.1 The intent of these specifications is for the **CONTRACTOR** to do all the work, including connections and repair of damage to the Distribution System in this construction contract.
- 36.2 In emergencies, to restore service, the **OWNER**, with its labor forces, will assist the **CONTRACTOR** when necessary at the discretion of the **ENGINEER**.
- 36.3 If the **OWNER** assists the **CONTRACTOR** for any reason, the **CONTRACTOR** shall pay for the cost of this assistance, based on the actual cost of labor, equipment, materials, and overhead.

37 - DAMAGE TO DISTRIBUTION SYSTEM

During the course of construction under this contract, whether by accident or carelessness, the **OWNER'S** distribution system may be damaged, the **CONTRACTOR** shall be held responsible for this damage, and shall make immediate repairs at his expense. In event service has been disrupted, immediate repair operations shall be continuous and around the clock, if necessary.

38 - CLEAN-UP OF JOB SITE

The **CONTRACTOR** shall remove all materials, equipment, tools, temporary structures, barricades, trees and other vegetation that have been cut or have died as a result of the work from both public and private property along the job site. There shall be no burning on the job site unless approved, in advance, by the **ENGINEER** and other agencies involved. All trenches and excavations sites shall be completely compacted / settled and level with the adjacent surfaces. Unless otherwise requested by the **CONTRACTOR** in writing and approved by the **ENGINEER**, cleanup and dressup of an area shall be completed within one month of the completion of the pipe installation and testing.

39 - MEASUREMENT AND PAYMENT

- 39.1 Basis for payment shall be in accordance with the unit or lump-sum prices shown on the **Bid Form**; or as agreed upon in writing, in the case of extra work encountered, which is outside the scope of these specifications.
- 39.2 No separate payment will be made for those materials and work required to make a complete installation as shown on the Plans or indicated in these specifications, except as shown on the **Bid Form**. Materials and work not itemized on the **Bid Form**, but nonetheless required for a complete installation shall be considered subsidiary to the principle item of work and the cost thereof included in the bid price for the principle items.
- 39.3 Measurements for payment shall be as follows (not all of these items may be on the **Bid Form**):
- 39.3.1 **Pipe and Encasement Structures** – Actual slope length (Linear Feet) field measurements furnished and installed of the various sizes and types of pipe. The laid length of inline valves shall not be included in the total pipe length unless otherwise specified. Tees, bends, polyethylene encasement, thrust blocking, nuts, bolts, glands, gaskets, pressure testing, disinfection, special trench backfill (when so designated in the Plans or in the **Bid Form**), and other accessories are subsidiary. If and only if so detailed in the **Bid Form**, Tees,

Bends, Anchor Collars, and/or Thrust Blocking may be shown as separate pay items, usually only for large diameter pipe. The price for encasement pipe shall include casing spacers. The price for encasement pipe shall NOT include the carrier pipe.

- 39.3.2 **Valves** - Actual quantity (Each) furnished and installed of the various sizes and types of valves. Box, extensions, lid, nuts, bolts, glands, gaskets, and other accessories are subsidiary to the valve. Valves for fire hydrants and blowoff assemblies shall be considered subsidiary to the complete installation of the fire hydrant.
- 39.3.3 **Fire Hydrants and Blowoff Assemblies** - Actual quantity (Each) furnished and installed. Tees, saddles, guardian valves, valve boxes, extensions, lids, barrel extensions, thrust blocking, drainage gravel, nuts, bolts, glands, gaskets, and other accessories are subsidiary to the fire hydrant or blowoff.
- 39.3.4 **CITY STREET Pavement Cut and Permanent Replacement (Concrete/Asphalt)** – Area (Square Yards) measured based on *length of cut* times *a width not to exceed **the nominal pipe diameter plus 24-inches*** (2 x 12” as shown in DETAIL NO. 2A – CITY STREET of the Standard Details). Trench width beyond the nominal pipe diameter will not be measured for payment. Extra trench width, compacted stone backfill, special backfill (if shown in the Plans or in the Bid Form), concrete, reinforcement, temporary asphaltic surface, permanent asphaltic or concrete surface, and pavement cutting are subsidiary to the pavement cut and permanent replacement. Only the pavements marked and approved for removal by the **ENGINEER** shall be paid for. Other pavements damaged and/or removed by the **CONTRACTOR** shall not be paid for.
- 39.3.5 **COUNTY ROAD Pavement Cut and Permanent Replacement (Concrete/Asphalt)** – Area (Square Yards) measured based on *length of cut* times *a width not to exceed **the nominal pipe diameter plus 48-inches*** (2 x 24” as shown in DETAIL NO. 2B – COUNTY ROAD of the Standard Details). Trench width beyond the nominal pipe diameter will not be measured for payment. Extra trench width, compacted stone backfill, special backfill (if shown in the Plans or in the Bid Form), concrete, reinforcement, temporary asphaltic surface, permanent asphaltic or concrete surface, and pavement cutting are subsidiary to the pavement cut and permanent replacement. Only the pavements marked and approved for removal by the **ENGINEER** shall be paid for. Other pavements damaged and/or removed by the **CONTRACTOR** shall not be paid for.
- 39.3.6 **STATE HIGHWAY Pavement Cut and Permanent Replacement (Concrete/Asphalt)** Area (Square Yards) measured based on *length of cut* times *a width not to exceed **the nominal pipe diameter plus 36-inches*** (2 x 18” as shown in DETAIL NO. 1 – STATE HIGHWAY of the Standard Details). Trench width beyond the nominal pipe diameter will not be measured for payment. Extra trench width, compacted stone backfill, special backfill (if shown in the Plans or in the Bid Form), concrete, reinforcement, temporary asphaltic surface, permanent asphaltic or concrete surface, and pavement cutting are subsidiary to the pavement cut and permanent replacement. Only the pavements marked and approved for removal by the **ENGINEER** shall be paid for. Other pavements damaged and/or removed by the **CONTRACTOR** shall not be paid for.
- 39.3.7 **IMPROVED ALLEYS, DRIVEWAYS, AND PARKING LOTS Pavement Cut and Permanent Replacement (Concrete/Asphalt)** – Area (Square Yards) measured based on *length of cut* times *the nominal pipe diameter* as shown in the Standard Details. Bridging of the trench is not normally required. If bridging is ordered in writing by the **ENGINEER**, the width of the bridging shall be included in the payable width for pavement repair. Trench width beyond the nominal pipe diameter will not be measured for payment. Extra trench width, compacted stone backfill, special backfill (if shown in the Plans or in

the Bid Form), concrete, reinforcement, temporary asphaltic surface, permanent asphaltic or concrete surface, and pavement cutting are subsidiary to the pavement cut and permanent replacement. Only the pavements marked and approved for removal by the **ENGINEER** shall be paid for. Other pavements damaged and/or removed by the **CONTRACTOR** shall not be paid for.

- 39.3.8 **Sidewalks Cut and Permanent Replacement** – Area (Square Yards) measured based on width times length of replacement. Only the sidewalks marked and approved for removal by the **ENGINEER** shall be paid for. Other sidewalks damaged and/or removed by the **CONTRACTOR** shall not be paid for. Handicapped ramps shall be paid for at the same Bid Price as regular sidewalks.
- 39.3.9 **Curb and Gutter** – Length (Linear Feet) measured to nearest expansion joint within five feet (5') of center line of pipe, or actual quantity (Linear Feet) replaced, whichever is less. Only the curbs and gutters marked and approved for removal by the **ENGINEER** shall be paid for. Curb and gutter construction must meet with the approval of the governing agency / jurisdiction. Other curbs and gutters damaged and/or removed by the **CONTRACTOR** shall not be paid for.
- 39.3.10 **Rock Excavation** – Volume (Cubic Yards) excavated as measured by the **ENGINEER** or his representative together with the **CONTRACTOR** or his representative. The measurement shall be taken and recorded before backfilling operations are commenced and shall include the quantity that was necessary to be removed in order to accommodate the pipe or appurtenances to the grade and alignment specified in the Plans or by the **ENGINEER**. No payment shall be made for overcuts, either vertically or horizontally or any rock excavation not measured by the **ENGINEER**. Trench width in excess of the nominal pipe diameter plus two feet (2') shall be considered overcut.
- 39.3.11 **Type 4 and Type 5 Bedding** – Slope length (Linear Feet) of the various sizes of pipe bedded. Payment will not be made unless Type 4 or Type 5 Bedding is specified in the Plans or directed by the **ENGINEER**.
- 39.3.12 **Tapping Sleeves and Valves** – Actual quantity (Each) furnished and installed of the various sizes. Tapping sleeve, valve, valve box, lid, extensions, thrust blocking, glands, nuts, bolts, glands, gaskets, and other accessories are subsidiary.
- 39.3.13 **Tee (Anchor Tee) and Valve** – Actual quantity (Each) furnished and installed of the various sizes. Anchor tee, valve, valve box, lid, extensions, thrust blocking, glands, nuts, bolts, glands, gaskets, and other accessories are subsidiary.
- 39.3.14 **Swing Connection** – Actual quantity (Each) furnished and installed of the various sizes. Tapping saddle, valve, tee, bend, valve box, lid, extensions, thrust blocking, glands, nuts, bolts, glands, gaskets, and other accessories are subsidiary. Pipe used in the swing connection will be measured as per Section 39.3.1 above.
- 39.3.15 **Fill Connection** – Actual quantity (Each) furnished and installed of the various sizes. Taps, saddles, valves, meter boxes, and accessories are subsidiary.
- 39.3.16 **Blow-off / Sample Point** – Actual quantity (Each) furnished and installed of the various sizes. Taps, saddles, valves, meter boxes, and accessories are subsidiary.
- 39.3.17 **Manual Air Release** – Actual quantity (Each) furnished and installed of the various sizes. Tap, saddle, valves, meter box, and accessories are subsidiary.

- 39.3.18 **Automatic Air Release** – Actual quantity (Each) furnished and installed of the various sizes. Tap, saddle, valves, meter box, and accessories are subsidiary.
- 39.3.19 **Combination Air/Vacuum Valve** – Actual quantity (Each) furnished and installed of the various sizes. Tap, saddle, valves, meter box, and accessories are subsidiary.
- 39.3.20 **Gravel Surface Cut and Replacement** – Actual quantity (Each) per gravel street, road, alley, or driveway; **alternately for long cuts and replacements** as may be shown in the **Bid Form**, Area (Square Yards) measured based on *length of cut times a width of twelve (12) inches* (total) for 2” and 3” pipe; **alternately for long cuts and replacements** as may be shown in the **Bid Form**, Area (Square Yards) measured based on *length of cut times a width of twelve (12) inches plus the nominal pipe diameter* for 4” through 24” pipe; **alternately for long cuts and replacements** as may be shown in the Bid Form, Area (Square Yards) measured based on *length of cut times a width of eighteen (18) inches plus the nominal pipe diameter* for 26” and larger pipe.
- 39.3.21 **Replace Sanitary Sewer Services with Pressure Pipe** – Actual quantity (Each) installed for the various sizes. A signed wastewater utility inspection report is required for payment.
- 39.3.22 **Excavation / Trench Safety Protective System** – LUMP SUM for the entire project; **alternately** as may be shown in the **Bid Form**, actual length (Linear Feet). When this pay item is shown in the **Bid Form** as LUMP SUM, no separate length or depth measurements will be made on any portion of the Work for Excavation / Trench Safety Protective System. Documentation shall be provided prior to payment as stated in **Section 3.7.1.2 of the Special Conditions**.
- 39.3.23 **Short Side SINGLE Meter Service (meter on same side of street/road/highway as water main)** – Actual quantity (Each) furnished and installed for the various sizes. Tap, saddle, service line, corporation stops (iron bodied gate valve for 2” services), curb stops, meter setter, testing, sterilization, licensed plumber connection to house/building line, pressure reducer if so specified, meter box, **pavement cut and repair or bore** (if needed), removal of abandoned meter / setter / meter box, yard restoration around new and abandoned meter locations, and any other work and/or accessories are subsidiary. **METER SHALL BE PROVIDED BY THE OWNER AND INSTALLED BY THE CONTRACTOR**. Existing pressure reducers shall be reused, or a new pressure reducer installed, subsidiary to the unit price of the meter service.
- 39.3.24 **Long Side SINGLE Meter Service (meter on opposite side of street/road/highway as water main)** – Actual quantity (Each) furnished and installed for the various sizes. Tap, saddle, service line, corporation stops (iron bodied gate valve for 2” services), curb stops, meter setter, testing, sterilization, licensed plumber connection to house/building line, pressure reducer if so specified, meter box, **street crossing work (pavement cut and replacement and/or trenchless installation under pavement)**, removal of abandoned meter / setter / meter box, yard restoration around new and abandoned meter locations, and any other work and/or accessories are subsidiary. **METER SHALL BE PROVIDED BY THE OWNER AND INSTALLED BY THE CONTRACTOR**. Existing pressure reducers shall be reused, or a new pressure reducer installed, subsidiary to the unit price of the meter service.
- 39.3.25 **Short Side DOUBLE (OR BULLHEAD) Meter Service (meter on same side of street/road/highway as water main)** – Actual quantity (Each) furnished and installed for the various sizes. Tap, saddle, service line, corporation stops (iron bodied gate valve for 2” services), curb stops, meter setter, testing, sterilization, licensed plumber connection to house/building line, pressure reducer if so specified, meter box, **pavement cut and repair**

or bore (if needed), removal of abandoned meter / setter / meter box, yard restoration around new and abandoned meter locations, and any other work and/or accessories are subsidiary. **METER SHALL BE PROVIDED BY THE OWNER AND INSTALLED BY THE CONTRACTOR.** Existing pressure reducers shall be reused, or a new pressure reducer installed, subsidiary to the unit price of the meter service.

- 39.3.26 **Long Side DOUBLE (OR BULLHEAD) Meter Service (meter on opposite side of street/road/highway as water main)** – Actual quantity (Each) furnished and installed for the various sizes. Tap, saddle, service line, corporation stops (iron bodied gate valve for 2” services), curb stops, meter setter, testing, sterilization, licensed plumber connection to house/building line, pressure reducer if so specified, meter box, **street crossing work (pavement cut and replacement and/or trenchless installation under pavement)**, removal of abandoned meter / setter / meter box, yard restoration around new and abandoned meter locations, and any other work and/or accessories are subsidiary. **METER SHALL BE PROVIDED BY THE OWNER AND INSTALLED BY THE CONTRACTOR.** Existing pressure reducers shall be reused, or a new pressure reducer installed, subsidiary to the unit price of the meter service.
- 39.3.27 **Handicap Access Ramp Cut and Permanent Replacement** – Area (Square Yards) measured based on width and length of replacement and/or new construction of ramps. All work, materials, grading, saw cutting, finishing, etc. are subsidiary to the ramp removal and construction. Only the ramps marked and approved for removal by the **ENGINEER** shall be paid for. Other ramps damaged and/or removed by the **CONTRACTOR** shall not be paid for. All handicap access ramp construction must meet with the approval of the **CITY** and the Americans with Disabilities Act (ADA).
- 39.3.28 **Abandon Valve and Main** – Actual Quantity (Each) completed of the various sizes. Closing and abandonment of valve, cut and plug of abandoned main, removal of valve box (if applicable), placement of topsoil and seed/mulch (if applicable), and all other work and accessories are subsidiary. Pavement repair (if applicable) will be paid for separately as previously detailed.
- 39.3.29 **Remove Valve and Plug at Main** – Actual Quantity (Each) completed of the various sizes. Shutdown of active water main, removing valve, removing connecting piece, plug/cap tap at the main, removal of valve box (if applicable), placement of topsoil and seed/mulch (if applicable), and all other work and accessories are subsidiary. Pavement repair (if applicable) will be paid for separately as previously detailed.
- 39.3.30 **Remove Valve and Tap Saddle/Sleeve and Place S.S. Full Circle Repair Sleeve** – Actual Quantity (Each) completed of the various sizes. Shutdown of active water main, removing valve, removing connecting piece, removing tap saddle/sleeve, installing stainless steel full circle repair sleeve, removal of valve box (if applicable), placement of topsoil and seed/mulch (if applicable), and all other work and accessories are subsidiary. Pavement repair (if applicable) will be paid for separately as previously detailed.
- 39.3.31 **Traffic Control** – LUMP SUM for the entire project. Traffic control as required by the Construction Specification and the **CITY**. Traffic control plan(s) must be approved by the **CITY**. All barricade plans, permits, traffic control devices, flagmen, and all other work and accessories are subsidiary.
- 39.3.32 **Seed and Mulch Pipe Trench** – Length (Linear Feet) of measured seed and mulch placed along pipe trench, including all disturbed areas along the pipe trench; seed and mulch placed where directed by the **ENGINEER**. All labor, seed, mulch, topsoil, fertilizer, watering, and other work and accessories are subsidiary.

- 39.3.33 **Sod Pipe Trench** – Length (Linear Feet) of measured sod placed along pipe trench, including all disturbed areas along the pipe trench; sod placed where directed by the **ENGINEER**. All labor, sod, topsoil, fertilizer, watering, and other work and accessories are subsidiary.
- 39.3.34 **Trenchless Installation Under Streets, Roads, and Highways for 2” and 3” PVC Pipe** – Length (Linear Feet) of measured trenchless installation using directional boring, hogging, mole, and/or penetrator tools and techniques. Encasement pipe is NOT required for this item. All labor, equipment, and associated work are subsidiary. This item does not include the provision and installation of the pipe. Pipe placed with trenchless installation will be paid for separately as detailed in Section 39.3.1 (i.e. payment for trenchless installation will be an “adder” to the item of pipe installation). Trenchless installation (if used) for “Long Side” meter services shall be included in the cost of “Long Side” meter services and will NOT be paid for separately.
- 39.3.35 **Asphalt Street Milling and Overlay** – Area (Square Yards) measured area based on width and length of milled surface. Milling area shall not extend beyond limits set by the **ENGINEER**. Milling and hot mix asphalt overlay depth shall be one and one-half (1 ½) inches. Trench backfill and placement of concrete trench-bridging shall be as specified in this Construction Specification and the Standard Details. **Trench backfill and trench-bridging (concrete) shall not be paid for separately when Asphalt Street Milling and Overlay is performed over new pipe installation.** Trench backfill and trench-bridging (concrete) shall be included in the price of the new pipe when located in areas to receive milling and overlay. Overlay smoothness shall meet the requirements of permanent asphalt replacement.
- 39.3.36 **Anchor Collar** – Actual quantity (Each) furnished and installed of the various sizes. Concrete, reinforcement bars, Series 300 stainless steel tie rods, nuts, and washers, retainer glands and/or welded rings, and accessories are subsidiary. **Anchor Collars will be a pay item only when shown in the Bid Form.**
- 39.3.37 **Thrust Blocking** – Actual quantity (Each) furnished and installed of the various sizes. Concrete, reinforcement bars, and accessories are subsidiary. **Thrust Blocking will be a pay item only when shown in the Bid Form.**
- 39.3.38 **Bends** – Actual quantity (Each) furnished and installed of the various sizes and types. Bend, glands, retainer glands, bolts, nuts, concrete thrust blocking, and accessories are subsidiary. **Bends will be a pay item only when shown in the Bid Form.**
- 39.3.39 **Special Surface Repairs for Taps and/or Cut and Plugs** – Area (Square Yards) measured based on *length of cut* times *payable width* as defined in the applicable payment section(s) for the various special surfaces (i.e. **Sections 39.3.4, 5, 6, 7, 8, and 20 herein**). Trench width beyond the width of the pipe diameter will not be measured for payment. Required bridging will be measured for payment. If additional special surface is removed and replaced for thrust blocking, that area shall be measured by the **ENGINEER** for additional payment. Extra trench width, compacted stone backfill, special backfill (if shown in the Plans or in the Bid Form), concrete, reinforcement, temporary asphaltic surface, permanent asphaltic or concrete surface, and pavement cutting are subsidiary to the pavement cut and permanent replacement. Only the pavements marked and approved for removal by the **ENGINEER** shall be paid for. Other pavements damaged and/or removed by the **CONTRACTOR** shall not be paid for.
- 39.3.40 Other items as noted in the Bid Form.

40 – PENALTIES FOR FAILURE TO CONFORM OR COMPLY WITH SPECIFICATIONS

40.1 For the health, welfare, safety, and/or convenience of the **PUBLIC** and the **OWNER**, it is imperative that all conditions and requirements of these specifications be complied by the **CONTRACTOR**.

40.1.1 Failure to comply with material and workmanship requirements may result in the **OWNER** officially shutting down the project or not accepting and not paying for certain types and quantities of the item in question. Cause for the shutting down of a project or the rejection of an item may be due to, but not be limited to, non-conforming work, non-conforming material, failure of tests, failure to properly notify the **OWNER** of work being performed, etc. The **OWNER (CENTRAL ARKANSAS WATER OR ITS DESIGNATED REPRESENTATIVE)** shall determine non-conformance.

40.1.2 Failure to comply with some requirements will result in a financial penalty being assessed against the **CONTRACTOR**. The **OWNER (CENTRAL ARKANSAS WATER OR ITS DESIGNATED REPRESENTATIVE)** shall determine failure to comply. Each day or each incident of non-compliance shall be considered a separate offense, each separate offense assessable for penalty. Penalties assessed against the **CONTRACTOR** shall be cumulative in nature and shall be in addition to, and not in lieu of, any penalties that may be assessed against the **CONTRACTOR** by any regulatory or government agency or department. Penalties assessed against the **CONTRACTOR** shall be deducted from the next regular payment to the **CONTRACTOR**. Penalties assessed against the **CONTRACTOR** will not be reimbursed or refunded at any time.

40.1.2.1 Upon the first failure to comply with a requirement that is **health or safety related**, the **CONTRACTOR** will be given a written notice detailing the failure to comply. Upon the second and all subsequent failures to comply, the **CONTRACTOR** shall be assessed a penalty in the amount of **\$200.00 per day or per incident**. Documentation of the failure to comply will be provided. A partial, and not all inclusive, list of **health or safety related** failure to comply examples are: (1) failure to properly cap/plug water pipe at the end of a work period, (2) allowing mud, dirty water, or other debris to enter a pipe during construction, (3) failure to immediately remove mud, dirty water, or other debris from a pipe with a chlorinated swab, (4) failure to properly and safely maintain traffic in and around the construction zone, (5) failure to adequately barricade excavations at the end of a work period, (6) failure to backfill excavations in a timely manner, (7) failure to properly maintain temporary special surface repairs.

40.1.2.2 Upon the first failure to comply with a requirement that is **nuisance related**, the **CONTRACTOR** will be given a written notice detailing the failure to comply. Upon the second and all subsequent failures to comply, the **CONTRACTOR** shall be assessed a penalty in the amount of **\$100.00 per day or per incident**. Documentation of the failure to comply will be provided. A partial, and not all inclusive, list of **nuisance related** failure to comply examples are: (1) failure to begin testing a water main within one week of completion of installation of the main, (2) failure to vigorously pursue completion of all testing once testing is started, (3) failure to remove above ground fill assemblies, blowoffs and sampling points within one week of their final use, (4) failure to complete cleanup and dressup and begin restoration of vegetation of disturbed areas within one month of completion of pipe installation and testing, (5) failure to clean debris, dirt, mud, etc. from streets, drives, roads, and highways.

40.1.2.3 The **OWNER** reserves the right to levy an immediate fine upon the first failure to comply if the **OWNER** deems the failure to be egregious, malicious, or willful. Any immediate fine will also be accompanied with a written notice detailing the failure.

40.1.3 When the **CONTRACTOR** performing the work is not under contract with the **OWNER**, all penalties shall be assessed against the **DEVELOPER** whom which is having the work performed/installed under contract with the **OWNER**.

41 – SANITARY SEWER - CROSSINGS & PARALLEL INSTALLATION

41.1 Water mains shall have a minimum horizontal separation of ten (10) feet from all sewer lines except for crossings. The water line shall pass above the sewer line with a minimum of eighteen (18) inches of vertical separation and maintain a minimum ground cover of thirty (30) inches above the water line. Where 18-inches of vertical separation and 30-inches of ground cover cannot be maintained or where the water line passes under the sewer line, then either the water line or the sewer line shall be encased as per ADH and CAW requirements. A minimum of six (6) inches clearance shall be maintained between the encasement pipe and the uncased line.

41.1.1 For sanitary sewer **services**, if 18-inches of clearance can not be provided or when the water main must pass under the service line, the sewer service line shall be removed and replaced with ductile iron pressure pipe as shown in the Detailed Drawings.

41.1.2 For sanitary sewer **mains**, if 18-inches of clearance can not be provided or when the water main must pass under the sewer main, either the sanitary sewer main or the water main shall be encased in twenty feet of watertight encasement pipe, centered over the point of crossing. The ends of the encasement pipe shall be sealed watertight. Encasement spacers are not required.

41.1.3 Sanitary sewer main and service line replacement shall be approved by the local wastewater Utility having jurisdiction.

41.2 When running generally parallel, potable water facilities shall have a ten (10) foot minimum horizontal separation from sanitary sewer facilities at all times.

REVISIONS:

4/26/04	Section 1.3 - additional sentence inserted to remind Contractor and/or Developer of penalties as per Section 40.
4/26/04	Section 6.4.3.3. - new section added to advise Contractor of sign requirement within the City of North Little Rock.
4/26/04	Section 11.11 - revised to include stranded wire.
4/26/04	Section 11.11.1 - revised to remove "blue discs"; "blue spheres" added to specification.

- 4/26/04 Section 18.4 - Bituminous coating on stainless steel valve extension deleted.
- 4/26/04 Section 20.1 - revised to include color coding of fire hydrants.
- 7/26/04 Section 5.4 - revised to include the following sentences: Cover over the pipe will exceed the minimum requirement of three feet (3') in the area of air release valves, vacuum valves, and certain other fittings and appurtenances. Extra trench depth required for the proper installation of these fittings and appurtenances will not be paid for separately.
- 7/30/04 Section 22.4 - paragraph revised to include specific tolerances for vertical and horizontal deviation of encasement pipe placement.
- 10/20/04 Section 10.3 - paragraph revised to include new requirement by Pulaski County Road Department that minimum trench width be **pipe diameter plus twenty-four inches (24")**, (12" each side of pipe) to facilitate better compaction of crushed stone backfill.
- 10/20/04 Standard Detail 2B (County Road Repair) - standard drawing revised to reflect new requirement by Pulaski County Road Department that minimum trench width be **pipe diameter plus twenty-four inches (24")**, (12" each side of pipe) to facilitate better compaction of crushed stone backfill.
- 10/29/04 Sections 6.6 and 29.1 - revised to include the following sentences: When heavy steel road plates are used in lieu of immediate backfill or used to cover and protect fresh concrete or flowable fill, all edges of the road plates shall be filleted and ramped with cold mix asphalt. The purpose of the asphalt shall be to both hold the plate in place and provide a smooth transition for vehicular traffic.
- 10/29/04 Standard Details - new Standard Detail MINIMUM UNDISTURBED SOIL BEHIND ANCHOR COLLAR / THRUST BLOCK added.
- 10/29/04 Standard Details - new PRESSURE AND LEAKAGE TEST form added.
- 10/29/04 Section 33.3 - revised to include the following sentence: The pressure test shall be documented on the Central Arkansas Water PRESSURE AND LEAKAGE TEST form.
- 10/29/04 Section 1.3 - revised to include the following sentences: The **ENGINEER** or his designated representative (**INSPECTOR**) may not be on the job site every hour that the **CONTRACTOR** is performing work. Certain work, including but not limited to placement of reinforcement steel, placement of concrete, valve operation, pressure and leakage tests, cut and plugs, etc., must be inspected and approved by the **ENGINEER** before start, completion, or backfill. The **CONTRACTOR** shall coordinate the inspection of this type of work with the **ENGINEER**.
- 11/29/04 Section 23.12 - Safe Bearing Values revised.
- 11/29/04 New Section 23.19 added - Anchor collars subject to two-way thrust shall have two identical "A"/"B" reinforcement steel mats as shown in the Detailed Drawings. Anchor collars for 24" and smaller diameter pipe with two-way thrust shall have two (2) Mega-Lug retaining glands placed back-to-back, spaced just inside the two reinforcing steel mats. Anchor collars for 26" and larger diameter pipe shall have two weld-on thrust rings, spaced just inside the two reinforcing steel mats.
- 11/29/04 Standard Details - ANCHOR COLLAR SCHEDULE AND CONSTRUCTION DETAILS revised and updated. Details for 48" pipe added to schedule. Notes

added concerning Mega-Lug glands required. Notes added concerning two-way thrust requirements.

- 12/01/04 Standard Details - new THRUST BLOCK / ANCHOR COLLAR AS-BUILT RECORD form added.
- 02/07/05 Section 40.1.2.3 - added - new subsection added to SECTION 40 detailing fine possible on first failure to comply if egregious, malicious, or willful.
- 02/07/05 Section 40.1.3 - added -new subsection added to SECTION 40 detailing penalties assessed to DEVELOPER if CONTRACTOR is not under contract with OWNER.
- 05/06/05 Section 11.14 - changed - the phrase "corporation stop" to "curb stop".
- 07/19/05 Section 22 - revised - to require bored in place encasement to be placed with the simultaneous dry auger bore and encasement jacking method unless otherwise approved by the ENGINEER. Un-encased main or service pipe may be placed by moleing or other method approved by the ENGINEER.
- 08/02/05 Section 19.1 - sentence added - Tapping sleeve, tapping saddle, or direct tap shall be installed at least twenty-four (24) inches from bell joints, fittings, end of pipe joint, or another tap.
- 08/02/05 Section 19.3 - revised - to require concrete "mud slab" be poured under tapping valves 14" and larger. Also revised to require weight of valves to NOT be supported by the tapping sleeve/saddle.
- 10/31/05 Section 20.2 - sentence added - The hydrant's "bury line" shall be set at or no more than four (4) inches above the finished grade elevation; therefore the bottom of hydrant nozzles shall be 18 to 22 inches above the finished grade elevation.
- 10/31/05 Section 11.18 - new section added - 11.18 In new development construction, other buried utilities such as electrical, gas, TV, and communication lines shall be no closer than five (5) feet horizontal to the water mains. Buried utilities crossing water mains shall be at right angles thereto. Electrical lines crossing water mains shall be placed in conduit extending five (5) feet each side of the water main.
- 06/12/06 Section 5.3 - sentence added - When pipeline locations parallel a street, road, or highway and where the top of ground elevation is higher than the road surface, the minimum cover over the water pipe shall be as required to place the top of the water pipe two (2) feet below the elevation of the parallel road ditch flow line.
- 10/20/06 Section 11.19 - section added - Section added to require that any polyethylene tubing installed for temporary construction purposes shall be completely disconnected from the system and removed from the ground.
- 10/20/06 Standard Details on Pages 10 and 11 of Standard Detail drawings changed 2" x 4" Brass Nipples to 2" x 6" Brass Nipples where belling into PVC pipe and ductile iron bell plug.
- 11/15/06 Section 18.3 - sentence added to require installation of a Valve Box Alignment Device with every valve and valve box combination.
- 11/15/06 Section 17 - section added to detail installation of meter settings.

11/15/06 Standard Detail on Page 16 of Standard Detail drawings changed to require weld-on thrust ring shall be designed for 250 PSI working pressure and 375 PSI test pressure. Also detailed changed to require two (2) Mega-Lug retainer glands be placed back-to-back for any thrust collar on 24" diameter pipe and smaller.

7/10/07 Section 31.4, Section 32.5, and Section 35.19 revised to require CONTRACTOR to direct flushing water to adequate drainage and be responsible for any water damages to adjacent facilities, structures, and/or property.

7/23/07 Section 22.12 revised to state that a Series 300 stainless steel wire rope cable shall be installed through an encasement pipe along with any carrier pipe 6-inch diameter or larger.

10/5/07 Section 11.4 revised to require copper tubing to be mechanically bent in lieu of hand bent. Any kinked or flattened tubing shall be replaced from the corporation stop to the meter setting.

10/5/07 Section 9.1 revised to better define definition of "rock excavation".

10/15/07 Section 23.1 revised to require that concrete anchor collars shall only be placed on ductile iron (or approved steel) pipe.

2/8/08 Section 11.6 revised to require pigging of any pipe not properly plugged or capped.

2/8/08 Standard Detail on Page 10 of Standard Detail drawings changed to remove requirement for 4" long threaded brass nipple at capped end of 2" main extension.

2/8/08 Standard Detail on Page 11 of Standard Detail drawings changed to remove requirement for 4" long threaded brass nipple at capped end of 2" and 3" main extensions.

4/18/08 Section 4.3 revised to require any pipe or appurtenance contaminated with sanitary sewer and/or hazardous liquid or debris to be removed from the project area.

4/18/08 Section 17.1 revised to require that meter settings not be located within areas of vehicular traffic.

10/15/08 Section 22.5 revised to require only simultaneous dry auger bore and encasement jacking unless otherwise approved in writing by CAW.

10/15/08 SECTION 35 - **DISINFECTING PIPE LINES & APPURTENANCES** - revised to disallow the tablet method for disinfection.

12/12/08 Section 11.3 revised to allow Class 7 crushed stone as alternate material for bedding under PVC water mains.

12/12/08 Section 35.18 revised to require de-chlorination as needed to limit receiving bodies of water that contain any aquatic life forms from exceeding 0.019 ppm of chlorine.

5/12/09 Section 33.10 - hydrostatic test formula revised to conform to latest AWWA specification.

3/17/10 Section 26.1 - Statement added to allow for trenches to remain open until inspection is made.

3/17/10 Section 11.3 - Amount of bedding below PVC pipe changed from 2-inches to 4-inches.

12/08/10 Section 18.4 - Specification modified to have top end of valve stem extension 12 to 24 inches below finished grade.

5/10/11 All miscellaneous stainless steel required to be Series 300.

01/05/12 Section 33 - Modification to pressure testing requirements.

11/05/12 Section 35.18 - Maximum chlorine residual limit changed from 0.019 ppm to 0.10 ppm to conform with Arkansas standard.

02/25/13 Section 1.3 - Language added regarding work hours - generally limited to dawn to dusk unless otherwise required.

02/25/13 Section 22.12 - Ten foot cable ends to be wrapped around the water pipe.

05/29/13 Section 6.4 - Street cut requirements for Cities of Little Rock and North Little Rock modified to meet current city standards and requirements.

05/29/13 Section 11.3 - Statement added prohibiting installation of PVC pipe where the working pressure exceeds 125 psi.

02/20/14 Section 11.11 - method and technique for tracing wire installation modified.

02/20/14 Section 11.13 - specification modified to require Link-Seal seals at ends of encasement pipe.

08/24/17 Section 18.4 - specification modified to remove the use of S.S. bar stock in the fabrication of valve stem extensions.

10/03/18 Section 23.19 - revised to make assumption that all anchor collars have two way thrust.

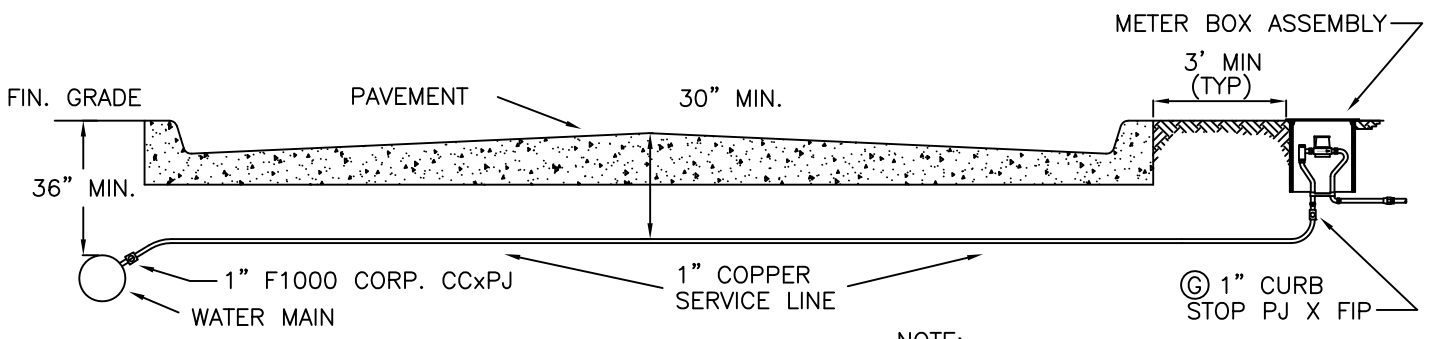
5/31/21 Section 18.4 - valve stem material changed from stainless steel to epoxy painted carbon steel.

5/31/21 Section 33.10.1 and 33.10.2 - acceptable range during pressure testing revised to allow zero (0) pressure rise during the test, an indication of air in the pipe.

5/31/21 Section 11.13 - revised to require all carrier pipe installed inside encasement pipe to be restrained joint.

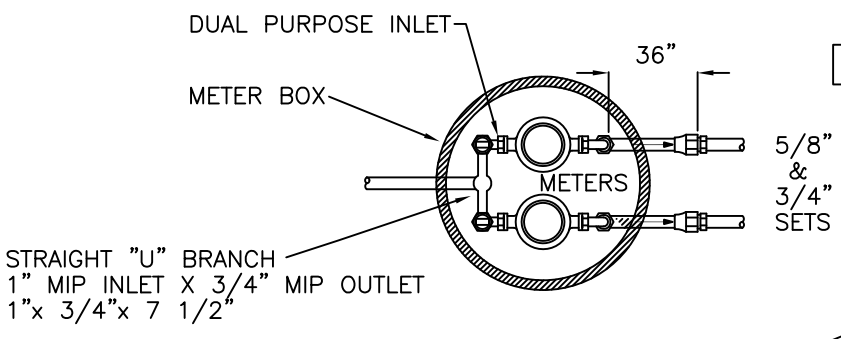
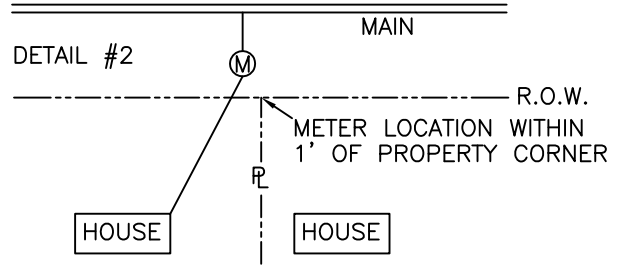
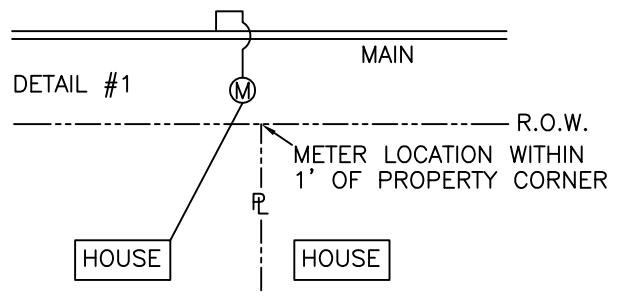
5/31/21 Section 11.24 - copper service lines under pavement shall be continuous, without joints.

5/31/21 Section 23.9 - minimum thickness of concrete thrust blocking changed from 6" to 12".

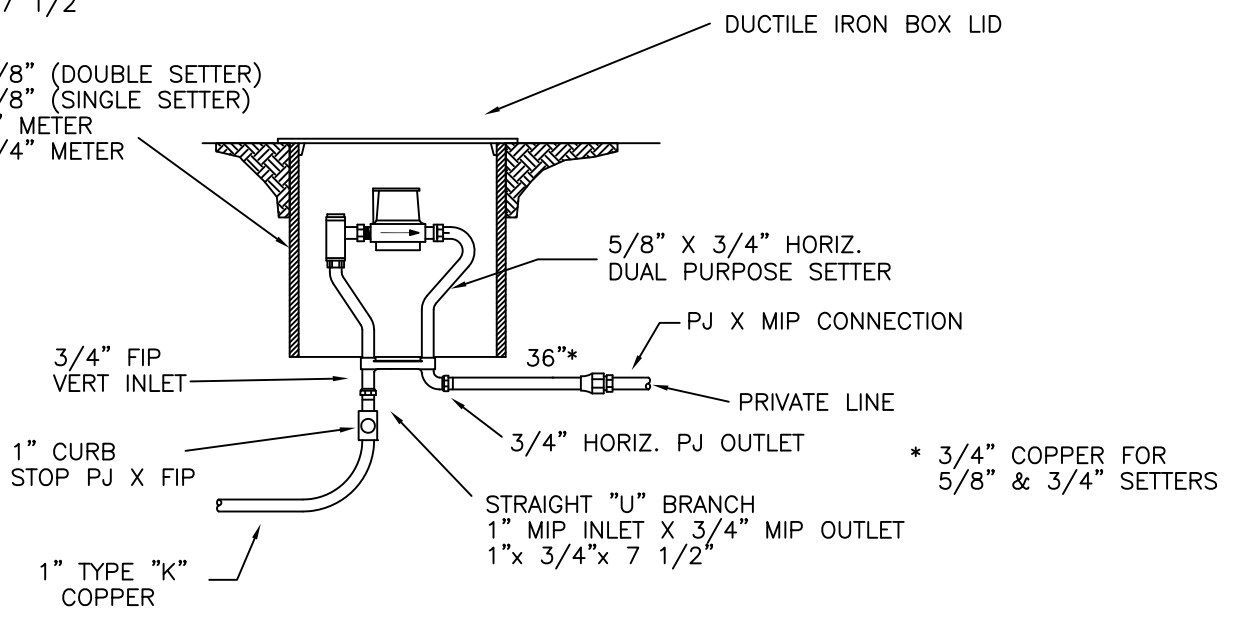


1. MINIMUM 30" DEPTH ON ALL SERVICE LINE INSTALLATIONS AND LINE SHALL BE EXTENDED A TYPICAL 3' BEHIND CURB.
2. CORPORATION STOP SHALL BE INSTALLED AT MAIN AND CURB STOP AT END OF SERVICE LINE. DIRECT TAP ON 6" AND LARGER D.I.P. TAP SADDLE FOR ALL PVC PIPE AND 4" D.I.P.
3. ALL SERVICE LINES SHALL BE 1" SEAMLESS, SOFT TEMPERED, TYPE "K" COPPER.
4. WHEN COPPER SERVICE LINE ARE TAPPED ONTO NON METALLIC MAINS, TRACER WIRE ON NON METALLIC MAIN SHALL BE WRAPPED AROUND TAPPING CORP. SEVERAL TURNS.
5. ANYTHING THAT HAS TO BE REMOVED TO FACILITATE NEW CONSTRUCTION SHALL BE DELIVERED TO CENTRAL ARKANSAS WATER CLEARWATER OPERATIONS CENTER
6. INSTALL METER BOX ASSEMBLY 3' BEHIND CURB UNLESS OTHERWISE DIRECTED BY C. A. W. (CITY AND COUNTY STREETS).
7. INSTALL METER BOX ASSEMBLY WITHIN 1' OF R. O. W. LINE, UNLESS OTHERWISE DIRECTED BY C. A. W. (FOR STATE HIGHWAYS).

NOTE:
METERS SHALL BE SET PERPENDICULAR TO STREET WITH OUTLETS GOING TOWARDS THE HOUSE OR BUSINESS

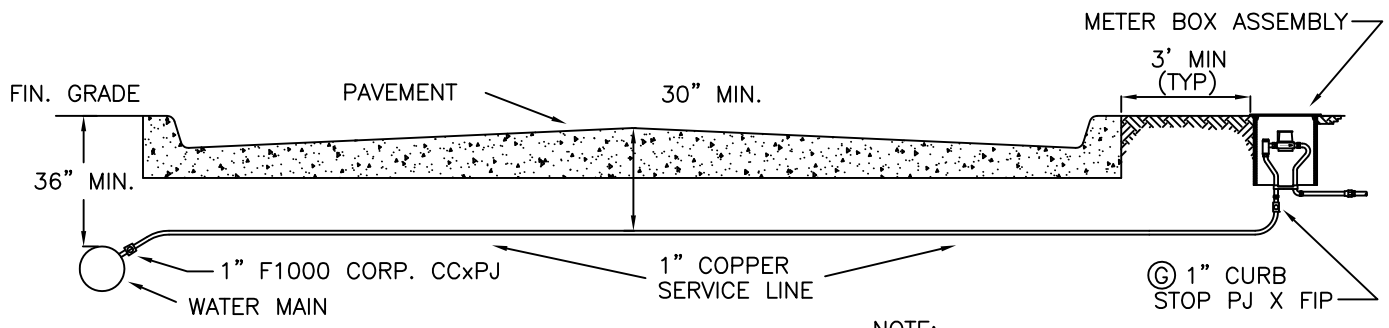


18" for 5/8" (DOUBLE SETTER)
15" for 5/8" (SINGLE SETTER)
21" for 1" METER
21" for 3/4" METER



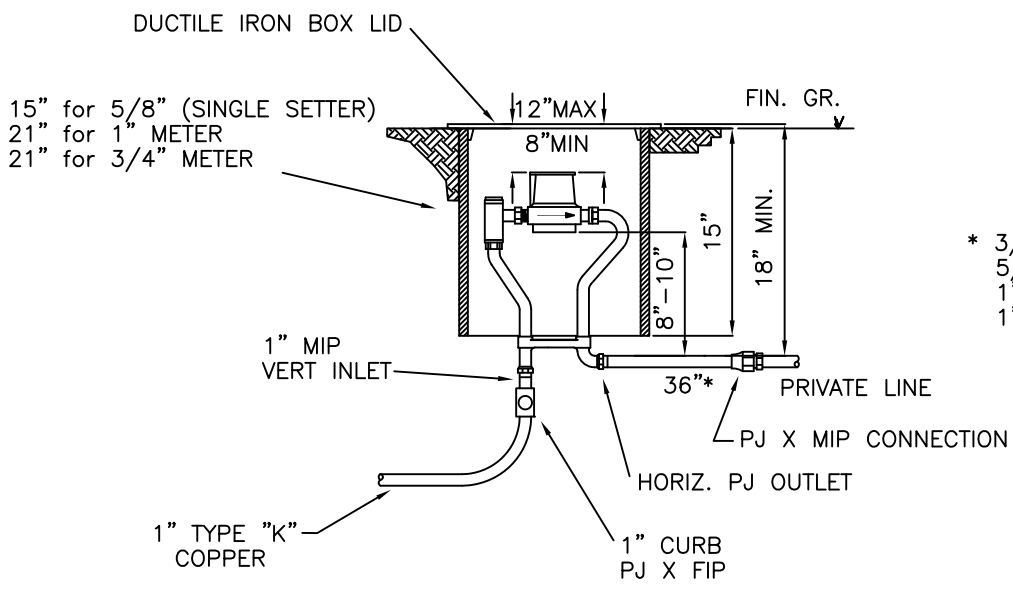
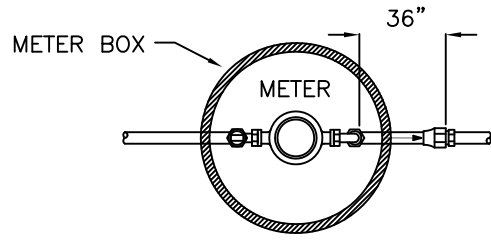
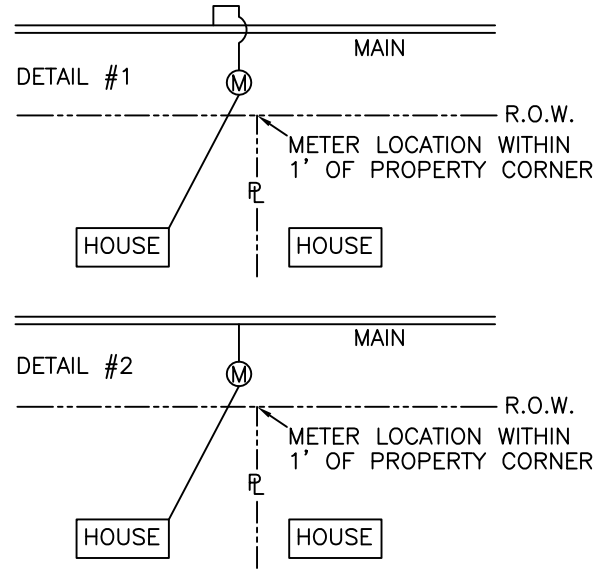
* 3/4" COPPER FOR 5/8" & 3/4" SETTERS

5/8", 3/4", 1" STANDARD DUAL METER BOX AND SETTING



1. MINIMUM 30" DEPTH ON ALL SERVICE LINE INSTALLATIONS AND LINE SHALL BE EXTENDED A TYPICAL 3' BEHIND CURB.
2. CORPORATION STOP SHALL BE INSTALLED AT MAIN AND CURB STOP AT END OF SERVICE LINE. DIRECT TAP ON 6" AND LARGER D.I.P. TAP SADDLE FOR ALL PVC PIPE AND 4" D.I.P.
3. ALL SERVICE LINES SHALL BE 1" SEAMLESS, SOFT TEMPERED, TYPE "K" COPPER.
4. WHEN COPPER SERVICE LINE ARE TAPPED ONTO NON METALLIC MAINS, TRACER WIRE ON NON METALLIC MAIN SHALL BE WRAPPED AROUND TAPPING CORP. SEVERAL TURNS.
5. ANYTHING THAT HAS TO BE REMOVED TO FACILITATE NEW CONSTRUCTION SHALL BE DELIVERED TO CENTRAL ARKANSAS WATER CLEARWATER OPERATIONS CENTER
6. INSTALL METER BOX ASSEMBLY 3' BEHIND CURB UNLESS OTHERWISE DIRECTED BY C. A. W. (CITY AND COUNTY STREETS).
7. INSTALL METER BOX ASSEMBLY WITHIN 1' OF R. O. W. LINE, UNLESS OTHERWISE DIRECTED BY C. A. W. (FOR STATE HIGHWAYS).

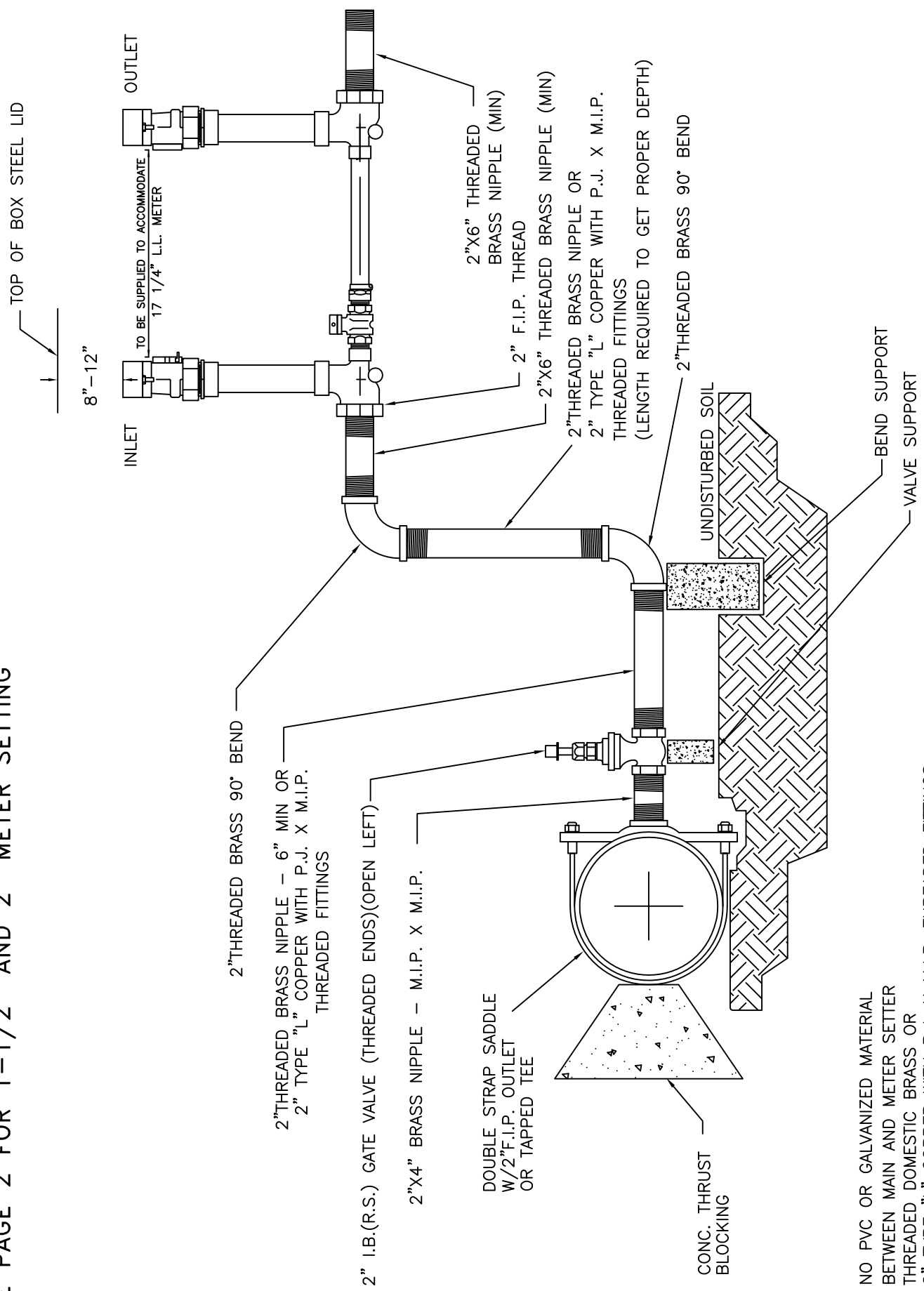
NOTE:
METERS SHALL BE SET PERPENDICULAR TO STREET WITH OUTLETS GOING TOWARDS THE HOUSE OR BUSINESS



* 3/4" COPPER FOR 5/8" & 3/4" SETTERS;
1" COPPER FOR 1" SETTERS

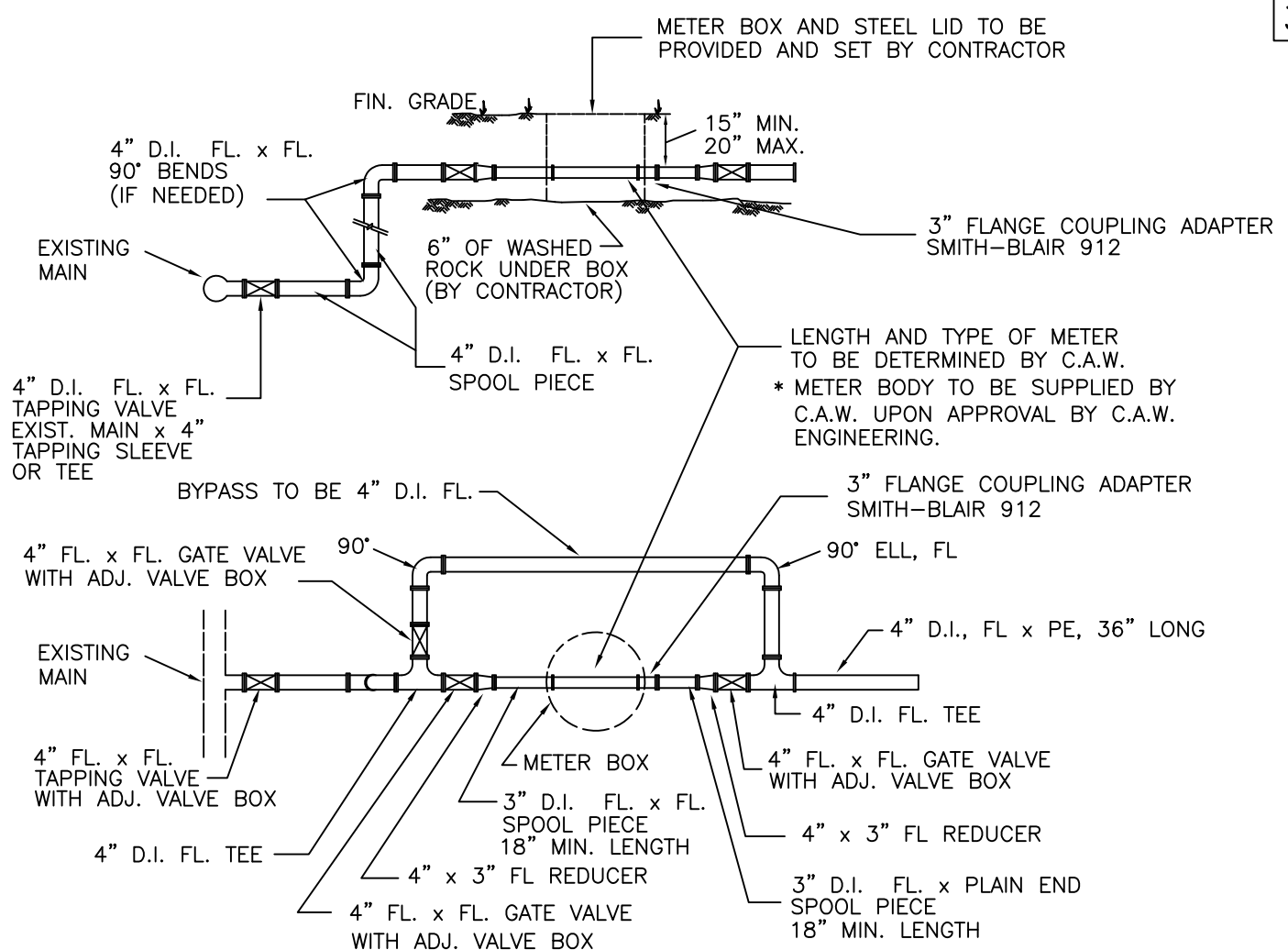
5/8", 3/4", 1" STANDARD SINGLE METER BOX AND SETTING

SEE PAGE 2 FOR 1-1/2" AND 2" METER SETTING



NO PVC OR GALVANIZED MATERIAL BETWEEN MAIN AND METER SETTER THREADED DOMESTIC BRASS OR 2" TYPE "L" COPPER WITH P.J. X M.I.P. THREADED FITTINGS

BASIC LAYOUT FOR METER SETTING INSTALLATION FOR 1-1/2" & 2" METERS

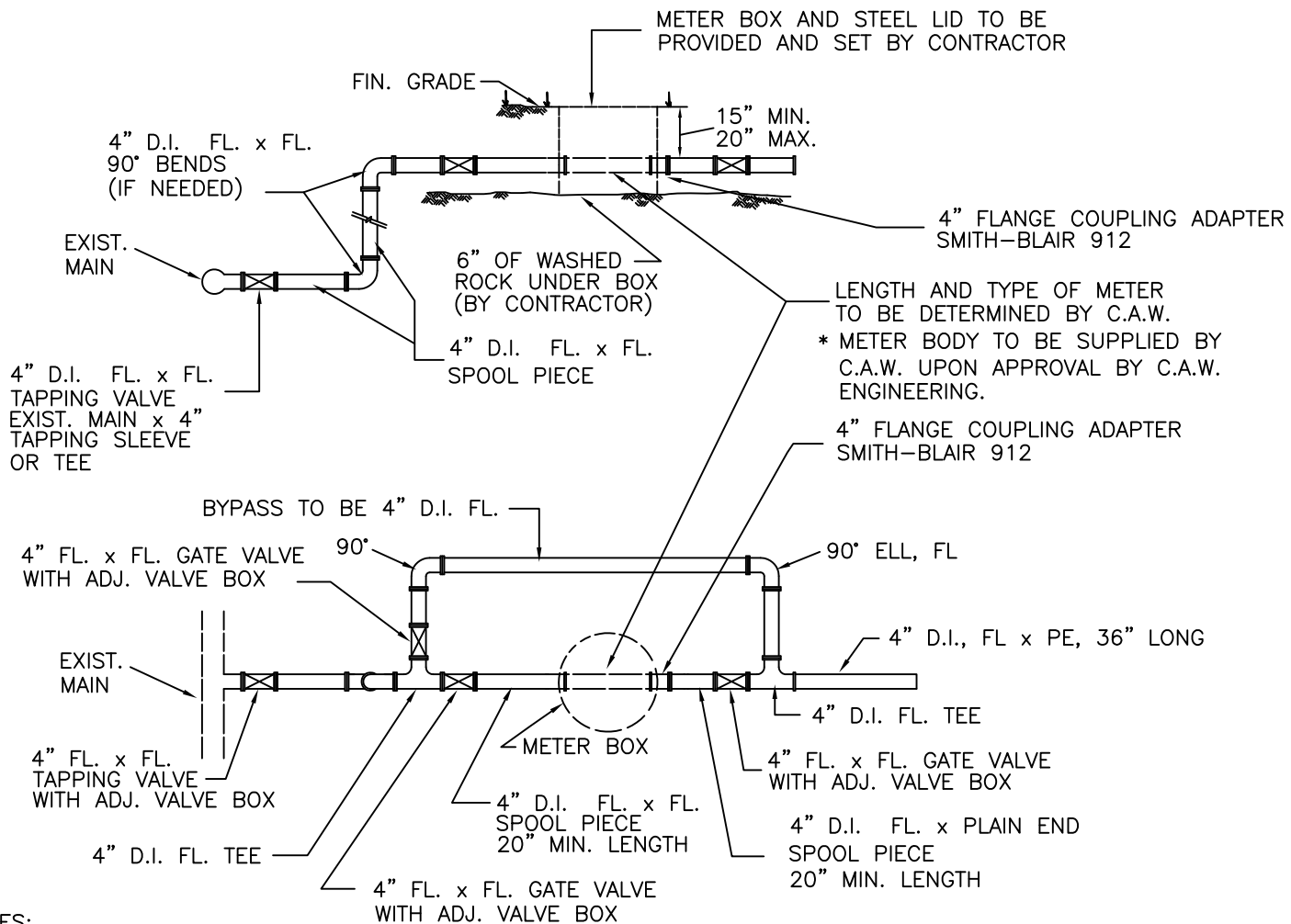


NOTES:

1. ALL PROCEDURES, MATERIAL AND WORKMANSHIP SHALL CONFORM TO THE SPECIFICATIONS OF CENTRAL ARKANSAS WATER
2. ALL D.I. PIPE & FITTINGS SHALL BE POLY WRAPPED.
3. ALL FITTINGS AND VALVES SHALL BE FLANGED. ALL PIPE SHALL BE FLANGED OR P. E. WITH FLANGE ADAPTER.
4. ALL VALVES SHALL OPEN RIGHT, EXCEPT FOR CERTAIN AREAS NORTH OF ARKANSAS RIVER WHICH SHALL OPEN LEFT.
5. METER BOX AND STEEL LID PER DETAIL PAGE 26 WILL BE PROVIDED AND SET BY CONTRACTOR.
6. UNI-FLANGES SHALL NOT BE USED.
7. IF FLANGE ADAPTERS (BEYOND THE ONE SHOWN) ARE USED, PLACE CONC. THRUST BLOCKING BEHIND AFFECTED TEES AND BENDS.

QUANTITY	3" METER SETTER PARTS DESCRIPTION
4	4" FLANGE X FLANGE RESILIENT SEAT VALVES
2	4" FLANGED TEES
2	4" FLANGED 90 DEGREE BENDS
1	4" X 7' 4" DI FLANGED SPOOL PIECE
1	4" X 36" DI FLANGED X PLAIN END SPOOL PIECE
1	4" X 12" DI FLANGED SPOOL PIECE
1	4" X 21" DI FLANGED SPOOL PIECE
1	3" FLANGED COUPLING ADAPTOR "SMITH BLAIR 912 ONLY"
2	4" X 3" FLANGED REDUCERS
1	3" X 18" DI FLANGED SPOOL PIECE
1	3" X 18" DI FLANGED X PLAIN END SPOOL PIECE
18	4" FLANGE PACKS "BOLTS & GASKETS"
4	3" FLANGE PACKS "BOLTS & GASKETS"
2	4" FLANGED 90 DEGREE BENDS (AS REQUIRED FOR FIELD CONDITIONS.)
2	4" FL X FL SPOOL PIECES (LENGTHS AS REQUIRED FOR FIELD CONDITIONS.)

3" TURBINE METER SET



NOTES:

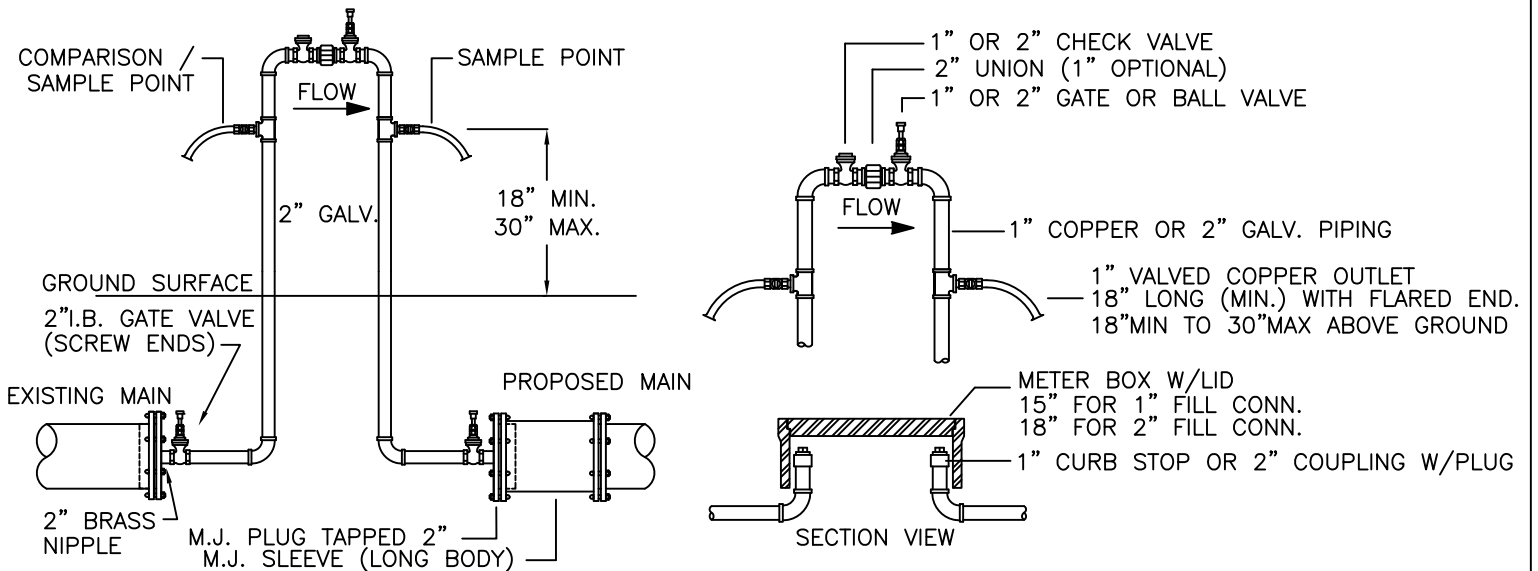
1. ALL PROCEDURES, MATERIAL AND WORKMANSHIP SHALL CONFORM TO THE SPECIFICATIONS OF CENTRAL ARKANSAS WATER
2. ALL D.I. PIPE & FITTINGS SHALL BE POLY WRAPPED.
3. ALL FITTINGS AND VALVES SHALL BE FLANGED. ALL PIPE SHALL BE FLANGED OR P. E. WITH FLANGE ADAPTER.
4. ALL VALVES SHALL OPEN RIGHT, EXCEPT FOR CERTAIN AREAS NORTH OF ARKANSAS RIVER WHICH SHALL OPEN LEFT.
5. METER BOX AND STEEL LID PER DETAIL PAGE 26 WILL BE PROVIDED AND SET BY CONTRACTOR.
6. UNI-FLANGES SHALL NOT BE USED.
7. IF FLANGE ADAPTERS (BEYOND THE ONE SHOWN) ARE USED, PLACE CONC. THRUST BLOCKING BEHIND AFFECTED TEES AND BENDS.

QUANTITY	4" METER SETTER PARTS DESCRIPTION
4	4" FLANGE X FLANGE RESILIENT SEAT VALVES
2	4" FLANGED TEES
2	4" FLANGED 90 DEGREE BENDS
1	4" X 7' 4" DI FLANGED SPOOL PIECE
1	4" X 36" DI FLANGED X PLAIN END SPOOL PIECE
1	4" X 12" DI FLANGED SPOOL PIECE
1	4" X 21" DI FLANGED SPOOL PIECE
1	4" FLANGED COUPLING ADAPTOR " SMITH BLAIR 912 ONLY "
1	4" X 24" DI FLANGED SPOOL PIECE
1	4" X 24" DI FLANGED X PLAIN END SPOOL PIECE
20	4" FLANGE PACKS "BOLTS & GASKETS"
2	4" FLANGED 90 DEGREE BENDS (AS REQUIRED FOR FIELD CONDITIONS.)
2	4" FL X FL SPOOL PIECES (LENGTHS AS REQUIRED FOR FIELD CONDITIONS.)

4" TURBINE METER SET

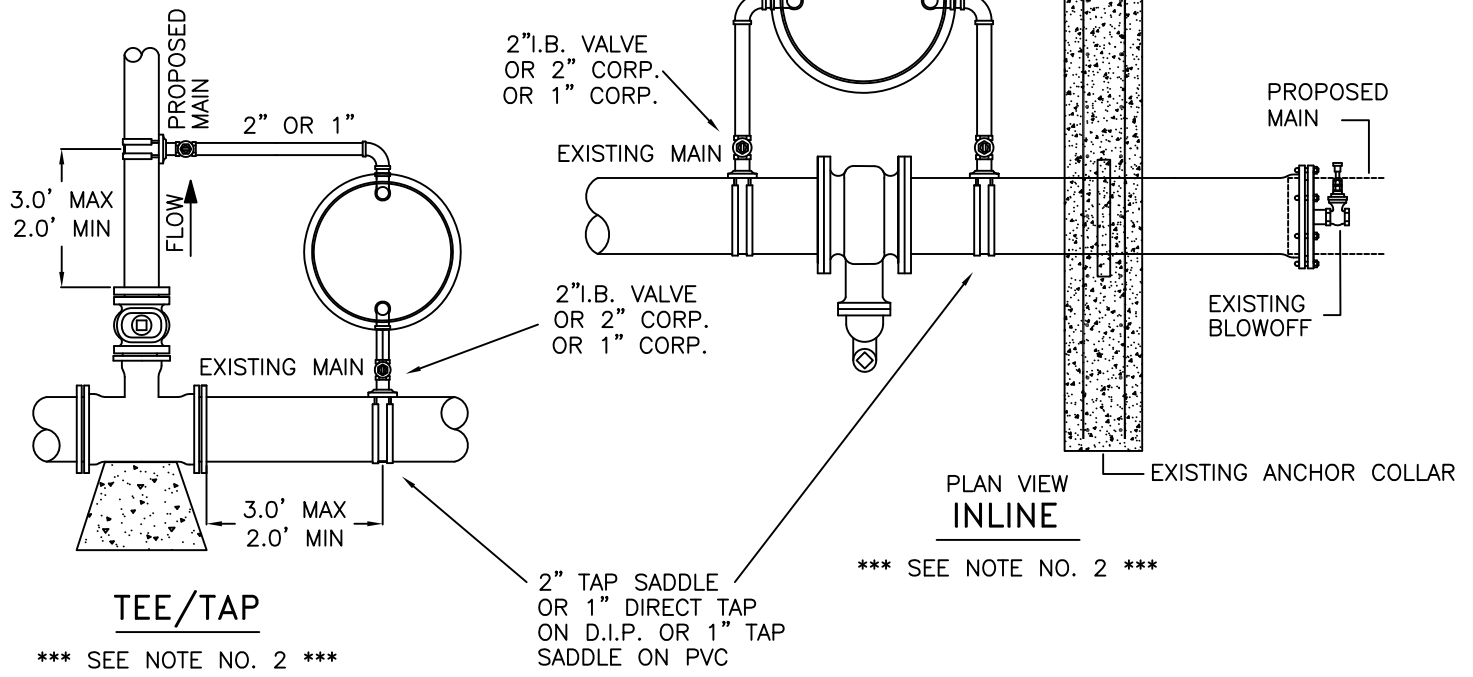
NOTES:

- 2-INCH FILL CONNECTIONS ARE REQUIRED ON ALL MAINS, 12-INCH'S AND LARGER, OR AS DIRECTED BY C.A.W. ENG... 1-INCH FILL CONNECTIONS SHALL BE USED ON ALL MAINS SMALLER THAN 12-INCH'S EXCEPT FOR MAINS WITH TEMPORARY END TO END CONNECTIONS OR AS SPECIFIED.
- FULL SIZE CONNECTIONS WILL BE ALLOWED **ONLY** WITH WRITTEN APPROVAL OF C.A.W. THESE CONNECTIONS SHALL HAVE A VALVE BOX TO ACCEPT "TYLER 7 1/2", LOCKING LID. VALVES SHALL BE OPERATED BY C.A.W. PERSONNEL **ONLY**. ALL OTHER CONNECTIONS TO EXISTING FACILITIES SHALL CONTAIN A CHECK VALVE.
- 2" BLOWOFFS ARE REQUIRED ON ALL MAINS 6" AND LARGER.
- AFTER APPROVAL OF SAMPLES, CLOSE CORP STOPS AT MAIN AND REMOVE THE ENTIRE FILL ASSEMBLY UNLESS OTHERWISE DIRECTED BY THE ENGINEER. FOR 2" PERMANENT CONNECTIONS, CLOSE 2" VALVES, REMOVE FILL ASSEMBLY, AND PLUG COUPLINGS. TEMPORARY CONNECTIONS SHALL HAVE ALL PIPING REMOVED AT MAIN CONNECTION POINTS AND 2" VALVES PLUGGED.
- 2" VALVES ON MAIN LINES SHALL BE I. B. (R.S.) WITH THREADED ENDS; OPEN LEFT. 2" NIPPLES SHALL BE BRASS. OR 2" CORP. STOPS
- 1" VALVES ON MAIN LINES SHALL BE BRASS CORPORATION STOPS.
- ALL 1" TAPS WILL BE BY DIRECT TAP METHOD, UNLESS PREVIOUSLY APPROVED BY CAW. EXCEPTIONS MAY BE: PRESSURE CLASS D.I., C-900, AND SDR17 PVC, WHERE THE USE OF SADDLES MAY BE PERMITTED.



TEMPORARY (END TO END)

(NO METER BOX REQUIRED) *** SEE NOTE NO. 1 ***

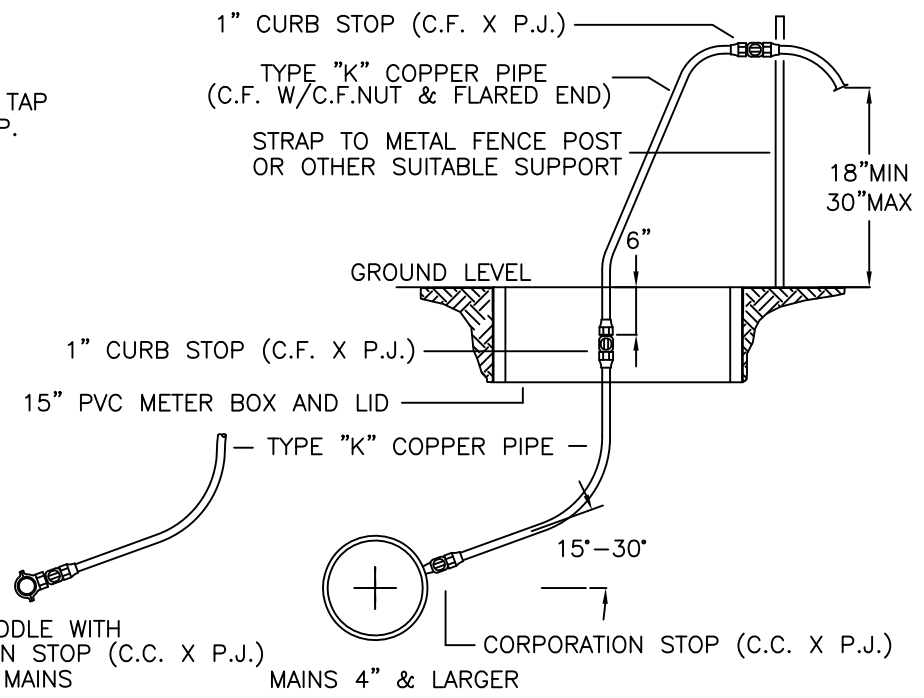


TEE/TAP

*** SEE NOTE NO. 2 ***

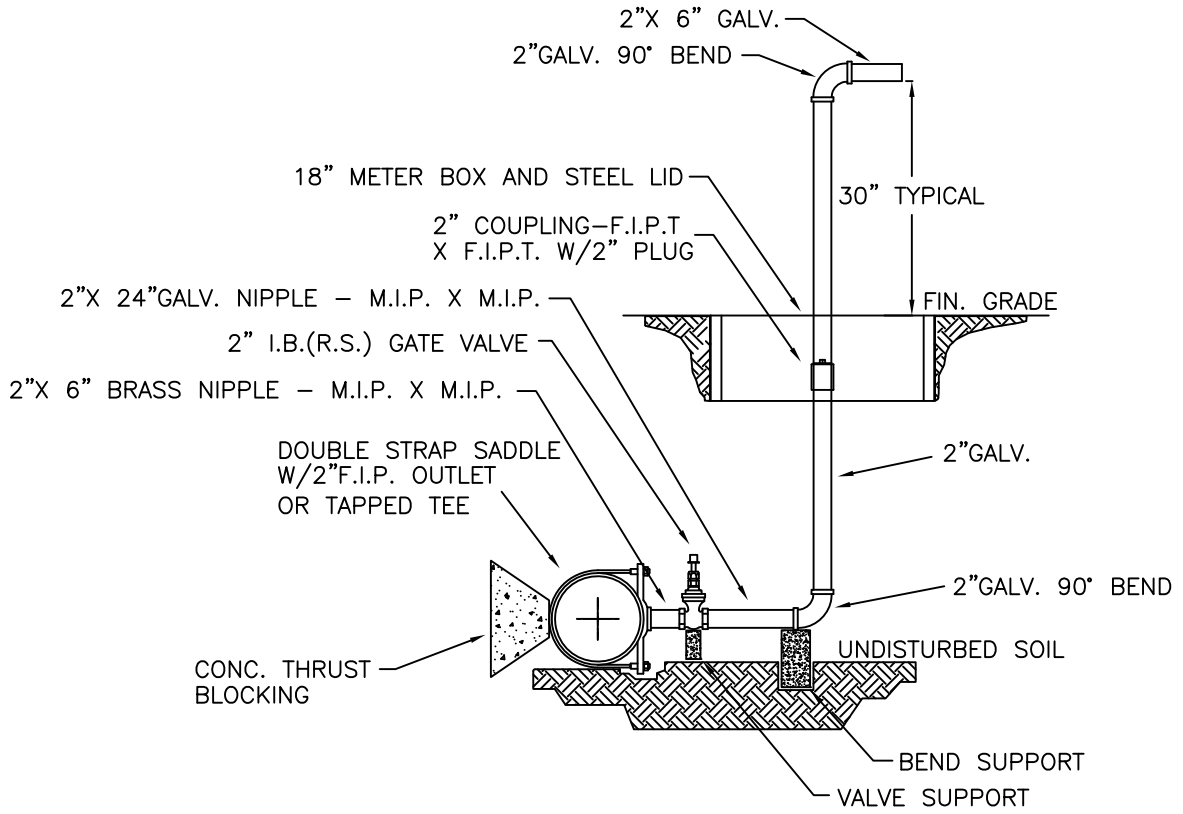
1" / 2" FILL CONNECTION DETAILS TYPICAL INSTALLATIONS

NOTE:
 ALL 1" TAPS WILL BE BY DIRECT TAP
 METHOD, ON 6" AND LARGER D.I.P.
 TAP SADDLE REQUIRED FOR ALL
 PVC PIPE AND 4" D.I.P.



NOTE:
 REMOVE RISER PIPE & INSTALL METER BOX W/LID
 WITHIN TEN (10) DAYS AFTER TAKING SAMPLE
 UNLESS OTHERWISE DIRECTED BY ENGINEER.

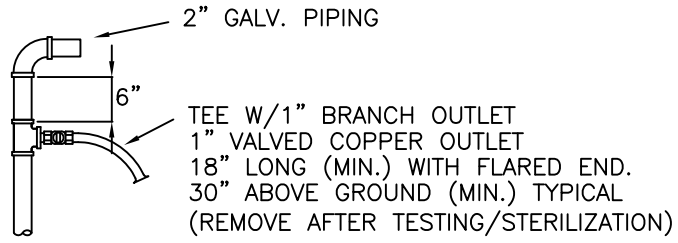
1" BLOW OFF / SAMPLE POINT ASSEMBLY



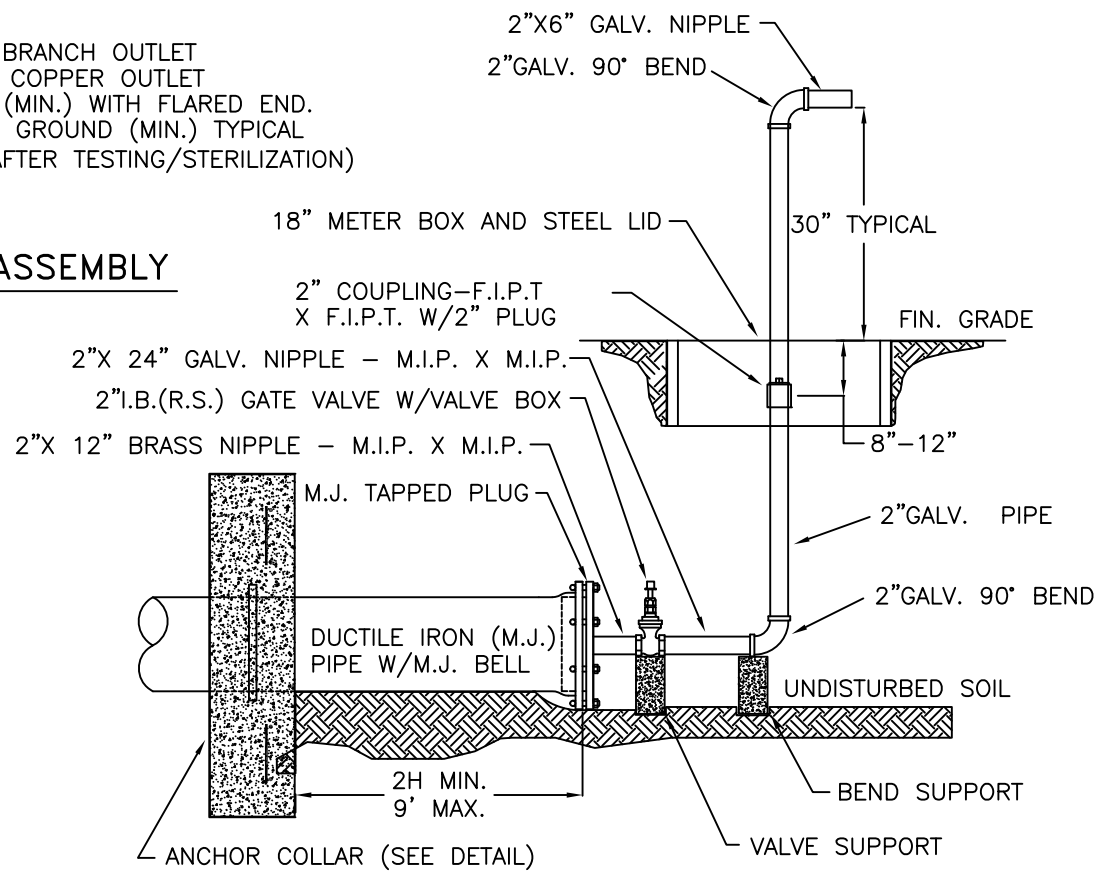
NOTES:

1. ALL SADDLES, STRAPS AND BOLTS SHALL BE POLYWRAPPED.
2. WHEN TAPPING MAIN USE 1 " BIT. 7/8
3. TAPPED TEES MAY BE USED ON CONNECTIONS TO NEW MAINS WHEN APPROVED BY OWNER.
4. ALL THREADED OUTLETS SHALL HAVE A DOUBLE WRAP OF TEFLON TAPE, TEFLON PASTE OR RECTORSEAL ON THREADS.
5. VALVE BOXES SHALL BE INSTALLED ON ALL BLOW OFF VALVES.
6. AFTER TESTING AND STERILIZATION IS COMPLETE, 2" GALV. PIPING TO BE REMOVED AND 2" VALVE PLUGGED.
7. RISER PIPE WILL BE PIPED INTO METER BOX AS SHOWN ONLY WHEN SPECIFIED.

2" SIDE BLOW OFF ASSEMBLY

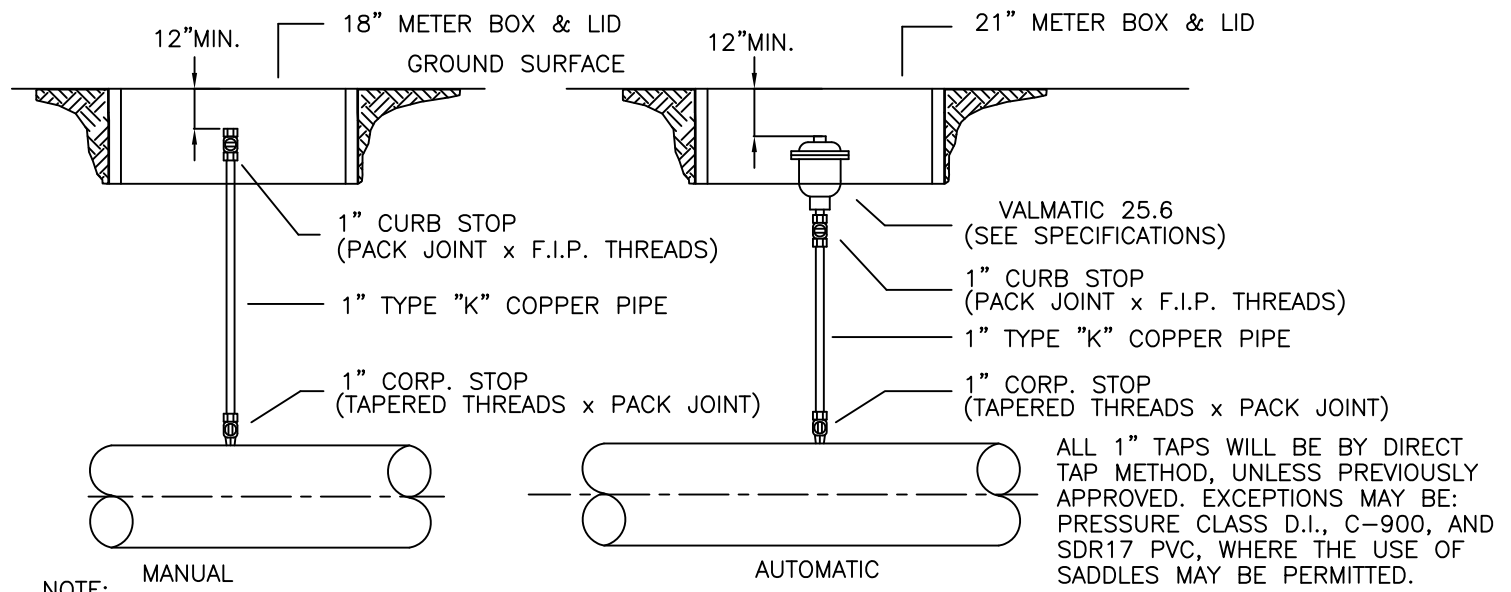


2" SAMPLE POINT ASSEMBLY



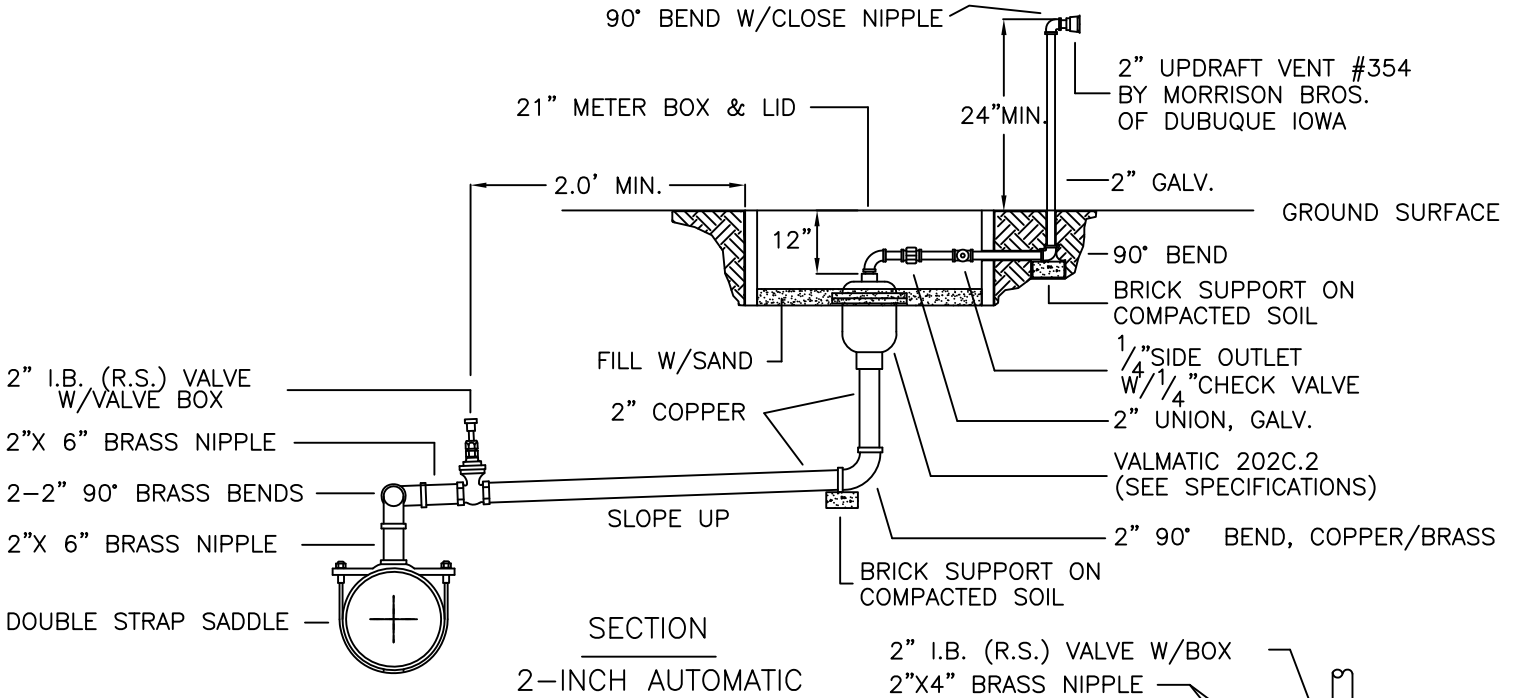
- NOTES:
1. 2" END BLOW OFF'S TO BE INSTALLED AT THE END OF MAINS 6" AND LARGER
 2. A 1" COPPER BLOW OFF SHALL BE INSTALLED AT ON NEAR THE END OF EVERY MAIN NOT REQUIRING A 2" BLOW OFF.
 3. ALL THREADED OUTLETS SHALL HAVE A DOUBLE WRAP OF TEFLON TAPE, TEFLON PASTE OR RECTORSEAL ON THREADS.
 4. VALVE BOXES SHALL BE INSTALLED ON ALL BLOW OFF VALVES.
 5. AFTER TESTING AND STERILIZATION IS COMPLETE, 2" GALV. PIPING TO BE REMOVED AND 2" VALVE PLUGGED.
 6. RISER PIPE WILL BE PIPED INTO METER BOX AS SHOWN ONLY WHEN SPECIFIED.

2" END BLOW OFF ASSEMBLY



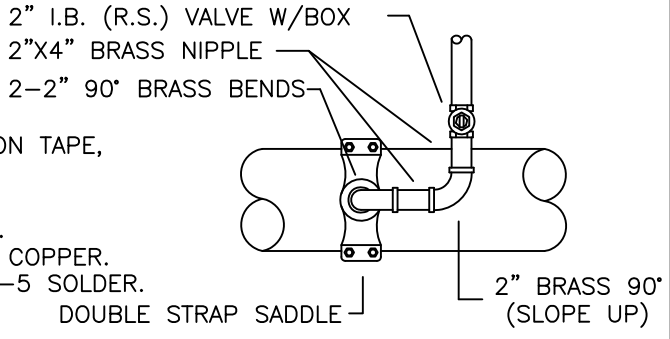
- NOTE:
1. ALL THREADED CONNECTIONS SHALL HAVE A DOUBLE WRAP OF TEFLON TAPE, TEFLON PASTE OR RECTORSEAL ON THE THREAD.
 2. VALVES WILL BE PIPED TO POINT BEYOND PAVEMENT AND SHOULDER.
 3. COPPER PIPE SHALL SLOPE CONTINUOUSLY UPWARDS FROM MAIN TO AIR RELEASE.

AIR RELEASE DETAIL



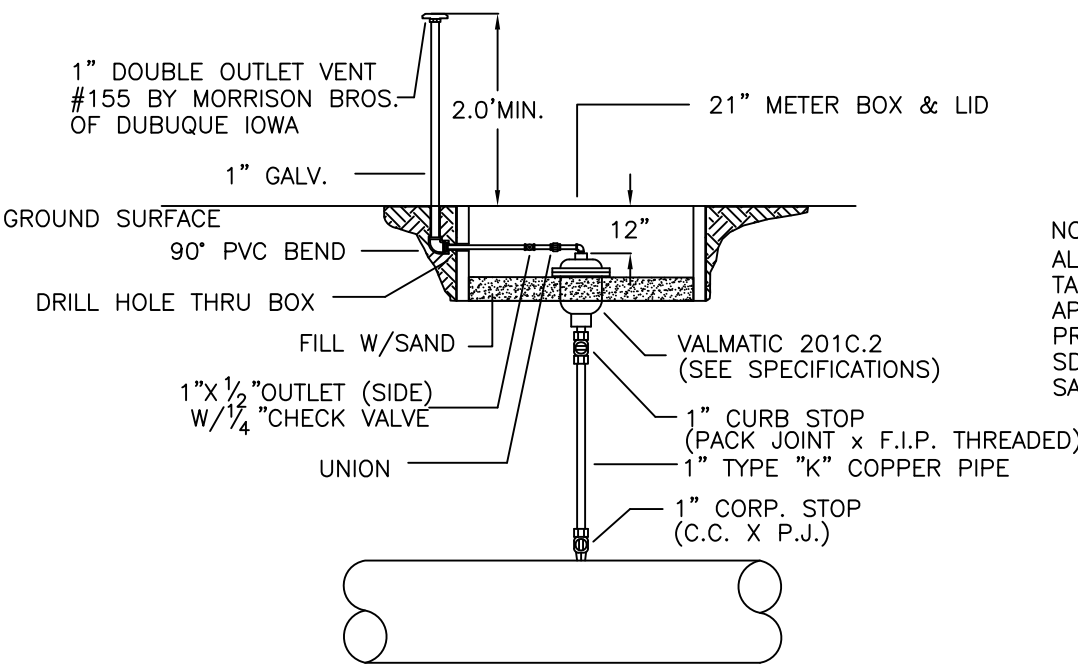
- 2" I.B. (R.S.) VALVE W/VALVE BOX
- 2"X 6" BRASS NIPPLE
- 2-2" 90° BRASS BENDS
- 2"X 6" BRASS NIPPLE
- DOUBLE STRAP SADDLE

SECTION
2-INCH AUTOMATIC



PLAN 2-INCH AUTOMATIC
(ROTATED 90°)

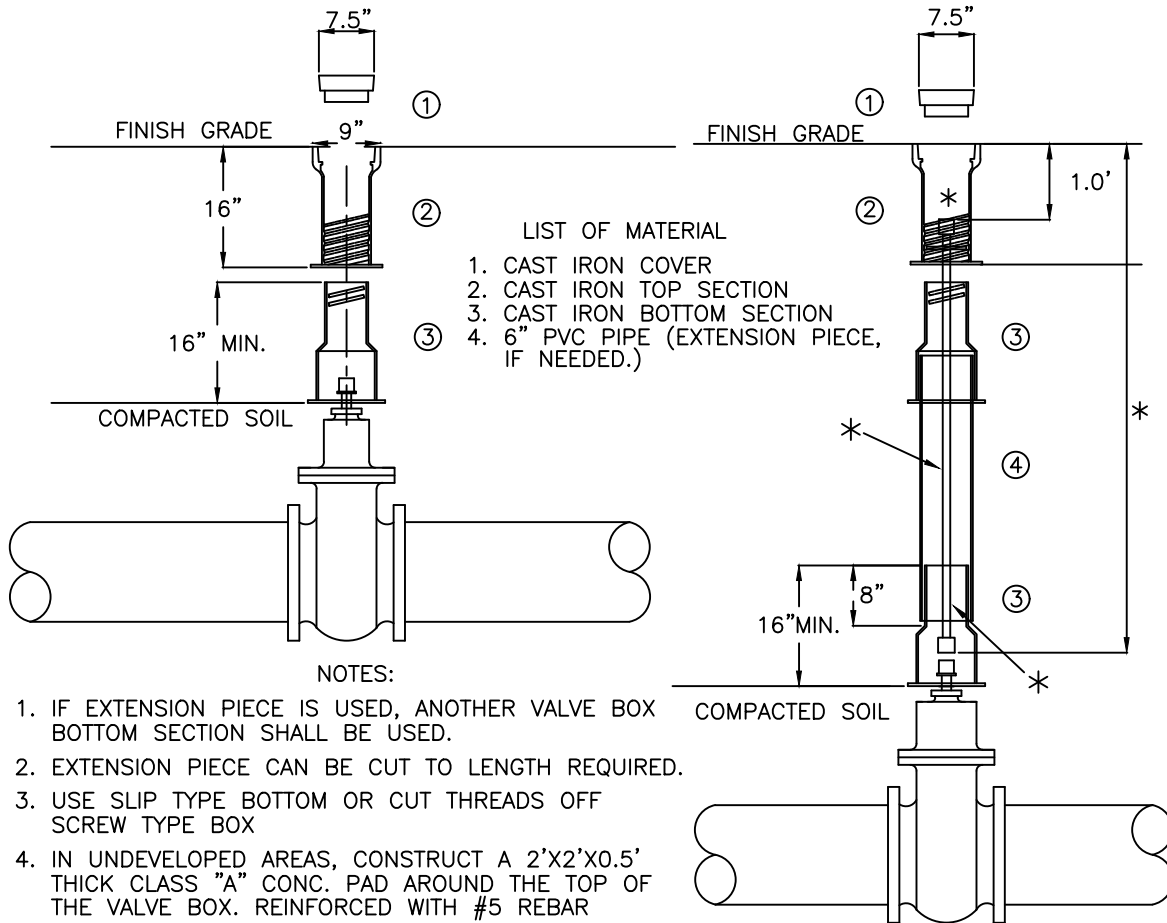
1. ALL THREADED CONNECTIONS SHALL HAVE A DOUBLE WRAP OF TEFLON TAPE, TEFLON PASTE, OR RECTORSEAL ON THREADS.
2. DRILL HOLE IN SIDE OF METER BOX FOR OUTLET PIPING.
3. VALVES WILL BE PIPED TO POINT BEYOND PAVEMENT AND SHOULDER.
4. PIPE BETWEEN 2" I.B. VALVE AND AIR VALVE SHALL BE 2" TYPE "K" COPPER. SWEAT ON ALL FITTINGS, ADAPTERS, ELLS, COUPLINGS, ETC. WITH 95-5 SOLDER.



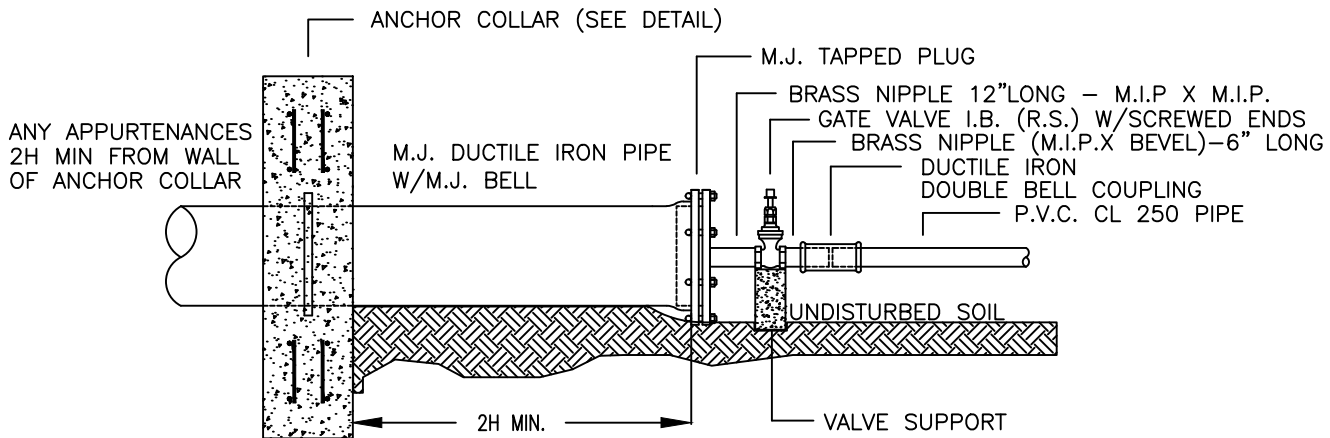
PLAN
1-INCH AUTOMATIC

NOTE:
ALL 1" TAPS WILL BE BY DIRECT TAP METHOD, UNLESS PREVIOUSLY APPROVED. EXCEPTIONS MAY BE: PRESSURE CLASS D.I., C-900, AND SDR17 PVC, WHERE THE USE OF SADDLES MAY BE PERMITTED.

COMBINATION AIR VALVE DETAIL



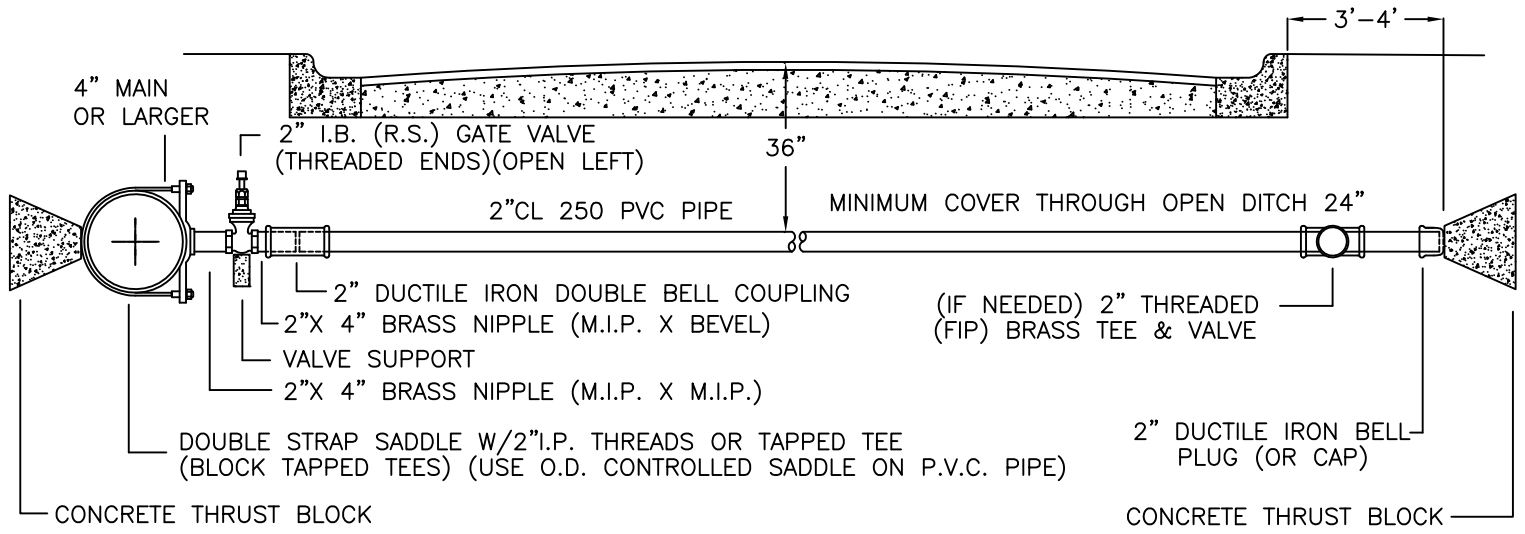
VALVE BOX INSTALLATION



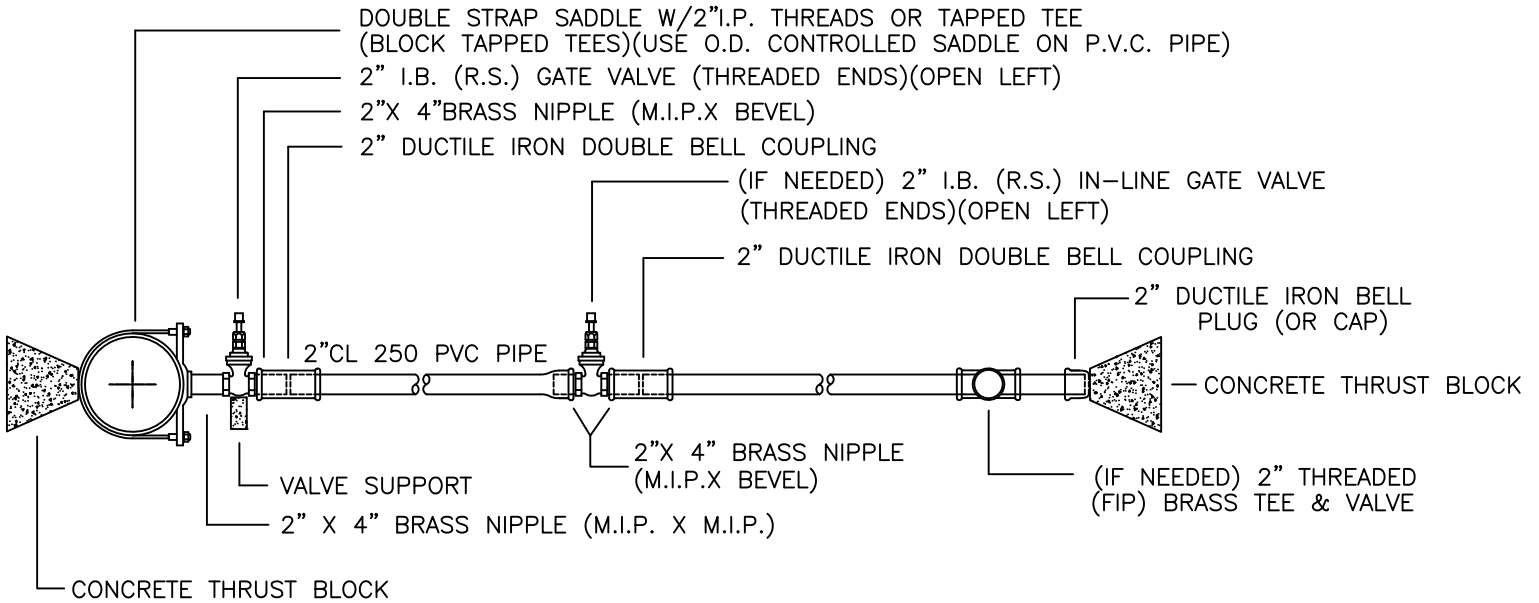
NOTES:

1. SIZE OF TAP, VALVE, AND PVC SHALL BE AS SHOWN IN THE CONSTRUCTION PLAN.
2. VALVE SHALL BE INSTALLED WITH VALVE BOX.

2" / 3" PVC MAIN CONNECTION TO 6" AND LARGER MAINS



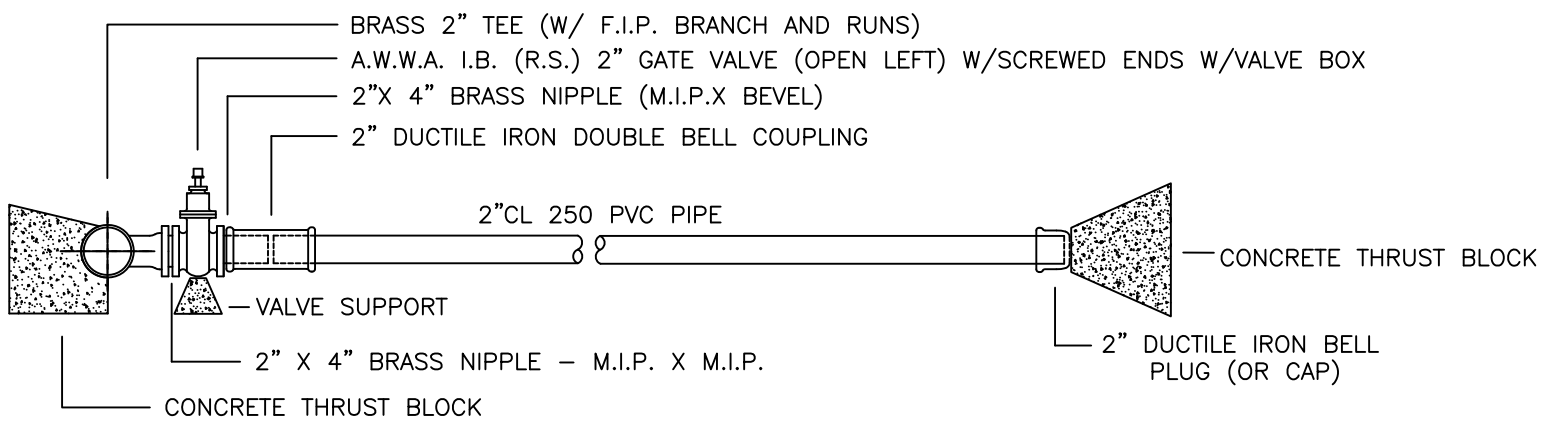
2" SERVICE CONNECTIONS – MAINS 4" AND LARGER



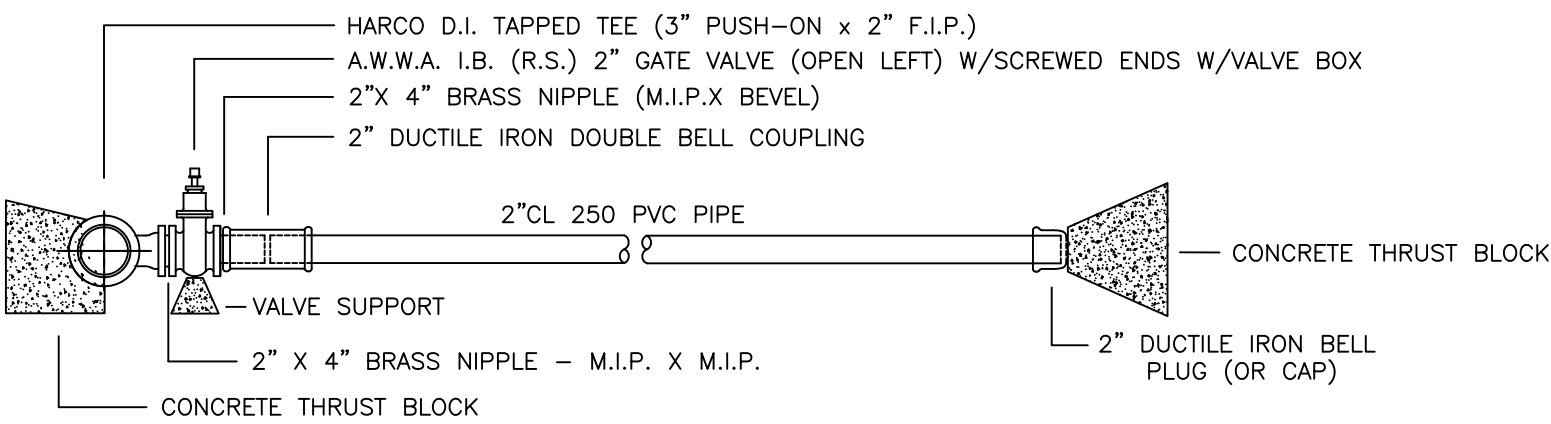
2" SERVICE AND MAIN CONNECTION – MAINS 4" AND LARGER

NOTES:

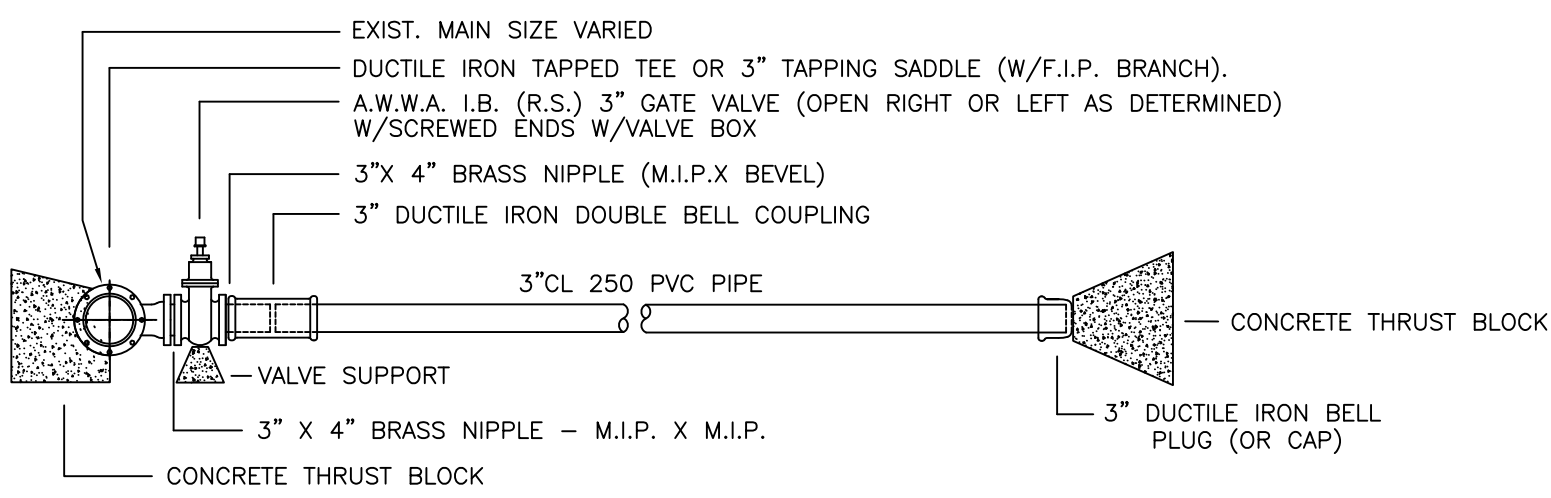
1. SADDLES, STRAPS AND BOLTS SHALL BE POLYWRAPPED.
2. WHEN MAIN TAPPED USE 1 7/8" BIT.
(TAPPED TEES MAY BE USED ON CONNECTIONS TO NEW MAINS WHEN SPECIFIED).
3. VALVE BOXES SHALL BE INSTALLED ON ALL VALVES.
4. INSTALL CONTINUOUS INSULATED COPPER WIRE WRAPPED AROUND ALL PVC PIPES.
5. PROVIDE CONCRETE SUPPORT UNDER VALVES ATTACHED TO SADDLES.



2" x 2" SERVICE AND MAIN CONNECTION



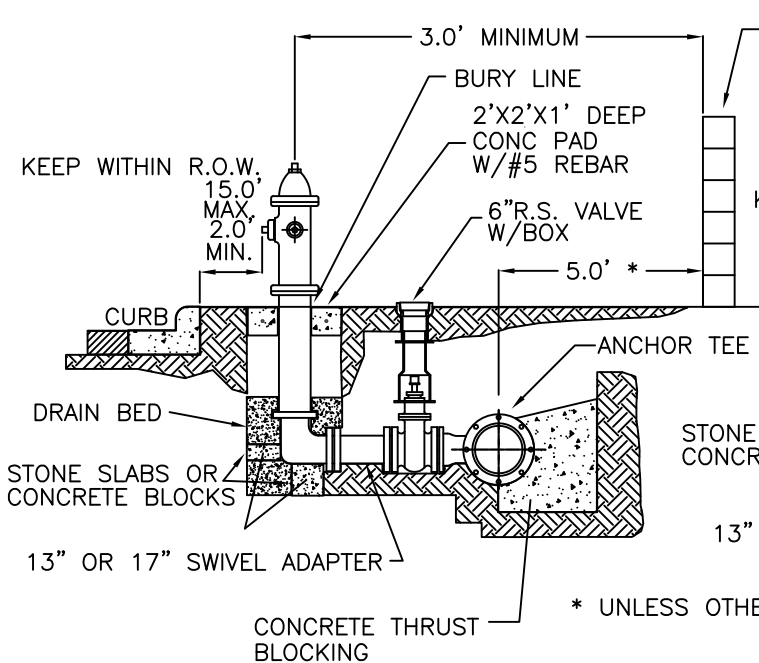
3" x 2" SERVICE AND MAIN CONNECTION



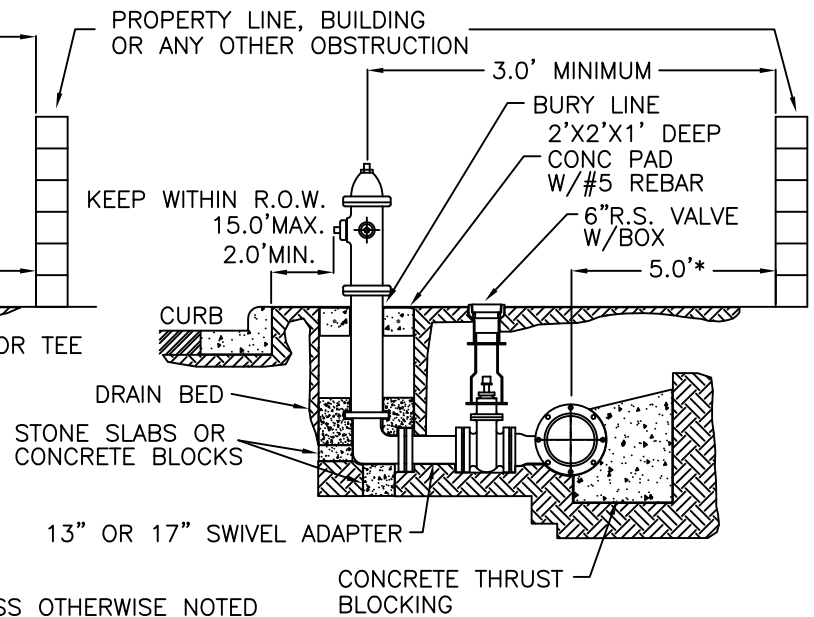
3" SERVICE AND MAIN CONNECTIONS

NOTES:

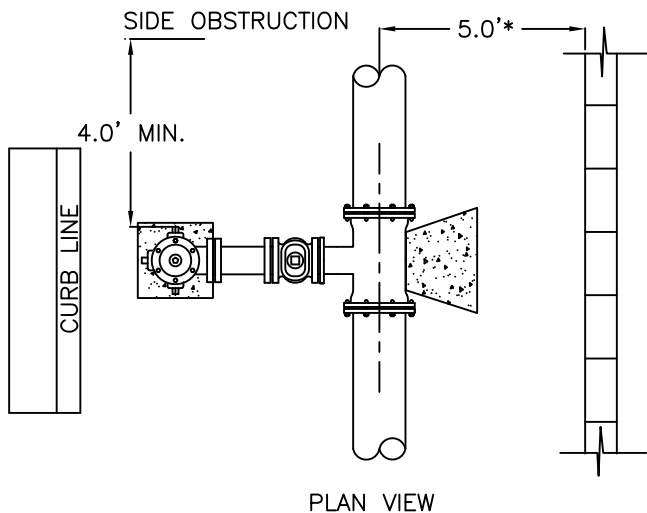
1. ALL THREADED CONNECTIONS SHALL HAVE A DOUBLE WRAP OF TEFLON TAPE, TEFLON PASTE, OR RECTOR SEAL.
2. LAY COPPER TRACING WIRE WITH PVC PIPE.
3. POLY WRAP ALL IRON FITTINGS, BOLTS, AND NUTS.



ELEVATION VIEW / STANDARD ANCHOR TEE

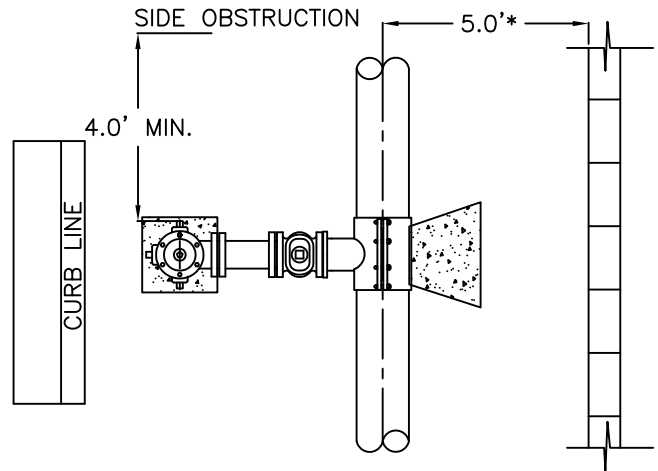


ELEVATION VIEW / FLANGED OUTLET
CONCRETE PIPE – USE TANGENT FLANGE OUTLET.



PLAN VIEW

STANDARD FIRE HYDRANT INSTALLATION
USE ANCHOR TEE (UNLESS OTHER WISE NOTED)



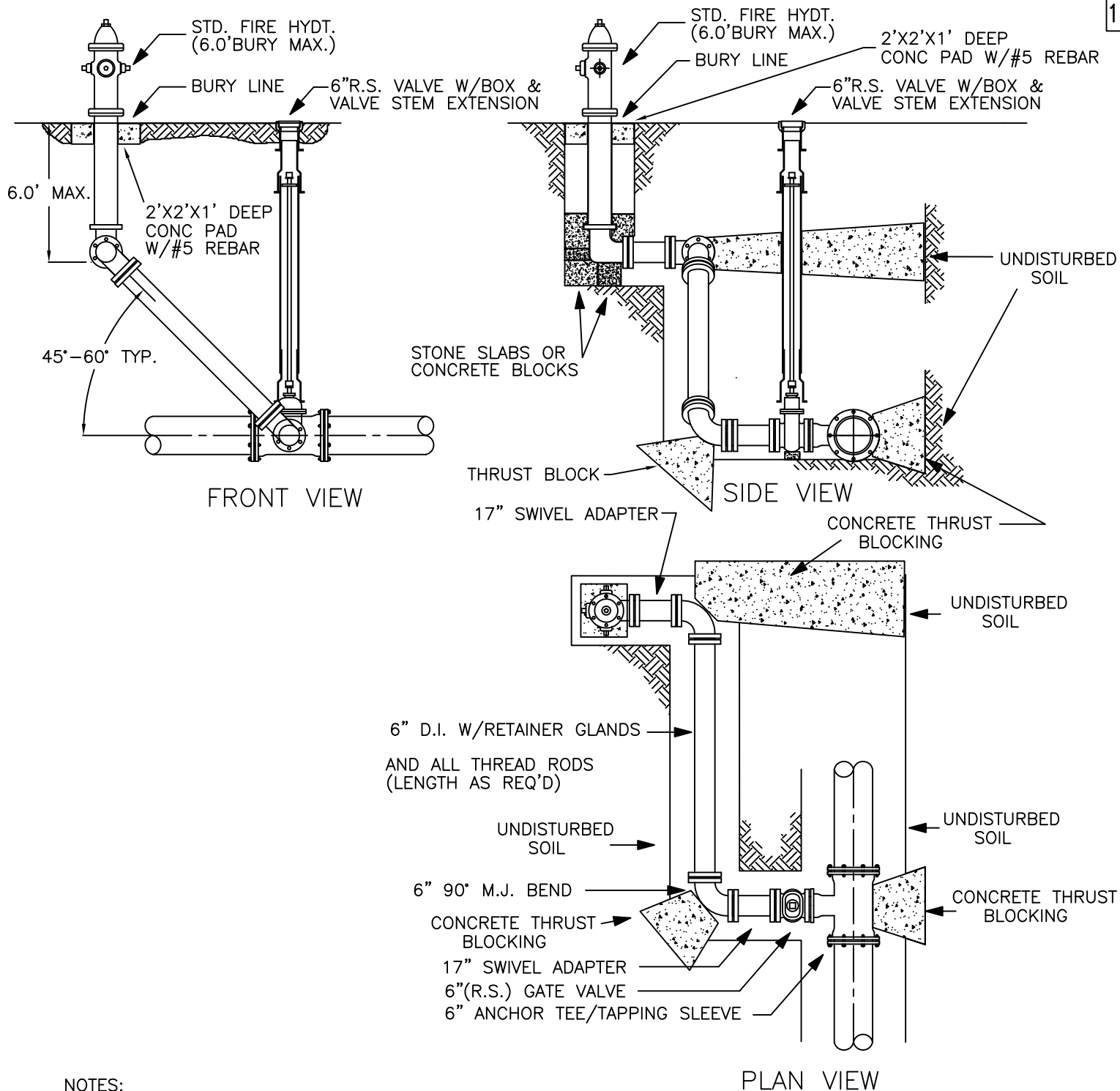
PLAN VIEW

TANGENT OUTLET
MAINS 16" AND LARGER

NOTES:

1. DRAINAGE BED SHALL CONSIST OF CRUSH STONE OR COURSE GRAVEL WITH COURSE SAND. MINIMUM VOLUME OF 6 CU. FT. DRAIN BED SHALL EXTEND A MINIMUM OF 6" ABOVE DRAIN OUTLET.
2. USE 6" D.I. NIPPLE WITH M.J. RETAINER GLANDS IF DISTANCE BETWEEN VALVE AND HYDRANT MUST BE GREATER THAN 17" SWIVEL ADAPTER.
3. FIRE HYDRANT TO BE BLOCKED AGAINST FIRM SOIL AS SHOWN.
4. ALL HYDRANTS SHALL BE INSTALLED PLUMB.
5. LARGE NOZZLE SHALL FACE CURB UNLESS OTHERWISE NOTED. ROTATE BARREL AS REQUIRED.
6. HYDRANT SHOULD NOT BE SET CLOSER THAN 4.0' TO OBSTRUCTIONS THAT ARE IN LINE WITH NOZZLE.
7. M.J. ANCHOR TEE OR TAPPING SLEEVE MAY BE USED (SEE MATERIAL SPECIFICATIONS)
WHEN USING REGULAR M.J. TEE USE 13" SWIVEL ADAPTER NIPPLE BETWEEN TEE AND VALVE.
8. HYDRANTS TO BE SET AT DEPTHS GREATER THAN 6.0' SHALL BE SET WITH A MODIFIED FIRE HYDRANT SETTING.
SEE DEEP BURY FIRE HYDRANT ASSEMBLY
9. POLY WRAP ALL PIPE, FITTINGS, BOLTS AND NUTS
10. FOR HYDRANTS NOT SET IN CONCRETE, PAVEMENT OR SIDEWALKS, A CONCRETE PAD SHALL BE CONSTRUCTED AROUND THE HYDRANT BARREL. CONCRETE PAD SHALL BE 2'X2'X1' DEEP, REINFORCED WITH ONE #5 REBAR ALL AROUND HYDRANT.

STANDARD FIRE HYDRANT ASSEMBLY

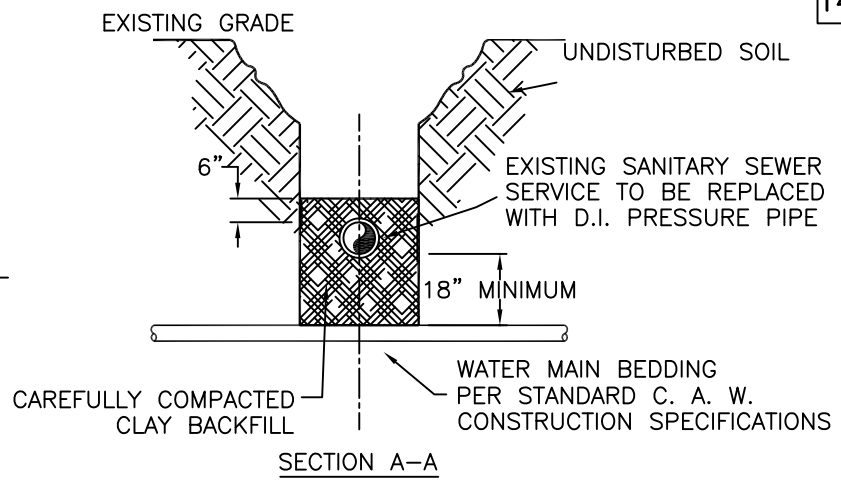
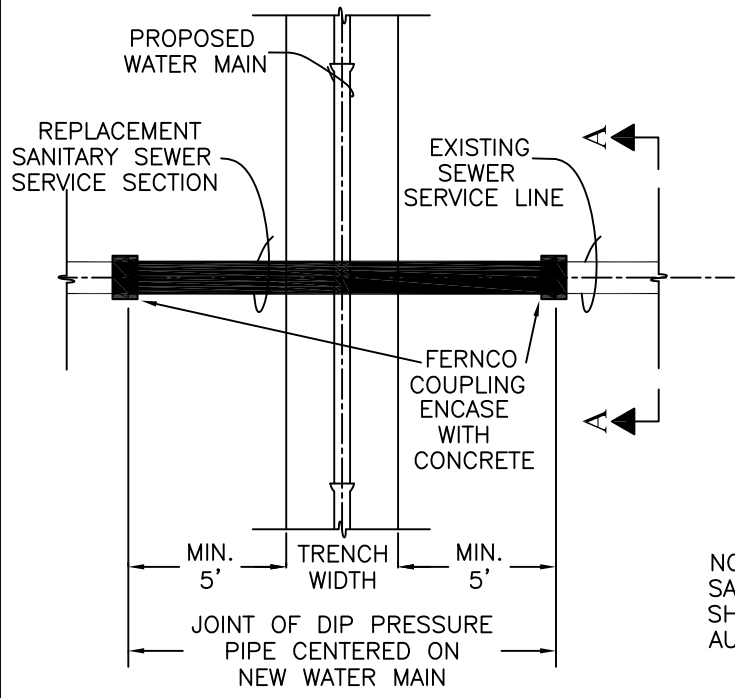


NOTES:

1. DRAINAGE BED SHALL CONSIST OF CRUSH STONE OR COURSE GRAVEL WITH COURSE SAND. MINIMUM VOLUME OF 6 CU. FT. DRAIN BED SHALL EXTEND A MINIMUM OF 6" ABOVE DRAIN OUTLET.
2. USE 6" D.I. NIPPLE WITH M.J. RETAINER GLANDS IF DISTANCE BETWEEN VALVE AND HYDRANT MUST BE GREATER THAN 17" SWIVEL ADAPTER.
3. FIRE HYDRANT TO BE BLOCKED AGAINST FIRM SOIL AS SHOWN.
4. ALL HYDRANTS SHALL BE INSTALLED PLUMB.
5. LARGE NOZZLE SHALL FACE CURB UNLESS OTHERWISE NOTED. ROTATE BARREL AS REQUIRED.
6. HYDRANT SHOULD NOT BE SET CLOSER THAN 4.0' TO OBSTRUCTIONS THAT ARE IN LINE WITH NOZZLE.
7. M.J. ANCHOR TEE OR TAPPING SLEEVE MAY BE USED (SEE MATERIAL SPECIFICATIONS) WHEN USING REGULAR M.J. TEE USE 13" SWIVEL ADAPTER NIPPLE BETWEEN TEE AND VALVE.
8. POLY WRAP ALL PIPE, FITTINGS, BOLTS AND NUTS
9. FOR HYDRANTS NOT SET IN CONCRETE, PAVEMENT OR SIDEWALKS, A CONCRETE PAD SHALL BE CONSTRUCTED AROUND THE HYDRANT BARREL. CONCRETE PAD SHALL BE 2'x2'x1' DEEP, REINFORCED WITH ONE #5 REBAR ALL AROUND HYDRANT.

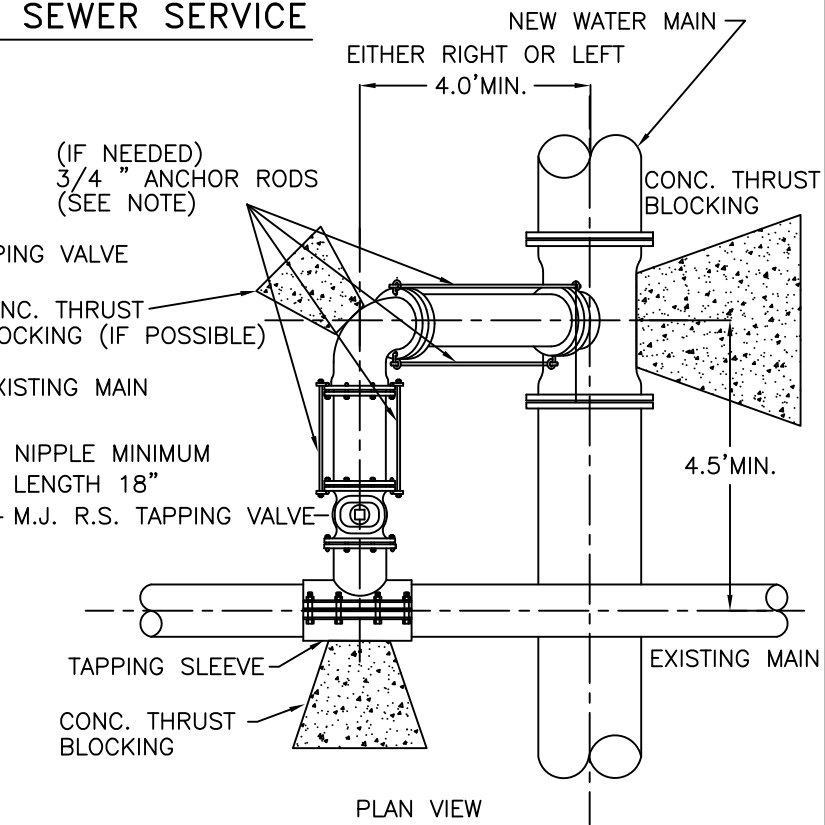
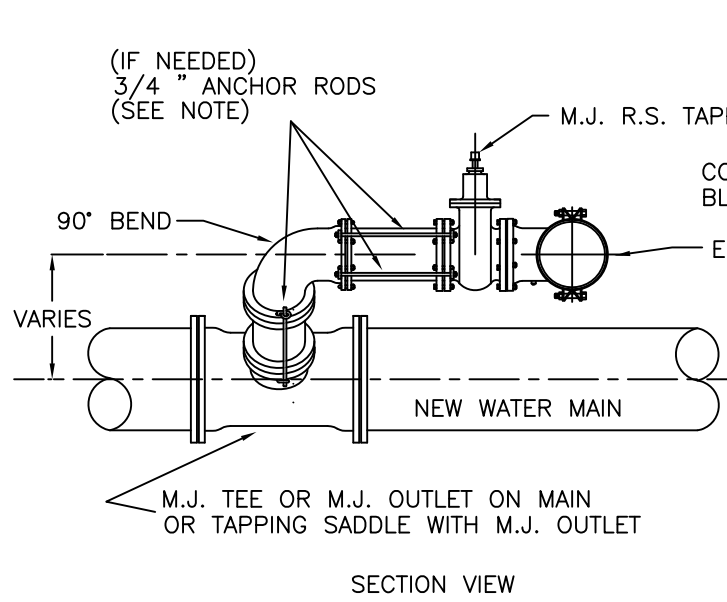
DEEP BURY FIRE HYDRANT ASSEMBLY

(BURY DEEPER THAN 6.0')



NOTE:
SANITARY SEWER SERVICE REPLACEMENT SHALL BE SUBJECT TO LOCAL WASTEWATER AUTHORITY SPECIFICATIONS AND INSPECTION.

PLAN **NEW WATER MAIN CROSSING UNDER EXISTING SANITARY SEWER SERVICE**



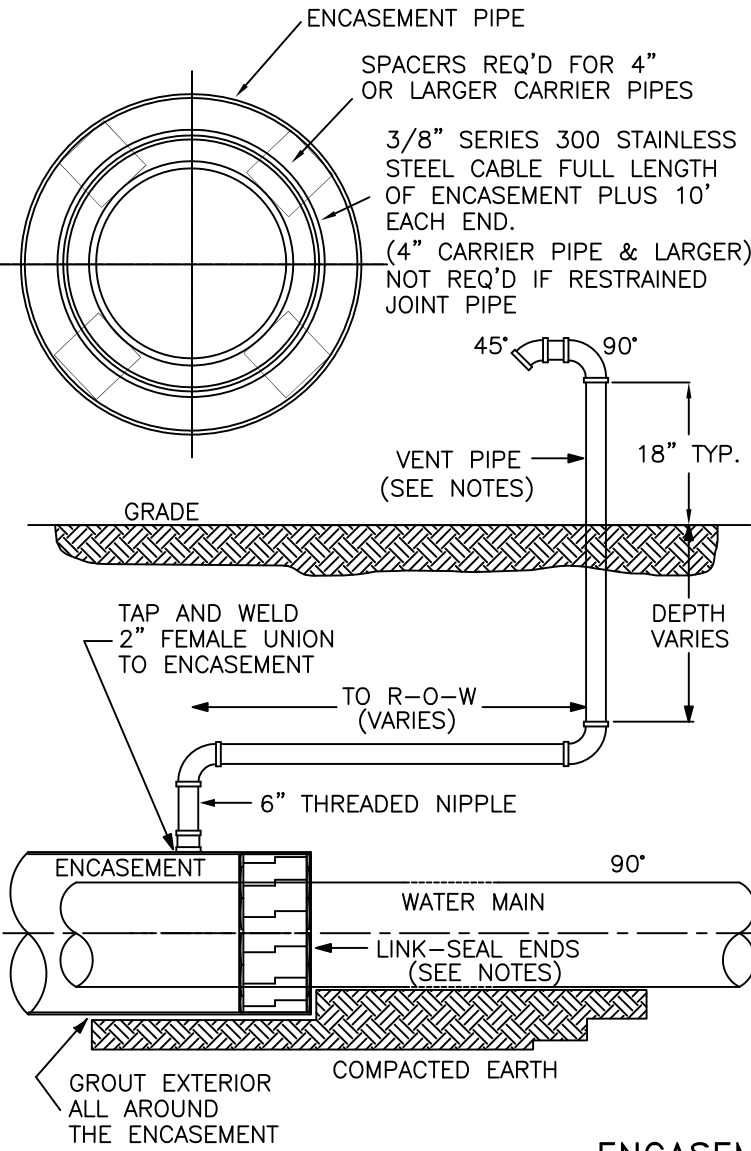
NOTES:

1. CONTRACTOR SHALL LOCATE EXISTING MAIN IN ADVANCE OF LAYING NEW LINE IN ORDER TO ASSURE ADEQUATE LENGTH TO ADJUST DEPTH OF NEW MAIN.
2. DIMENSIONS SHOWN ARE RECOMMENDED MINIMUMS TO PROVIDE ADEQUATE ROOM FOR TIGHTENING BOLTS ON JOINTS. (OTHER DIMENSIONS MAY BE USED)
3. USE TIE RODS IF ADEQUATE THRUST BLOCKING AGAINST UNDISTURBED SOIL IS NOT POSSIBLE.
4. ALL TIE RODS AND NUTS FOR PERMANENT PLACEMENT SHALL BE SERIES 300 STAINLESS STEEL USE 3/4" RODS FOR 6" THRU 24". USE 1" RODS FOR 30" THRU 36". USE 1 1/4" RODS FOR 42" THRU 48".
5. RODS SHALL BE FIELD CUT TO FIT & SHALL BE PROTECTED WITH POLYWRAP.
6. ROTATE TEE UP & ELBOW DOWN AS REQUIRED TO MATCH.

225 PSI
SERIES 300
STAINLESS
STEEL

PIPE SIZE	6"	8"	10"	12"	16"	20"	24"	30"	36"	42"	48"
RODS / NIPPLE	2	2	4	4	8	12	16	14	18	16	20

SWING CONNECTION – NEW MAIN TO EXISTING MAIN



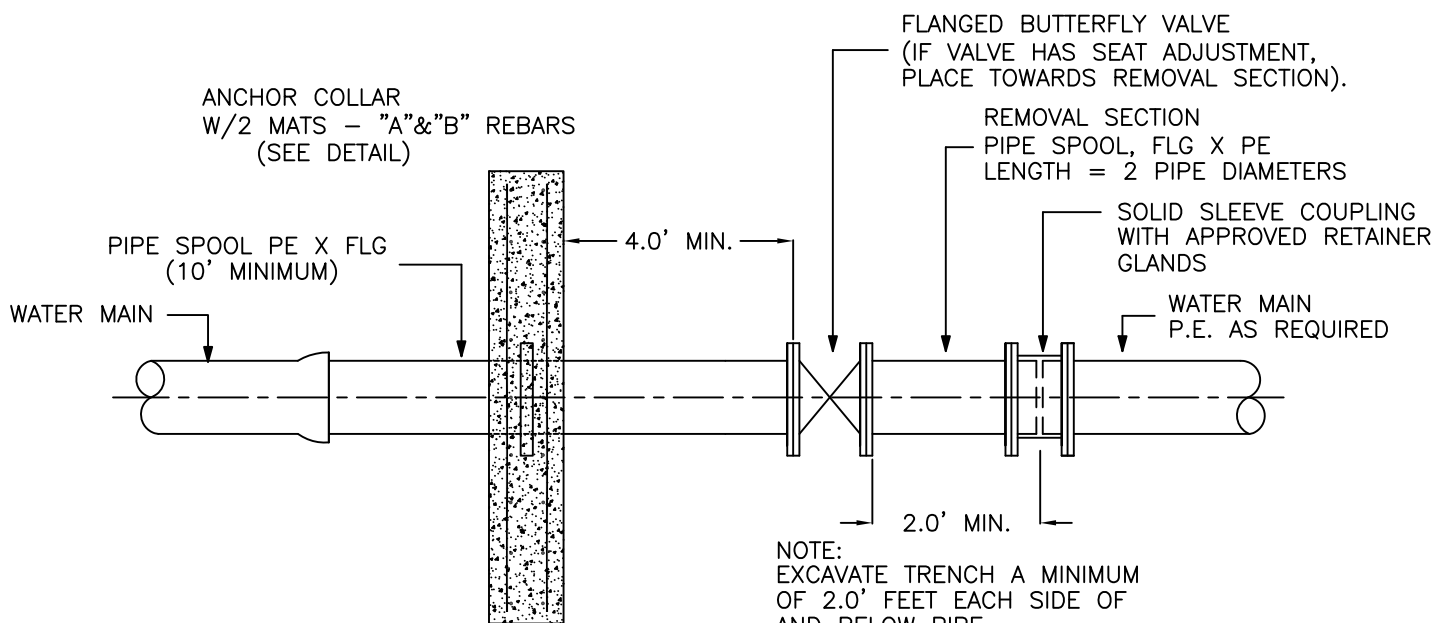
NOTES:

1. SPACER SHALL BE AS SPECIFIED IN THE MATERIAL SPECIFICATIONS IN THE FOLLOWING AMOUNTS:
4 EACH FOR 12" AND LARGER PIPE > PER JOINT OF PIPE
3 EACH FOR 4" THRU 10" PIPE
2. PLACE SPACERS 2.0' FROM ENDS.
3. WHEN CONCRETE PIPE IS USED, JOINT PROTECTION WILL BE AS SPECIFIED IN PARAGRAPH 16.8.2.4 OF THE CONSTRUCTION SPECIFICATIONS.

NOTES:

1. ENCASEMENT VENTS PIPES SHALL BE MADE OF 2-INCH GALV. AND SHALL BE CONSTRUCTED AS SHOWN.
2. VENT PIPES SHALL BE INSTALLED PLUMB & WITHIN 6-INCHES OF THE RIGHT-OF-WAY.
3. VENTS ARE REQUIRED UNLESS DELETED BY THE ENGINEER.
4. ENCASEMENT ENDS SHALL BE SEALED WITH LINK-SEAL OR APPROVED EQUAL.
5. GROUT EXTERIOR ANNULAR SPACE AROUND ENCASEMENT (PARAGRAPH 22.12 OF THE CONSTRUCTION SPECIFICATIONS).
6. ENCASEMENTS FOR MAINS 2-INCH AND LARGER THAT CROSS R.O.W.'S CONTROLLED BY THE AHTD OR RAILROAD SHALL HAVE VENT PIPE PLACED AT EACH RIGHT-OF-WAY LINE. VENT PIPES SHALL BE 2-INCH GALV. AND SHALL HAVE A C.A.W. LABEL ATTACHED. (LABELS WILL BE PROVIDED BY C.A.W.)
7. FOR CARRIER PIPES 4" AND LARGER 3/8" SERIES 300 STAINLESS STEEL CABLE SHALL BE SECURELY FASTENED TO THE LEAD END OF THE WATER MAIN DURING INSTALLATION WITH A 3/8" CABLE CLAMP AND SPIRAL WRAPPED AROUND WATER MAIN AS PLACED THROUGH THE ENCASEMENT. ONCE THE WATER MAIN IS IN PLACE, THE 3/8" CABLE CLAMP SHALL BE REMOVED AND THE REQUIRED 10" OF ADDITIONAL CABLE ON EACH END SHALL BE WRAPPED AROUND WATER MAIN AND SECURED INSIDE THE SEALED END. IF RESTRAINED JOINT WATER PIPE, DO NOT INSTALL CABLE.

ENCASEMENT AND VENT



NOTE:
EXCAVATE TRENCH A MINIMUM OF 2.0' FEET EACH SIDE OF AND BELOW PIPE.

TYPICAL BUTTERFLY VALVE INSTALLATION
IN STRAIGHT RUN OF PIPE

(16" AND LARGER PIPE)

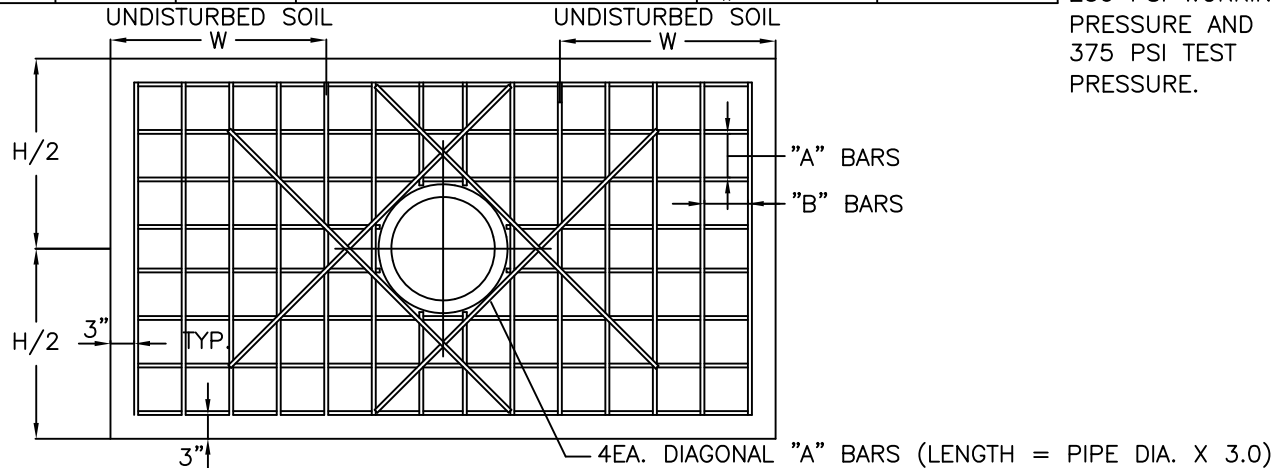
ANCHOR COLLAR SCHEDULE

PIPE SIZE	* MINIMUM DIMENSIONS *				REINFORCING BARS	
	W	H	T	THRUST COLLAR	"A" BARS	"B" BARS
6"	1.5'	2.0'	2.0'	M.L. RETAINER GLAND	#6 @ 6"	#6 @ 6"
8"	1.5'	2.5'	2.0'	M.L. RETAINER GLAND	#6 @ 6"	#6 @ 6"
12"	2.0'	4.0'	2.0'	M.L. RETAINER GLAND	#6 @ 6"	#6 @ 6"
16"	3.0'	4.5'	2.0'	M.L. RETAINER GLAND	#6 @ 6"	#6 @ 6"
20"	3.5'	5.0'	2.0'	M.L. RETAINER GLAND	#6 @ 6"	#6 @ 6"
24"	4.5'	5.5'	2.0'	M.L. RETAINER GLAND	#7 @ 6"	#7 @ 10"
30"	6.5'	6.0'	2.5'	4.5" X 1.0" WELD-ON	#8 @ 6"	#8 @ 10"
36"	7.5'	7.0'	2.5'	4.7" X 1.0" WELD-ON	#8 @ 6"	#8 @ 10"
42"	8.5'	8.0'	3.0'	5.0" X 1.25" WELD-ON	#8 @ 6"	#8 @ 10"

ALL RETAINER GLANDS SHALL BE MEGA-LUG

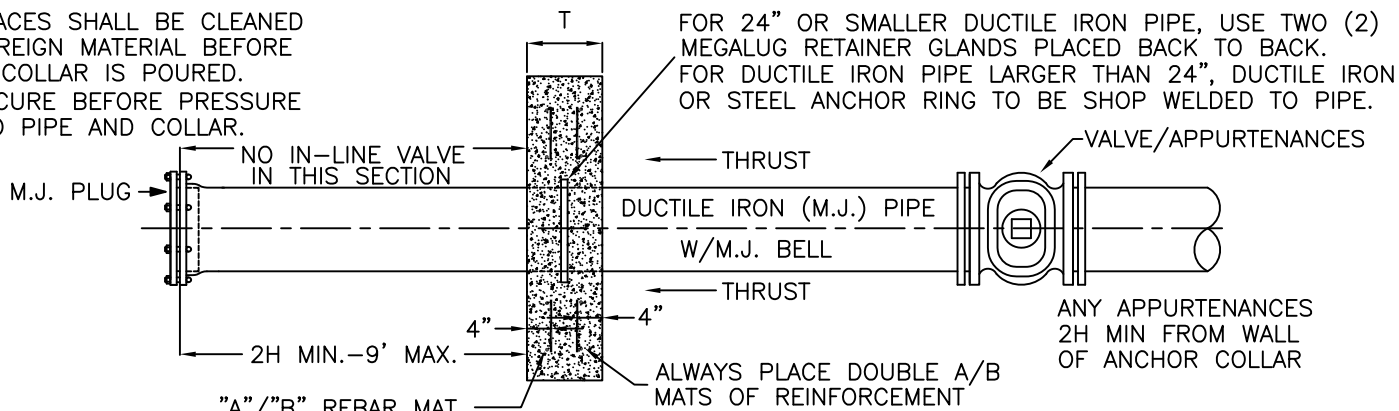
 WELD-ON THRUST RING SHALL BE DUCTILE IRON OR STEEL

 WELD ON THRUST RING SHALL BE DESIGNED FOR 250 PSI WORKING PRESSURE AND 375 PSI TEST PRESSURE.



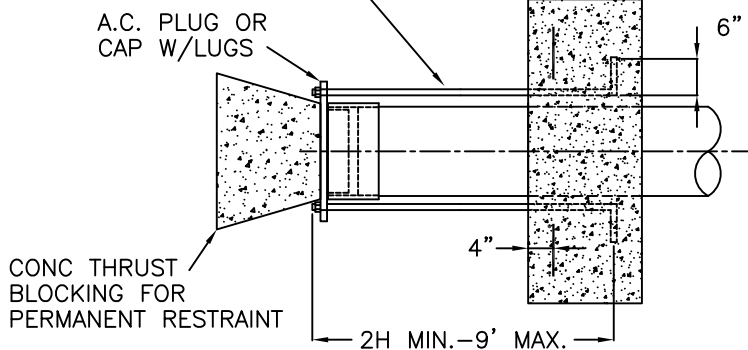
ANCHOR COLLAR (ELEVATION)

NOTE:
 PIPE SURFACES SHALL BE CLEANED OF ALL FOREIGN MATERIAL BEFORE CONCRETE COLLAR IS POURED.
 72 HOUR CURE BEFORE PRESSURE APPLIED TO PIPE AND COLLAR.

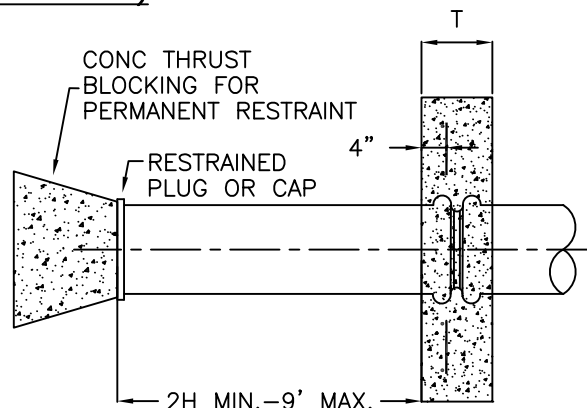


DUCTILE IRON PIPE (TOP VIEW)

ALL THREAD RODS FOR TEMPORARY RESTRAINT SIZE AND NUMBER AS SPECIFIED BY ENGINEER



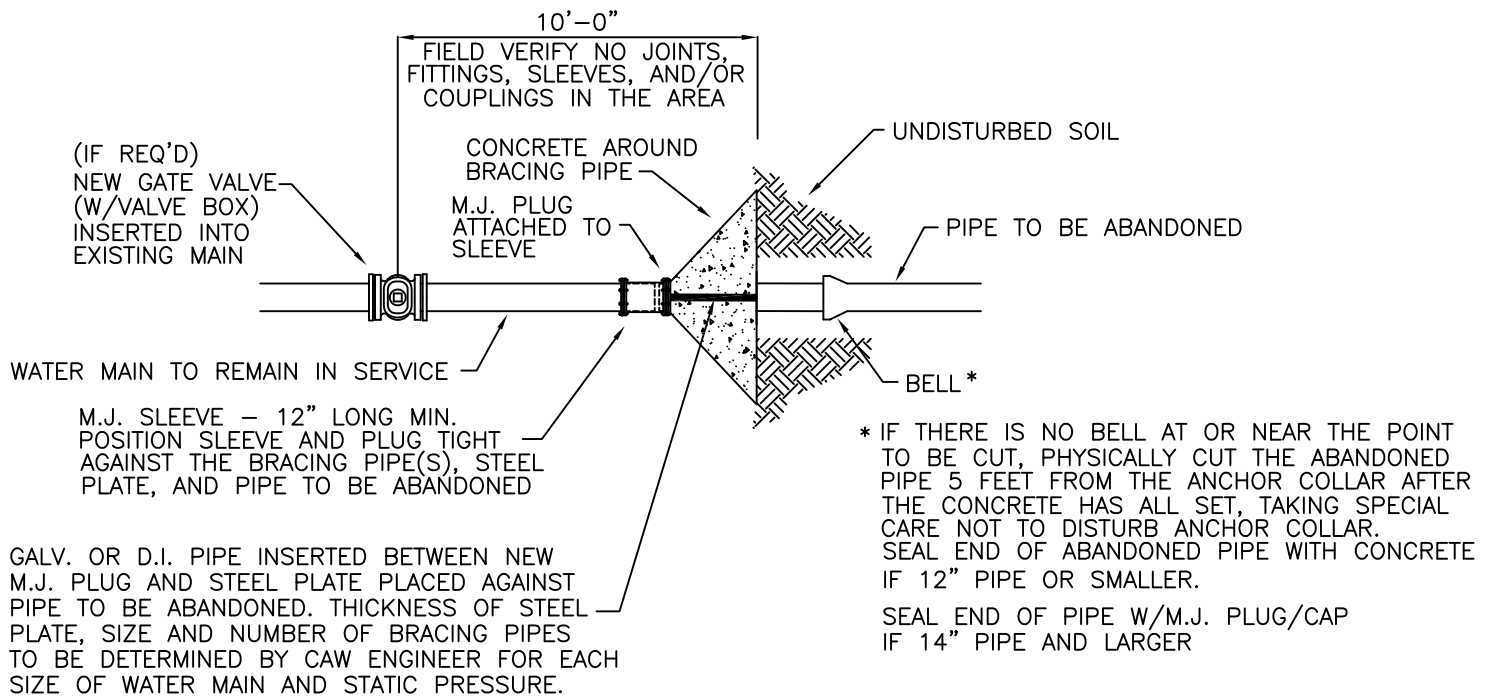
ASBESTOS CEMENT PIPE ANCHOR COLLAR DETAIL



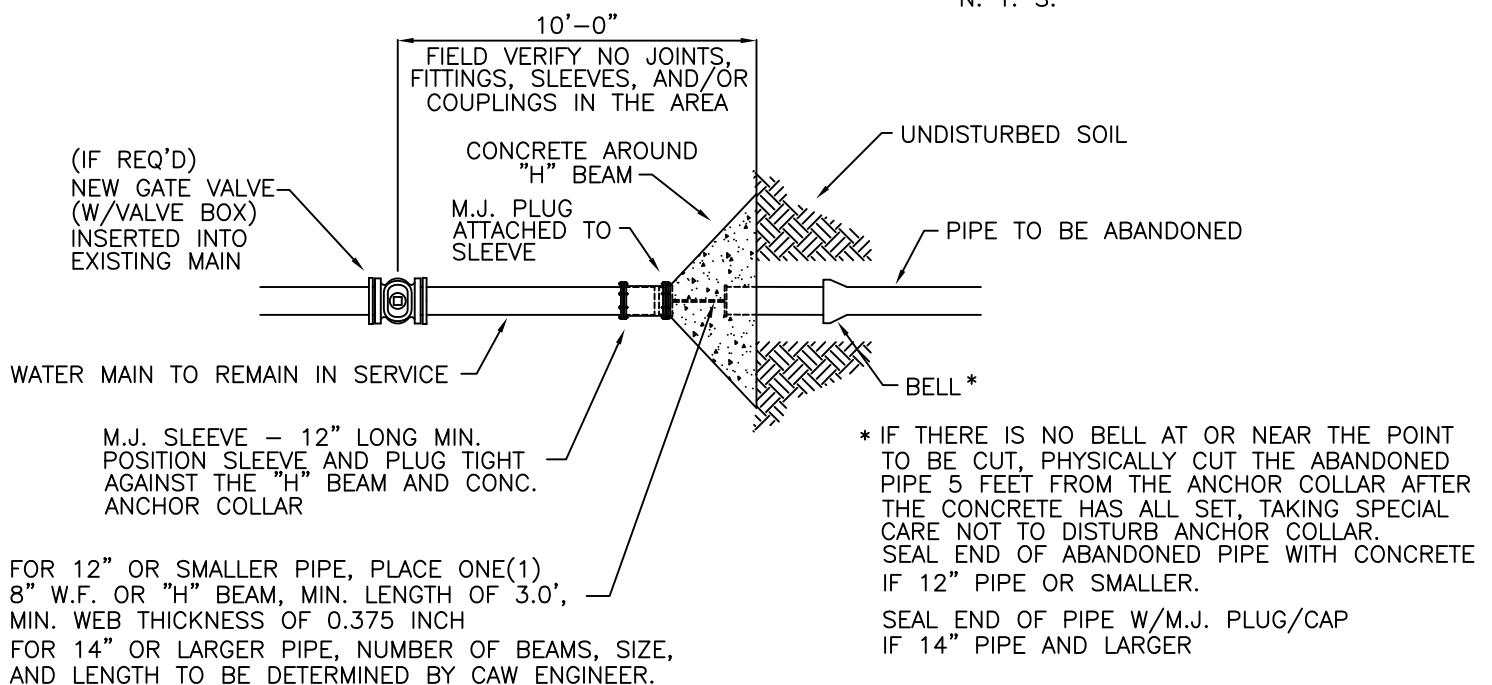
CONCRETE PIPE-PRECAST KEY

NOTES:

1. NEW VALVE SHALL BE INSTALLED ONLY IF SHOWN IN THE CONSTRUCTION PLAN.
2. IF WATER MAIN CAN BE TEMPORARILY SHUT DOWN, NEW INSERTED VALVE SHALL BE CUT IN BY CONTRACTOR.
3. IF WATER MAIN CAN NOT BE TEMPORARILY SHUT DOWN PRIOR TO CUT AND PLUG, NEW INSERTED VALVE SHALL BE INSTALLED BY C.A.W. USING HYDRO-TAP METHOD.
4. SEE C.A.W. STANDARD DETAILS FOR MINIMUM DIMENSIONS OF ANCHOR COLLAR.

STANDARD CUT AND PLUG DETAIL NO. 1

N. T. S.



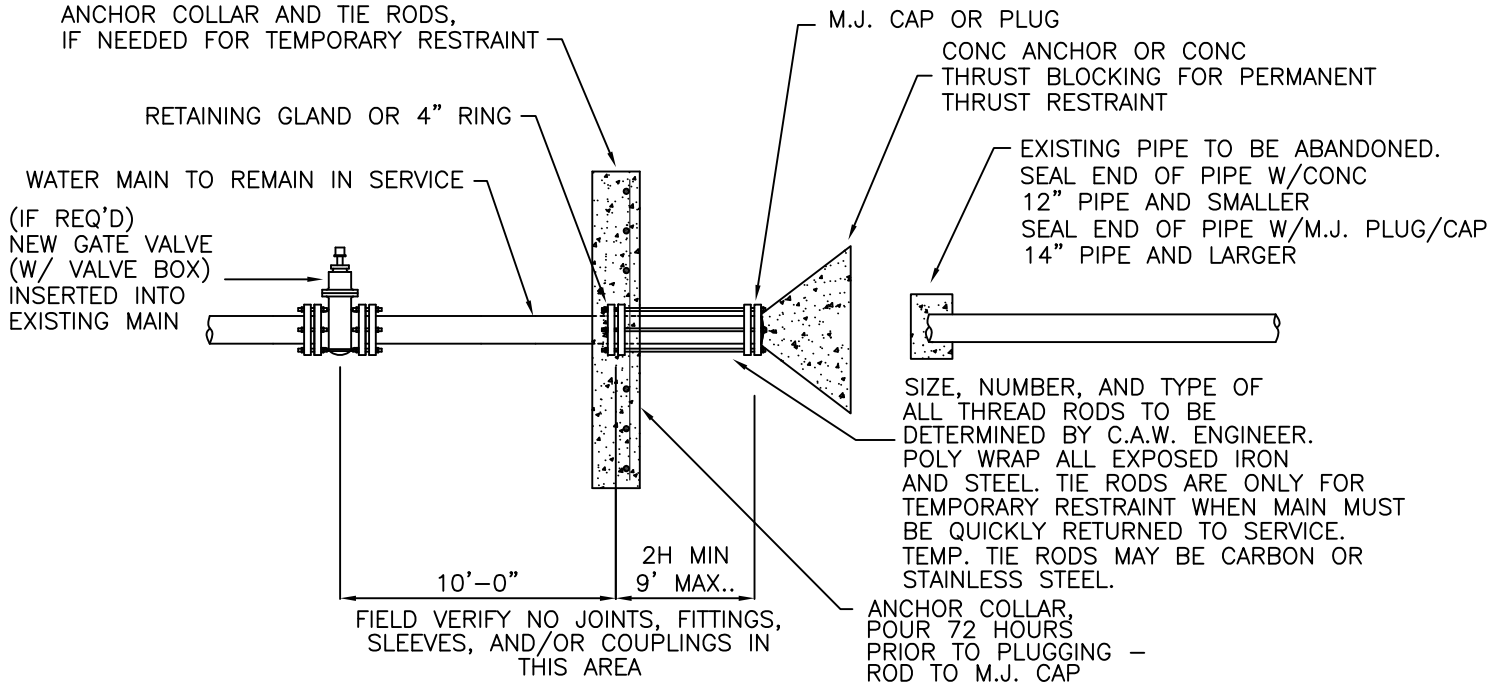
TORCH WILL BE NEEDED TO MODIFY
H-BEAM IN FIELD TO ACCOMMODATE
PROTRUSION OF BOLTS.

STANDARD CUT AND PLUG DETAIL NO. 2

N. T. S.

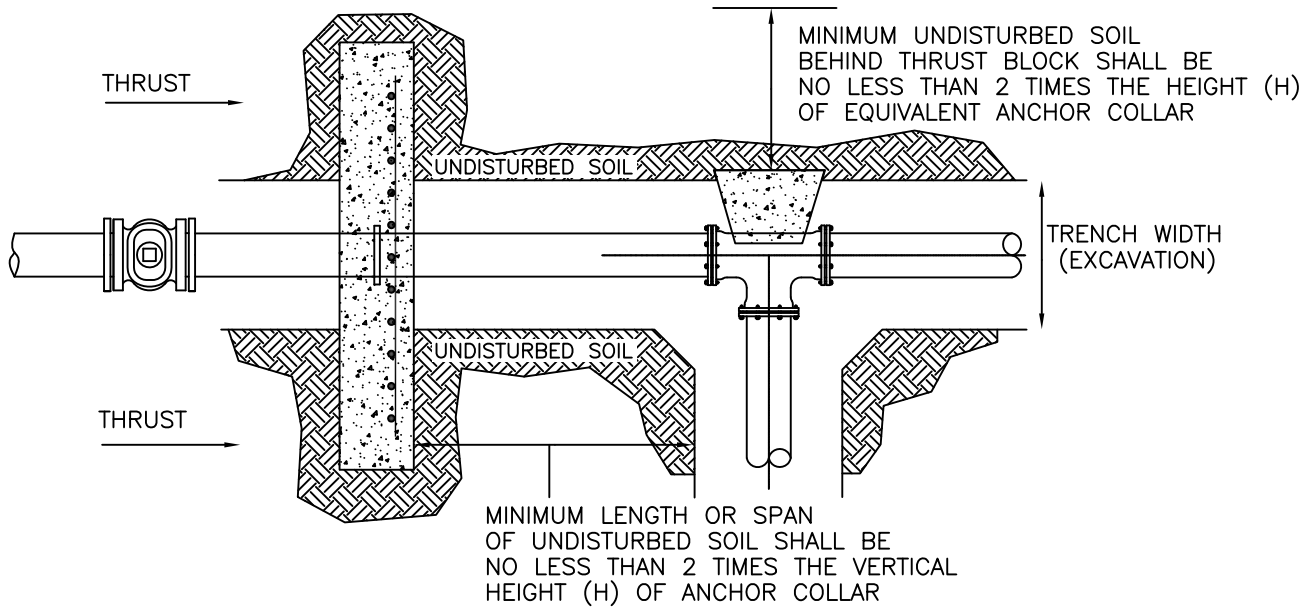
NOTES:

1. NEW VALVE SHALL BE INSTALLED ONLY IF SHOWN IN THE CONSTRUCTION PLAN.
2. IF WATER MAIN CAN BE TEMPORARILY SHUT DOWN, NEW INSERTED VALVE SHALL BE CUT IN BY CONTRACTOR.
3. IF WATER MAIN CAN NOT BE TEMPORARILY SHUT DOWN PRIOR TO CUT AND PLUG, NEW INSERTED VALVE SHALL BE INSTALLED BY C.A.W. USING HYDRO-TAP METHOD.
4. SEE C.A.W. STANDARD DETAILS FOR MINIMUM DIMENSIONS OF ANCHOR COLLAR.



ALTERNATE CUT AND PLUG DETAIL

TO BE USED ONLY UPON WRITTEN APPROVAL FROM C.A.W.
N. T. S.

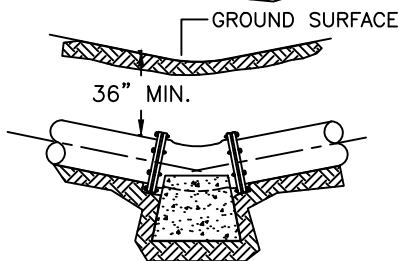
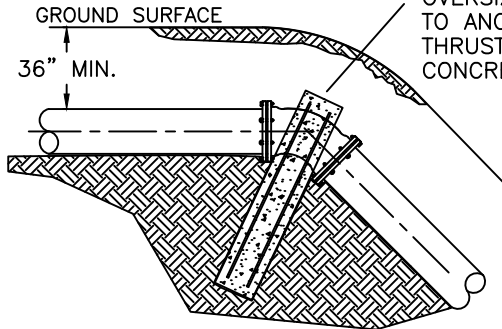


MINIMUM UNDISTURBED SOIL BEHIND ANCHOR COLLAR / THRUST BLOCK

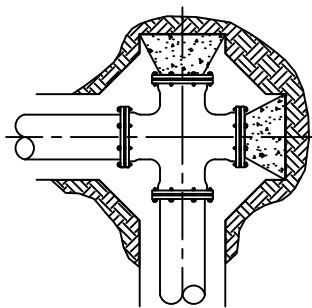
PLAN VIEW

ALLOWED BY C.A.W. ENG..
IN WRITING ONLY

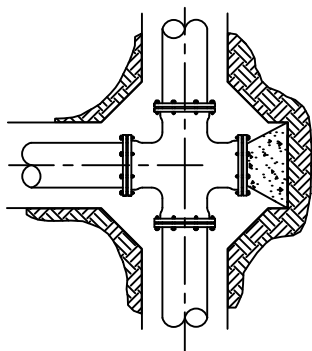
CONC ANCHOR COLLAR
AS PER STANDARD DETAIL.
OVERSIZED AS NECESSARY
TO ANCHOR AGAINST THE APPLIED
THRUST BY WEIGHT OF
CONCRETE ALONE.



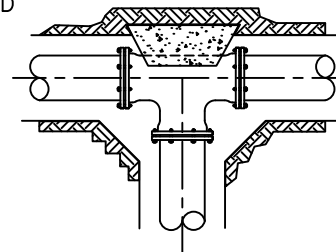
TYPICAL BLOCKING
FOR VERTICAL BENDS



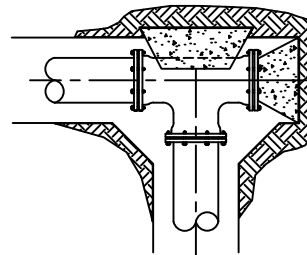
TYPICAL SECTION OF CROSS & 2 PLUG BLOCKING
(WHEN DIRECTED BY ENGINEER)



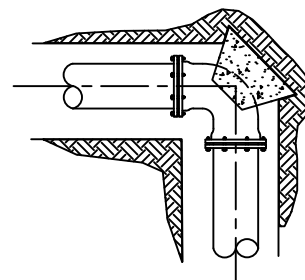
TYPICAL SECTION OF CROSS & PLUG BLOCKING
(WHEN DIRECTED BY ENGINEER)



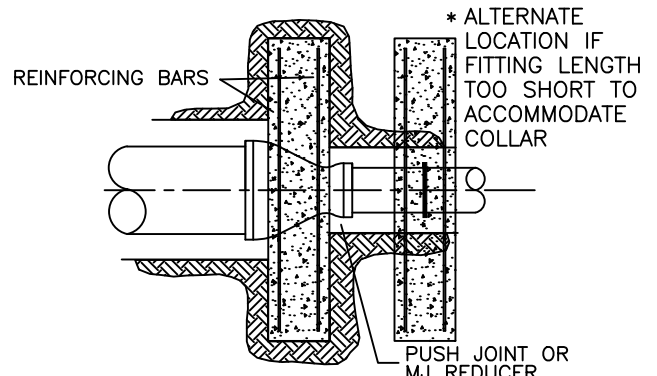
BLOCKING FOR TEE



* SPECIAL BLOCKING OF TEE & PLUG
(WHEN DIRECTED BY ENGINEER)



TYPICAL BLOCKING
FOR HORIZONTAL BENDS

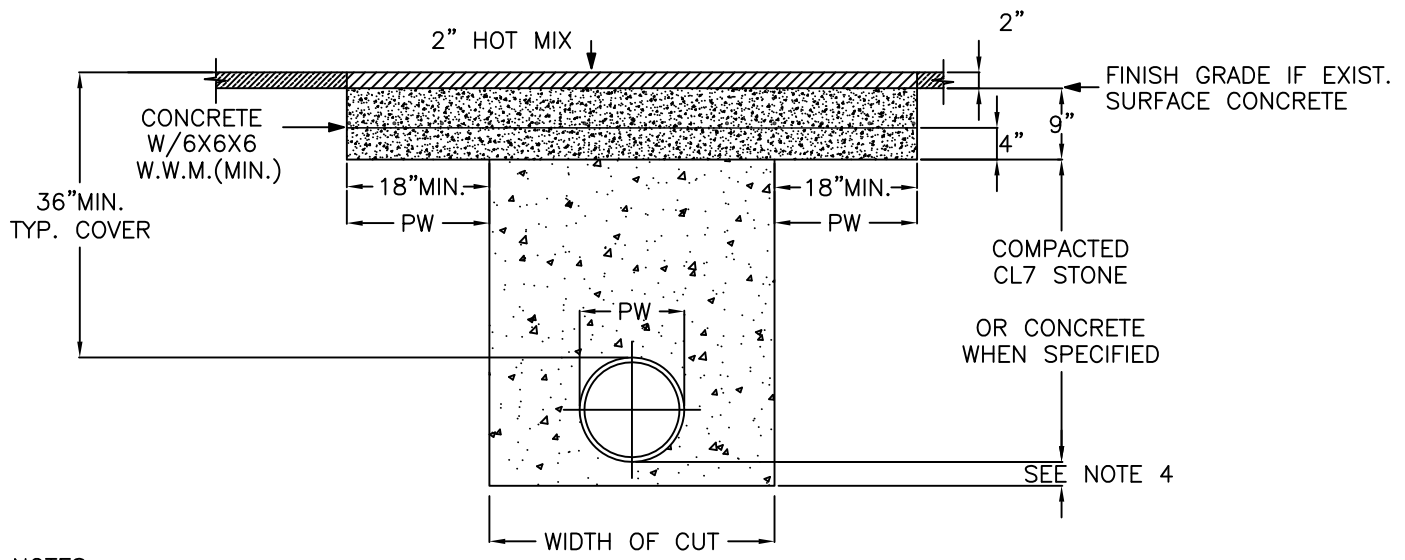


THRUST SUPPORT FOR REDUCER
(SIZE TO BE DETERMINED BY ENGINEER)

NOTES ON THRUST BLOCKING

1. ALL BLOCKING SHALL BE AGAINST UNDISTURBED SOIL.
2. * WHERE SOIL CONDITIONS MAKE IT NECESSARY TO POUR CONCRETE OVER JOINTS, THE ENDS OF THE ADJACENT PIPES MUST HAVE A THRUST BLOCK TO RESIST MOVEMENT OF THESE JOINTS.
3. WEIGHT CALCULATIONS TO BE BASED ON THRUST DUE TO STATIC PRESSURE + 50% OR TEST PRESSURE, WHICH EVER IS GREATER. ($THRUST = 2AP \sin(\phi/2)$ WHERE A = AREA OF PIPE P = WATER PRESSURE)
4. WHEN BLOCKING AGAINST PLUG, PLUG SHALL BE COVERED TO PREVENT BONDING OF CONCRETE.
5. WHERE SHEAR BECOMES A PROBLEM PROPER REINFORCING MUST BE INSTALLED INTO THE BLOCKING.
6. CLEARANCE SHALL BE A MINIMUM OF 6" BETWEEN PIPE AND OBSTRUCTIONS.
7. CLEARANCE ON PIPES BELONGING TO OIL/GAS COMPANIES SHALL BE 18" UNLESS SPECIAL PERMISSION IS GIVEN BY THESE COMPANIES.

STANDARD THRUST BLOCKING

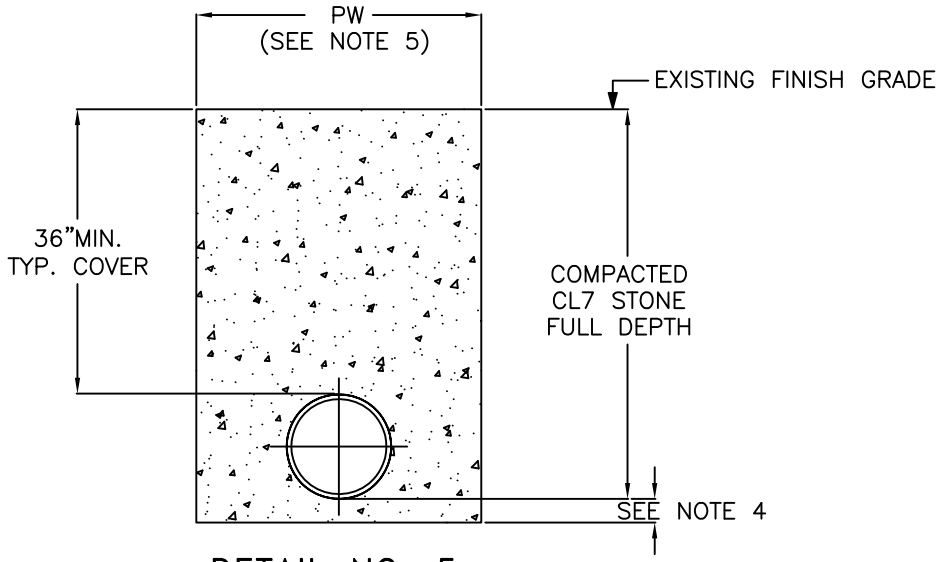


NOTES:

1. MATERIAL TO MEET OR EXCEED ARKANSAS HIGHWAY COMMISSION SPECIFICATIONS.
2. REFER TO BEDDING & BACKFILL DETAILS FOR PVC PIPE BEDDING REQUIREMENTS WITH SAND OR #67 STONE.
3. DO NOT PLACE CLASS 7 STONE AGAINST PVC PIPE; IF PVC PIPE ENCAPSULATE PVC WITH #67 STONE.
4. PLACE 6"-9" OF SELECT GRANULAR RIVER SAND OR #67 STONE FOR ALL PIPE LAID IN HARD ROCK.
5. PW: PAYABLE WIDTH FOR PAVEMENT REPAIR. ANY TRENCH WIDTH EXCEEDING PW DIMENSION IS A NON PAY ITEM, BUT MUST BE BACKFILLED AS PER DETAIL.

TYPICAL SECTION OF REPAIR FOR UTILITY CUT ON STATE HIGHWAY

DETAIL NO. 1

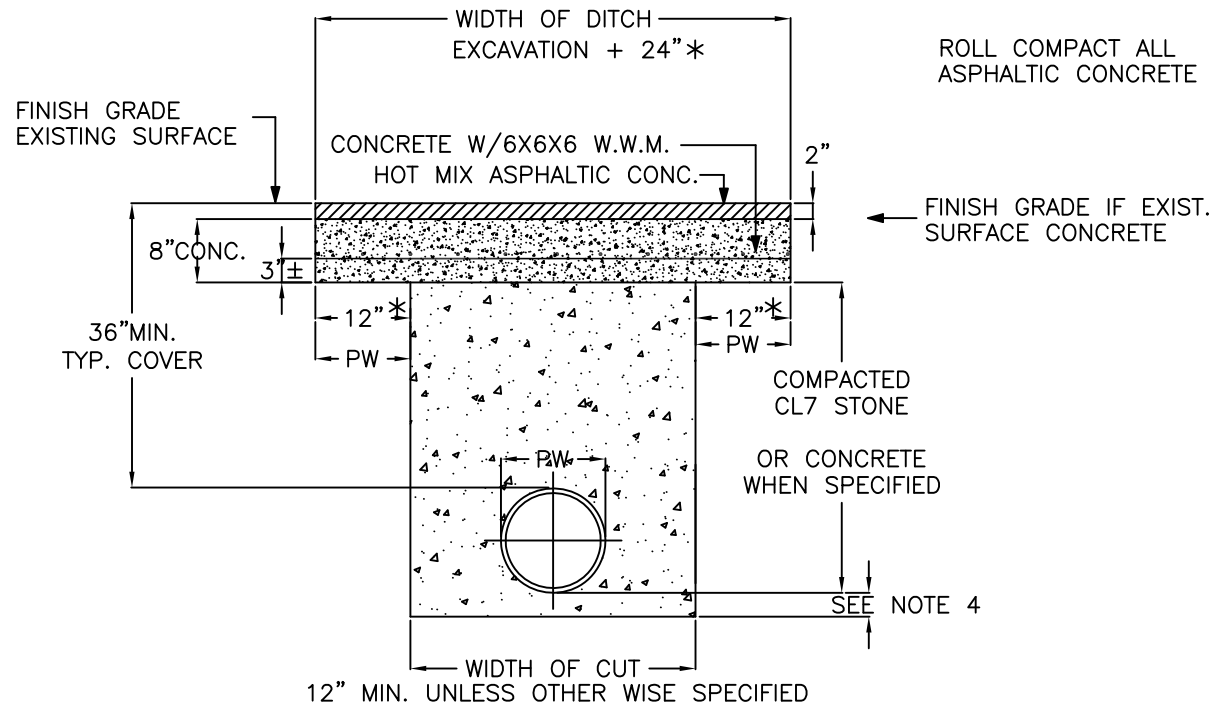


DETAIL NO. 5

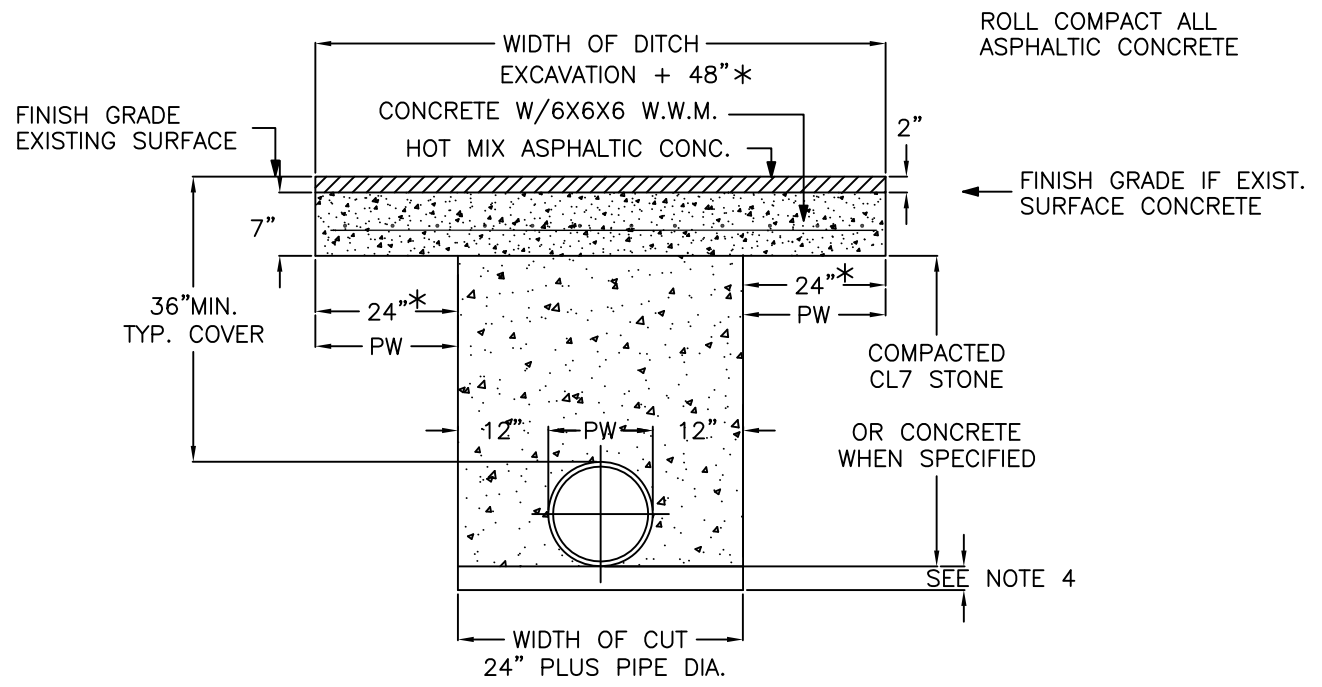
NOTES:

1. MATERIAL TO MEET OR EXCEED ARKANSAS HIGHWAY COMMISSION SPECIFICATIONS.
2. REFER TO BEDDING & BACKFILL DETAILS FOR PVC PIPE BEDDING REQUIREMENTS WITH SAND OR #67 STONE.
3. DO NOT PLACE CLASS 7 STONE AGAINST PVC PIPE; IF PVC PIPE ENCAPSULATE PVC WITH #67 STONE.
4. PLACE 6"-9" OF SELECT GRANULAR RIVER SAND OR #67 STONE FOR ALL PIPE LAID IN HARD ROCK.
5. PW: PAYABLE WIDTH FOR PAVEMENT REPAIR AS DEFINED IN SECTION 39.3.20. ANY TRENCH WIDTH EXCEEDING PW DIMENSION IS A NON PAY ITEM, BUT MUST BE BACKFILLED AS PER DETAIL.

UNIMPROVED GRAVEL ROADS, STREETS, ALLEYS, DRIVEWAYS AND PARKING LOTS



DETAIL NO. 2A
CITY STREET

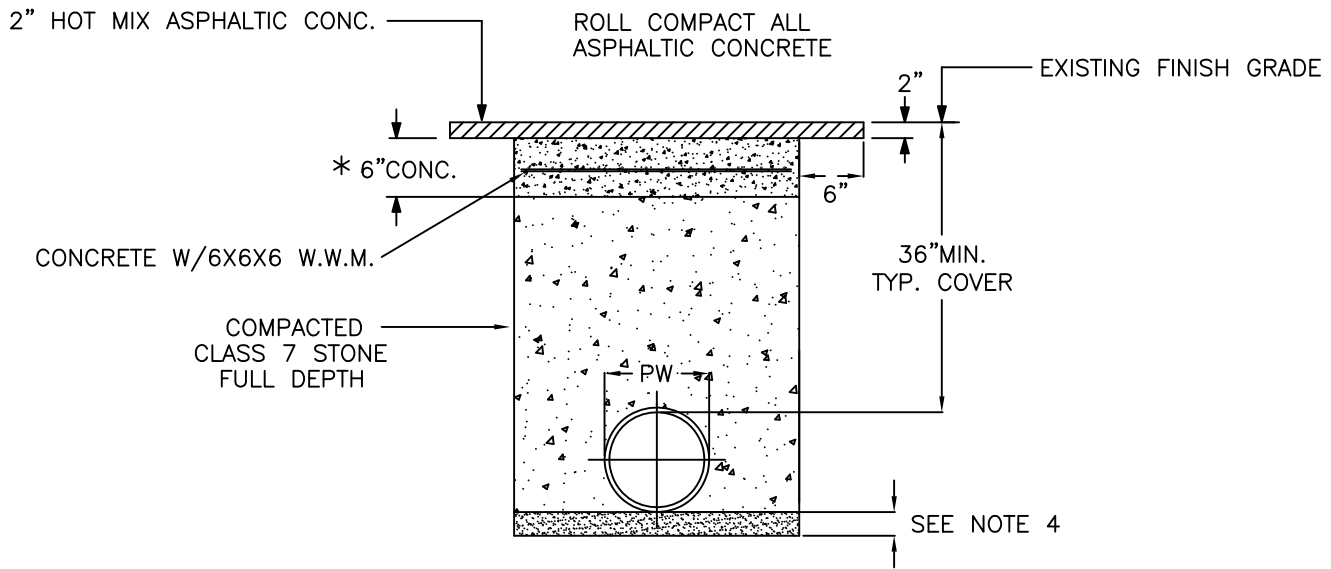


DETAIL NO. 2B
COUNTY ROAD

NOTES:

1. MATERIAL TO MEET OR EXCEED ARKANSAS HIGHWAY COMMISSION SPECIFICATIONS.
 2. REFER TO BEDDING & BACKFILL DETAILS FOR PVC PIPE BEDDING REQUIREMENTS WITH SAND OR #67 STONE.
 3. DO NOT PLACE CLASS 7 STONE AGAINST PVC PIPE; IF PVC PIPE ENCAPSULATE PVC WITH #67 STONE.
 4. PLACE 6"-9" OF SELECT GRANULAR RIVER SAND OR #67 STONE FOR ALL PIPE LAID IN HARD ROCK.
 5. PW: PAYABLE WIDTH FOR PAVEMENT REPAIR. ANY TRENCH WIDTH EXCEEDING PW DIMENSION IS A NON PAY ITEM, BUT MUST BE BACKFILLED AS PER DETAIL.
- * INCREASE EACH SIDE IN UNSTABLE SOIL CONDITIONS AS DIRECTED BY THE ENGINEER.

TRENCH WIDTH 12" AND GREATER IMPROVED COUNTY & CITY ROAD SURFACES

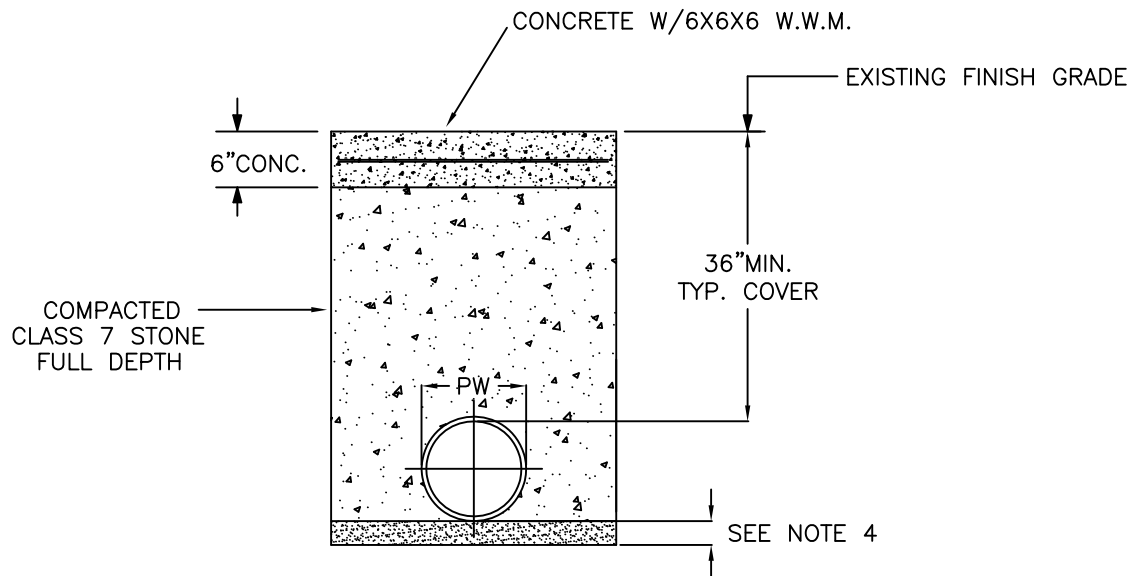


DETAIL NO. 4A

NOTES:

1. MATERIAL TO MEET OR EXCEED ARKANSAS HIGHWAY COMMISSION SPECIFICATIONS.
 2. REFER TO BEDDING & BACKFILL DETAILS FOR PVC PIPE BEDDING REQUIREMENTS WITH SAND OR #67 STONE.
 3. DO NOT PLACE CLASS 7 STONE AGAINST PVC PIPE; IF PVC PIPE ENCAPSULATE PVC WITH #67 STONE.
 4. PLACE 6"–9" OF SELECT GRANULAR RIVER SAND OR #67 STONE FOR ALL PIPE LAID IN HARD ROCK.
 5. PW: PAYABLE WIDTH FOR PAVEMENT REPAIR. ANY TRENCH WIDTH EXCEEDING PW DIMENSION IS A NON PAY ITEM, BUT MUST BE BACKFILLED AS PER DETAIL.
- * OPTIONAL: WHEN SURFACE IS ASPHALT OR SURFACE TREATMENT, DELETE CONCRETE AND PLACE 6" OF HOT ASPHALTIC CONCRETE BASE COURSE LAID IN 2" LIFTS, COMPACTED.

IMPROVED ALLEYS, DRIVEWAYS AND PARKING LOTS (ASPHALT SURFACE)

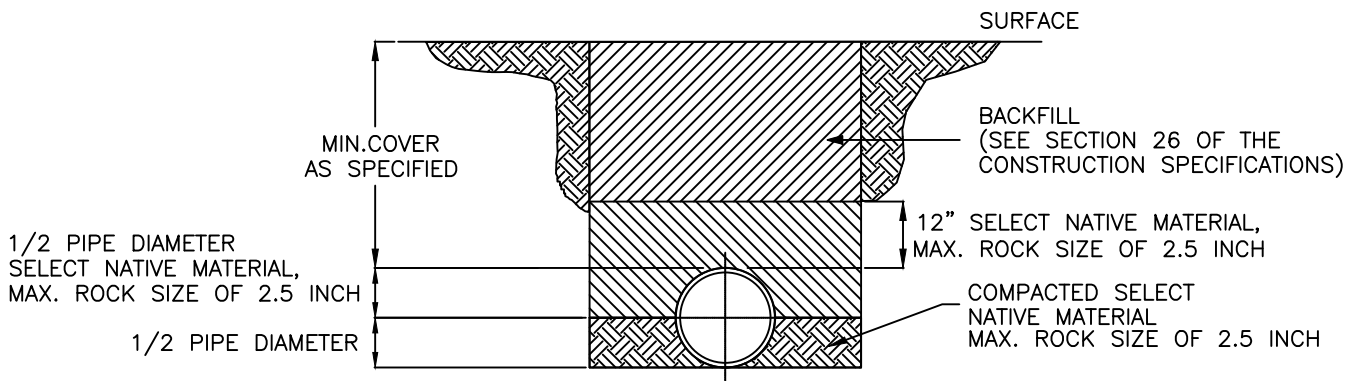


DETAIL NO. 4B

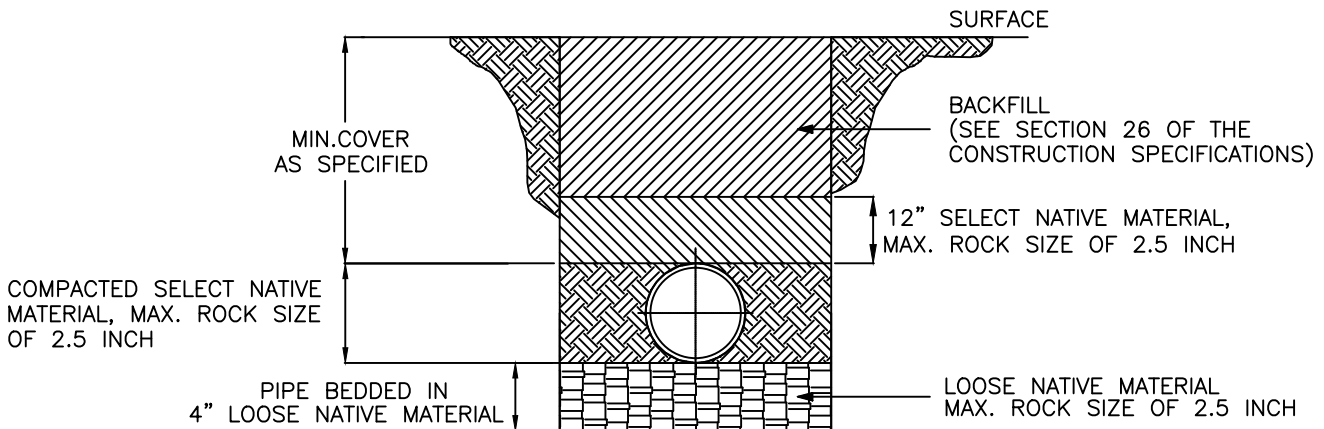
NOTES:

1. MATERIAL TO MEET OR EXCEED ARKANSAS HIGHWAY COMMISSION SPECIFICATIONS.
2. REFER TO BEDDING & BACKFILL DETAILS FOR PVC PIPE BEDDING REQUIREMENTS WITH SAND OR #67 STONE.
3. DO NOT PLACE CLASS 7 STONE AGAINST PVC PIPE; IF PVC PIPE ENCAPSULATE PVC WITH #67 STONE.
4. PLACE 6"–9" OF SELECT GRANULAR RIVER SAND OR #67 STONE FOR ALL PIPE LAID IN HARD ROCK.
5. PW: PAYABLE WIDTH FOR PAVEMENT REPAIR. ANY TRENCH WIDTH EXCEEDING PW DIMENSION IS A NON PAY ITEM, BUT MUST BE BACKFILLED AS PER DETAIL.

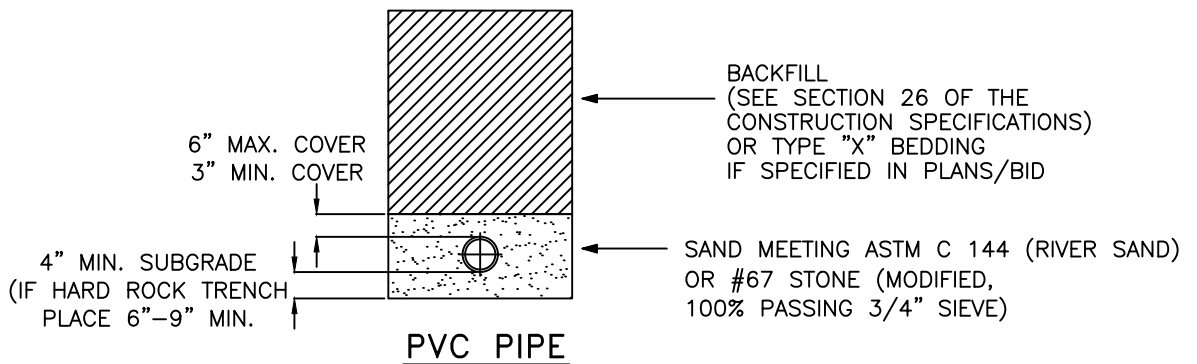
IMPROVED ALLEYS, DRIVEWAYS AND PARKING LOTS (CONCRETE SURFACE)



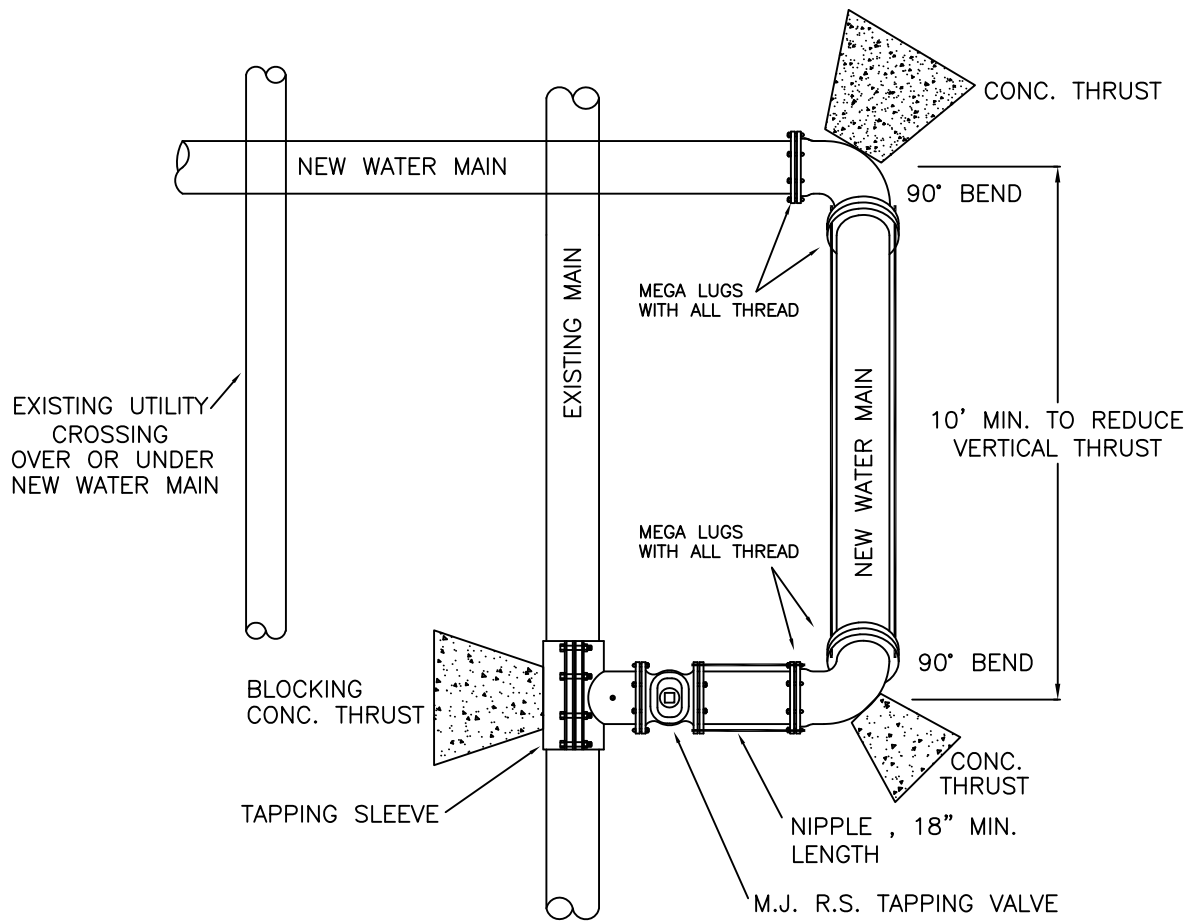
**TYPE 2 BEDDING
FOR D.I.P.**



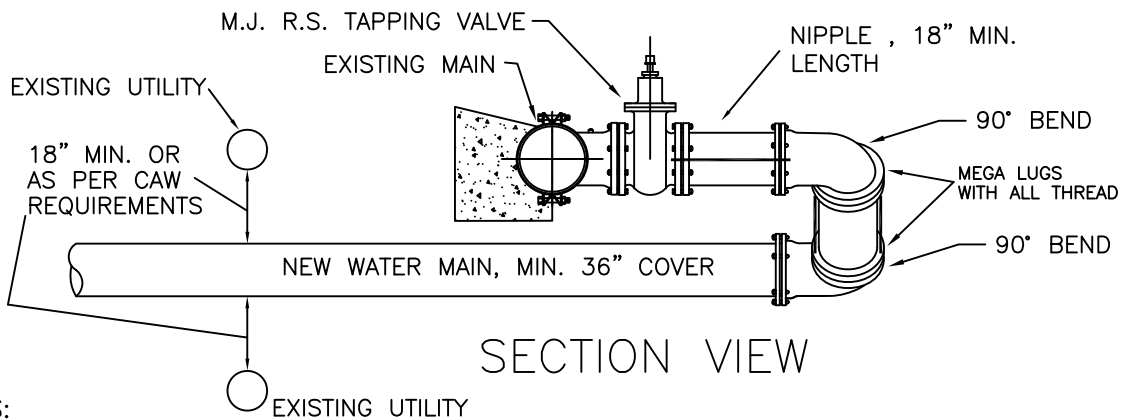
**TYPE 3 BEDDING
FOR D.I.P.**



BEDDING & BACKFILL DETAILS



PLAN VIEW



SECTION VIEW

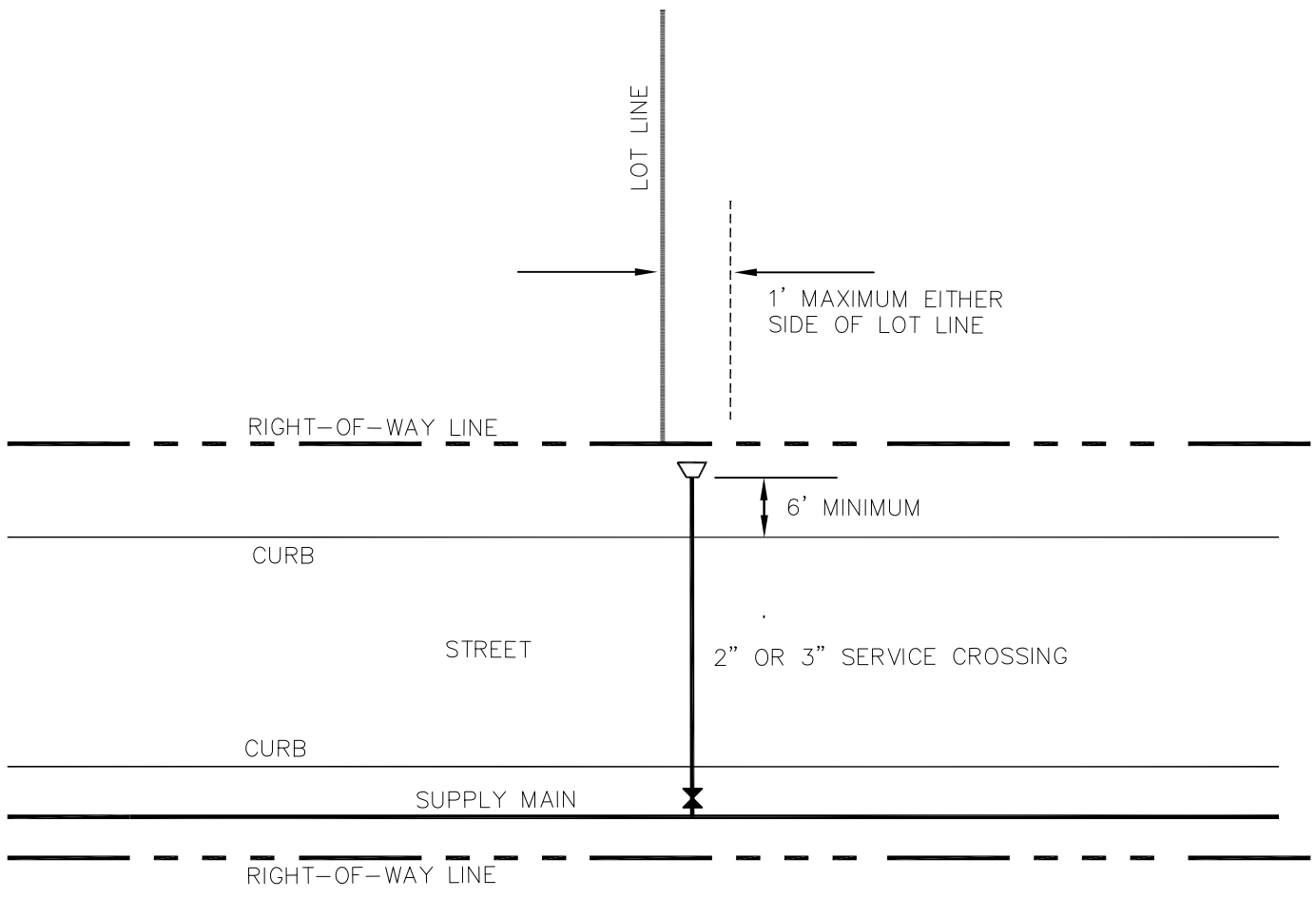
NOTES:

1. CONTRACTOR SHALL LOCATE EXISTING MAIN IN ADVANCE OF LAYING NEW LINE IN ORDER TO ASSURE ADEQUATE LENGTH TO ADJUST DEPTH OF NEW MAIN.
2. DIMENSIONS SHOWN ARE RECOMMENDED MINIMUMS TO PROVIDE ADEQUATE ROOM FOR TIGHTENING BOLTS ON JOINTS. (OTHER DIMENSIONS MAY BE USED)
3. USE TIE RODS IF ADEQUATE THRUST BLOCKING AGAINST UNDISTURBED SOIL IS NOT POSSIBLE.
4. ALL TIE RODS AND NUTS FOR PERMANENT PLACEMENT SHALL BE SERIES 300 STAINLESS STEEL. USE 3/4" RODS FOR 6" THRU 24". USE 1" RODS FOR 30" THRU 36". USE 1 1/4" RODS FOR 42" THRU 48".
5. RODS SHALL BE FIELD CUT TO FIT & SHALL BE PROTECTED WITH POLYWRAP.
6. ROTATE TEE UP & ELBOW DOWN AS REQUIRED TO MATCH.

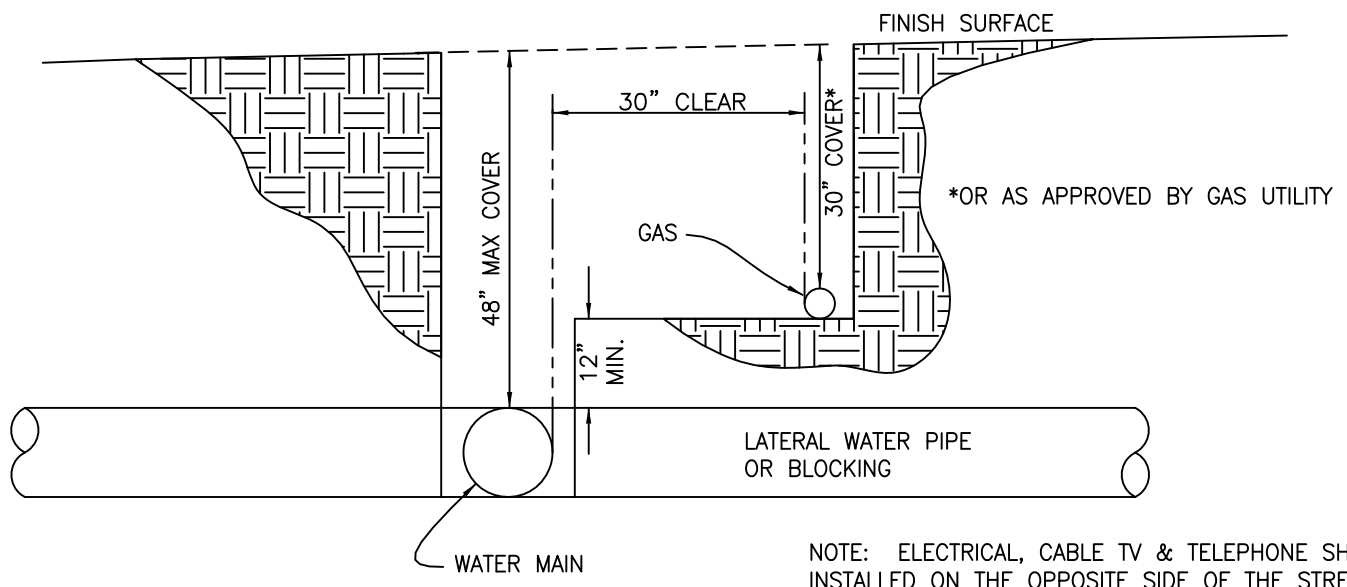
225 PSI
SERIES 300
STAINLESS
STEEL

PIPE SIZE	6"	8"	10"	12"	16"	20"	24"	30"	36"	42"	48"
RODS / NIPPLE	2	2	4	4	8	12	16	14	18	16	20

BACKSIDE TAP SWING CONNECTION



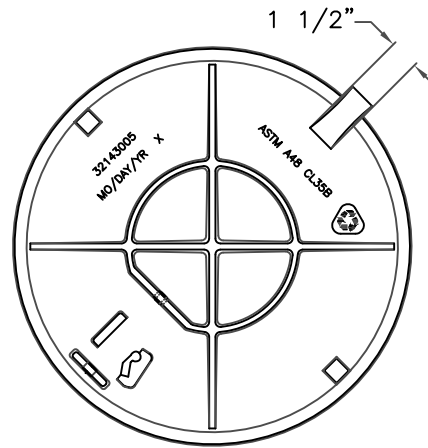
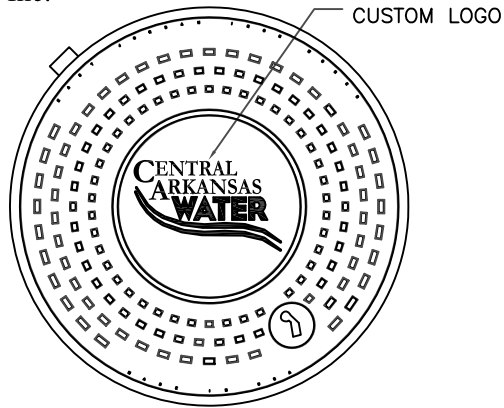
2" & 3" SERVICE STREET CROSSING LOCATION



SHARED TRENCH OPTION FOR WATER AND GAS MAINS

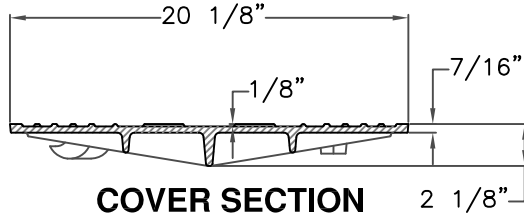
TYPICAL SECTION

Manufacturer
East Jordan Iron Works, Inc.
P.O.Box 439
East Jordan, MI 49727
1-800-874-4100
Fax 231-536-4458



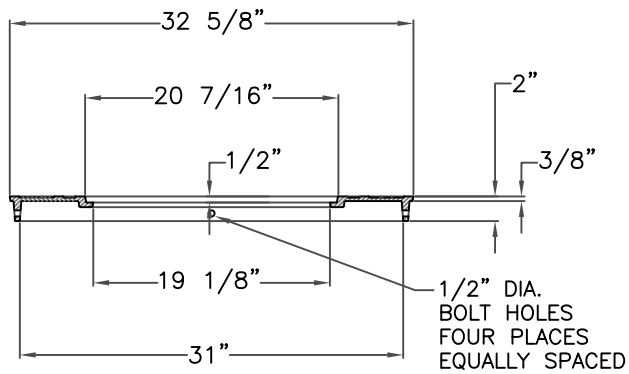
BOTTOM VIEW

PRODUCT NO. 32143005RING
COVER - GRAY IRON
ASTM A48 CL35B
ESTIMATED WEIGHT
COVER - 42LBS 19kg
LOAD RATING - NON TRAFFIC

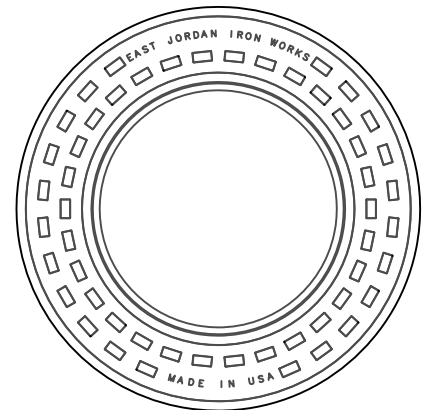


COVER SECTION

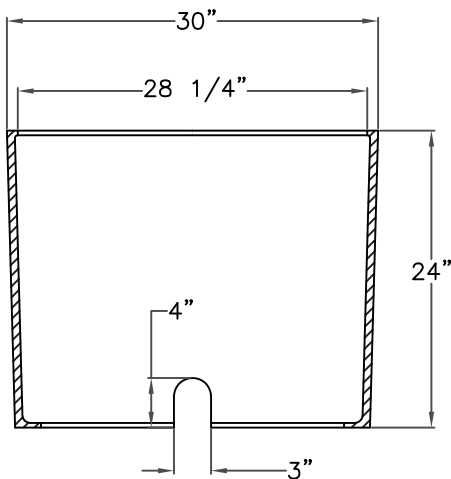
1-1/2", 2", 3", 4" - METER BOX LID



RING SECTION



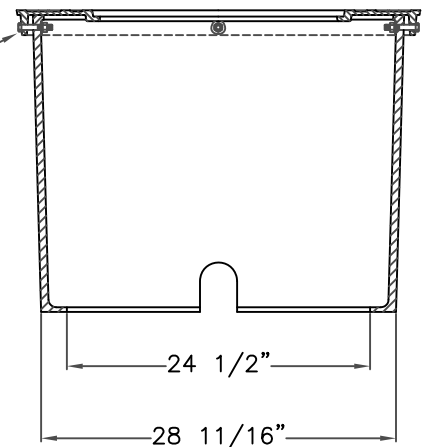
RING TOP VIEW



BOX SECTION

7/16"-14
X 2.00"
HEX BOLT
FLAT WASHER
LOCK WASHER
HEX NUT
4 PLACES

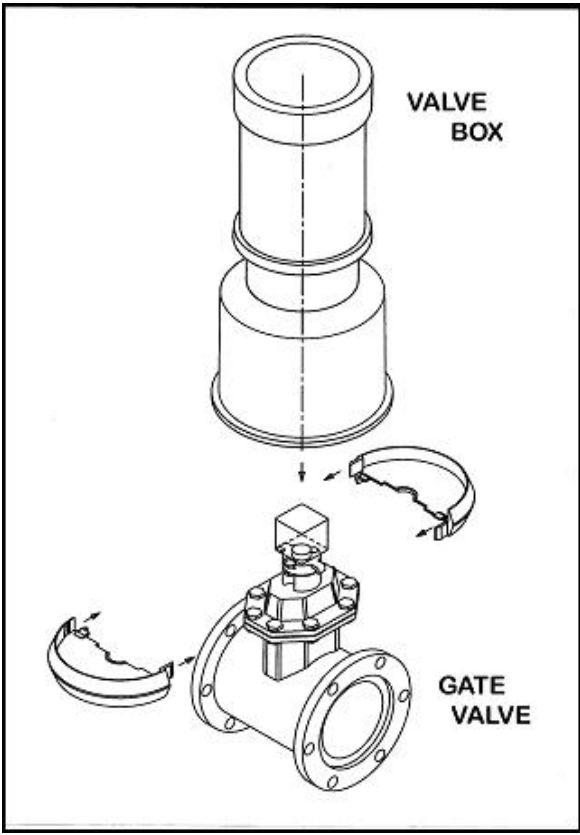
PRODUCT NO. 38543224
RING - GRAY IRON
ASTM A48 CL35B
BOX - PLASTIC
ESTIMATED WEIGHT
RING - 65LBS 30kg
PLASTIC BOX 30LBS 14kg
MISC PARTS - 1LB 1kg



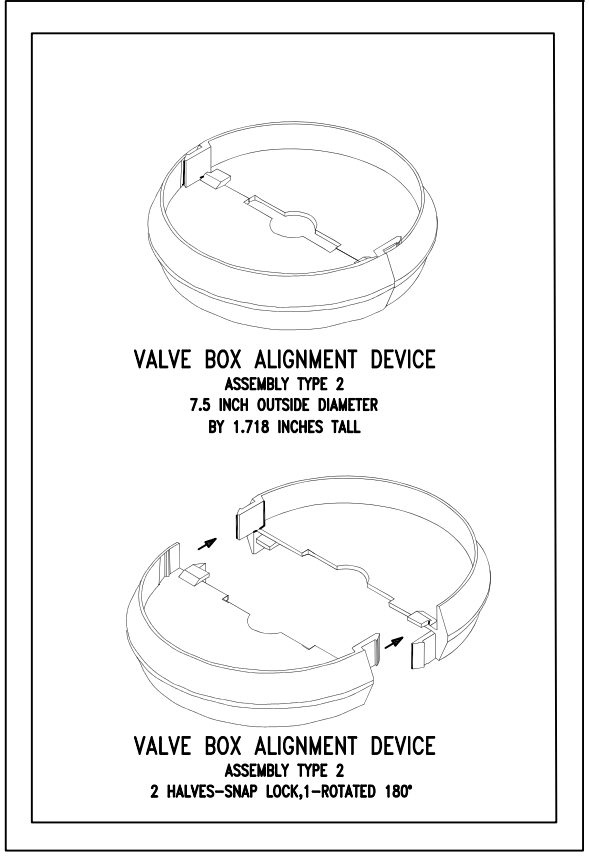
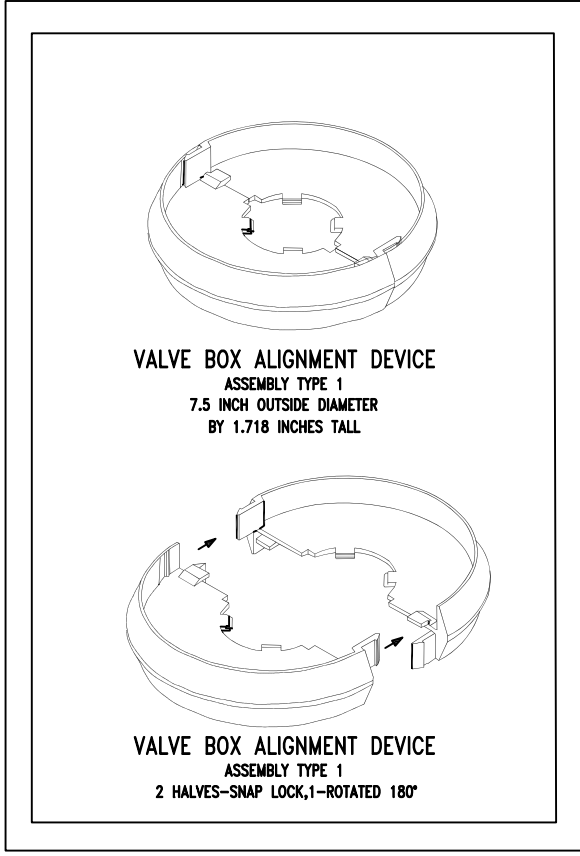
1-1/2", 2", 3", 4" - METER BOX & LID RING

BOXLOK

VALVE BOX ALIGNMENT DEVICE TYPE NUMBERS



Valve Size (inches)	2"	3"	4"	6"	8"	10"	12"
AFC	2	2	2	2	2	1	1
AVK	1	1	1	1	1	1	1
Clow	2	2	2	2	2	2	1-CLOW
Kennedy	2	2	2	2	2	2	--
M&H	2	2	2	2	2	2	--
Mueller	2	2	2	2	2	2	1
Waterous	1	1	1	1	1	1	--
US Pipe (pre 2006)	1	1	1	1	1	1	1
US Pipe (after 2006)	2	2	2	2	2	2	2



THRUST BLOCK/ANCHOR COLLAR AS-BUILT RECORD FORM

CAW PROJECT NO. : _____ DATE AND TIME : _____

JOB DESC : _____ SUPV : _____ COORD : _____

PIPE DIA. & TYPE : _____ TYPE OF FITTING : _____

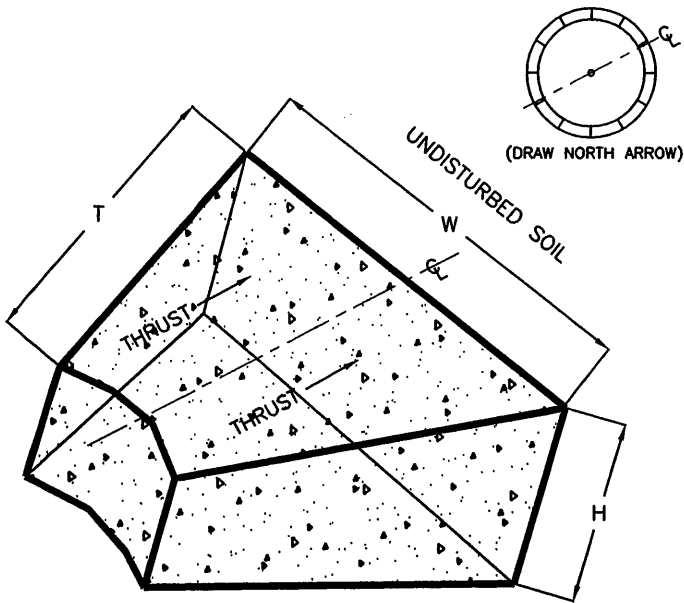
LOCATION (STA. NO., INTERSECTION, FEATURE LOCATE) : _____

TONS OF THRUST : _____ SOIL TYPE : _____

*REQUIRED LOAD BEARING AREA (S.F.) :

*(SEE OTHER SIDE FOR SAFE BEARING AREA TABLES)

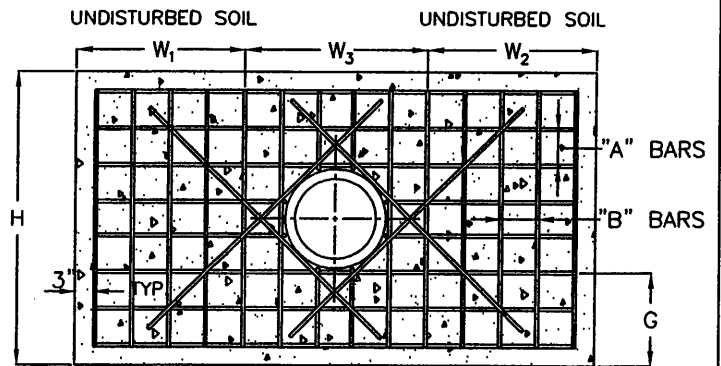
THRUST BLOCK AS-BUILT



ISOMETRIC

W = _____	FT
H = _____	FT
T = _____	FT

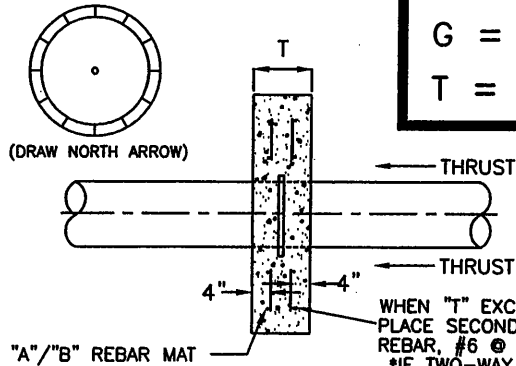
ANCHOR COLLAR AS-BUILT



ELEVATION

"A" BARS = # _____ @ _____"
"B" BARS = # _____ @ _____"

W ₁ = _____	FT
W ₂ = _____	FT
W ₃ = _____	FT
H = _____	FT
G = _____	FT
T = _____	FT



PLAN

WHEN "T" EXCEEDS 1.5',
PLACE SECOND MAT OF
REBAR, #6 @ 12" O.C.E.W.
*IF TWO-WAY THRUST SEE
STANDARD DETAILS FOR
ADDITIONAL REQUIREMENTS.

NOTES ON THRUST BLOCKING

1. ALL BLOCKING SHALL BE AGAINST UNDISTURBED HAND DUG SOIL.
2. WHERE SOIL CONDITIONS MAKE IT NECESSARY TO POUR CONCRETE OVER JOINTS, THE ENDS OF THE ADJACENT PIPES MUST HAVE A THRUST BLOCK TO RESIST MOVEMENT OF THESE JOINTS.
3. WHERE SHEAR BECOMES A PROBLEM PROPER REINFORCING MUST BE INSTALLED INTO THE BLOCKING.
4. CLEARANCE SHALL BE A MINIMUM OF 6" BETWEEN PIPE AND OBSTRUCTIONS.
5. CLEARANCE ON PIPES BELONGING TO OIL/GAS COMPANIES SHALL BE 18" UNLESS SPECIAL PERMISSION IS GIVEN BY THESE COMPANIES.

(S.F.) SOLID ROCK Suggested Safe Bearing Area at 225 psi TEST Pressure

Fitting / Pipe Dia.	(25 tons / sq. ft.)									
	6"	8"	12"	16"	20"	24"	30"	36"	42"	48"
11 1/4°	1	1	2	3	4	5	7	9	11	14
15°	1	1	2	3	4	5	7	9	11	14
22 1/2°	1	1	2	3	4	5	7	9	11	14
30°	1	1	2	3	4	5	7	9	11	14
45°	1	1	2	3	4	5	7	9	11	14
90°	1	1	2	3	4	5	7	9	11	14
Plug (dead-end)	1	1	2	3	4	5	7	9	11	14

(S.F.) HARD SHALE Suggested Safe Bearing Area at 225 psi TEST Pressure

Fitting / Pipe Dia.	(6 tons / sq. ft.)									
	6"	8"	12"	16"	20"	24"	30"	36"	42"	48"
11 1/4°	1	1	2	3	4	5	7	9	11	14
15°	1	1	2	3	4	5	7	9	11	14
22 1/2°	1	1	2	3	4	5	7	9	11	14
30°	1	1	2	3	4	5	7	10	14	18
45°	1	1	2	3	5	7	11	15	20	26
90°	1	2	3	6	9	12	19	27	37	48
Plug (dead-end)	1	1	3	4	6	9	14	19	26	34

(S.F.) MEDIUM SHALE or DRY CLAY GRAVEL Suggested Safe Bearing Area at 225 psi TEST Pressure

Fitting / Pipe Dia.	(4 tons / sq. ft.)									
	6"	8"	12"	16"	20"	24"	30"	36"	42"	48"
11 1/4°	1	1	2	3	4	5	7	9	11	14
15°	1	1	2	3	4	5	7	9	11	14
22 1/2°	1	1	2	3	4	5	8	12	16	20
30°	1	1	2	3	5	7	11	15	21	27
45°	1	2	3	5	7	10	16	22	30	39
90°	2	3	5	8	13	18	29	41	56	72
Plug (dead-end)	1	2	4	6	9	13	20	29	39	51

(S.F.) SOFT SHALE, DRY SAND or LOAM Suggested Safe Bearing Area at 225 psi TEST Pressure

Fitting / Pipe Dia.	(2 tons / sq. ft.)									
	6"	8"	12"	16"	20"	24"	30"	36"	42"	48"
11 1/4°	1	1	2	3	4	5	8	12	14	16
15°	1	1	2	3	5	7	11	15	21	27
22 1/2°	1	2	3	5	7	10	16	23	31	40
30°	1	2	4	6	10	14	21	30	41	53
45°	2	3	5	9	14	20	31	44	60	78
90°	3	5	9	16	25	36	57	81	111	144
Plug (dead-end)	2	3	7	12	18	26	40	57	78	102

(S.F.) SOFT CLAY Suggested Safe Bearing Area at 225 psi TEST Pressure

Fitting / Pipe Dia.	(1.125 tons / sq. ft.)									
	6"	8"	12"	16"	20"	24"	30"	36"	42"	48"
11 1/4°	1	1	3	4	7	9	14	20	24	28
15°	1	2	3	6	9	12	19	27	37	48
22 1/2°	2	2	5	8	13	18	28	40	54	71
30°	2	3	6	11	17	24	37	53	72	94
45°	3	4	9	16	24	35	55	78	106	139
90°	4	8	16	29	45	64	100	144	196	256
Plug (dead-end)	3	5	12	21	32	46	71	101	139	181

(S.F.) WET CLAY Suggested Safe Bearing Area at 225 psi TEST Pressure

Fitting / Pipe Dia.	(0.55 tons / sq. ft.)									
	6"	8"	12"	16"	20"	24"	30"	36"	42"	48"
11 1/4°	2	2	5	9	13	18	29	41	48	56
15°	2	3	7	11	17	25	38	55	74	97
22 1/2°	3	4	9	16	25	36	57	82	111	145
30°	3	6	12	22	34	48	75	108	147	192
45°	5	8	18	32	50	71	111	160	217	284
90°	9	15	33	59	91	131	205	295	401	524
Plug (dead-end)	6	11	24	42	65	93	145	206	284	371