Construction Standards for the City of Bristol, Tennessee

Adopted: January 8, 2002

Addendum to the Subdivision Regulations
Adopted by the Bristol Tennessee Municipal/Regional Planning Commission
November 19, 2001
# CONSTRUCTION STANDARDS

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I. General Provisions

1. License Requirements

   All Contractors must be licensed by the State of Tennessee for the type of work they will be performing on the project.

2. Shop Drawings

   The Contractor shall submit a minimum of three (3) copies of detailed shop drawings to the City for all material that will be utilized in constructing the project. Installation of material on the project without an associated approved shop drawing will not be allowed.

   Shop drawings shall be checked by the Contractor and evidence of such checking shall be indicated thereon. The Contractor shall be completely responsible for the accuracy, completeness, compatibility and compliance of the shop drawings with the approved Plans and Specifications. The Contractor shall plainly mark on the shop drawings the item or items in which approval is requested. Failure to do so may result in disapproval of the shop drawing.

3. Warranty

   For a period of at least one year after final acceptance of the project by the City, the Contractor shall warrant the fitness and soundness of all materials, equipment and work completed on the project. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting there from, which shall appear within a period of one year from the date of final acceptance of the project.

4. Testing And Control Of Materials

   Materials used in construction of the project, particularly those upon which the strength and durability of the project may depend, shall be subject to inspection and testing to establish conformance with the specification and suitability for the uses intended. The inspection and testing shall be in accordance with accepted standards. The City will select the laboratory or agency that will perform the inspection or testing. Results of the inspecting or testing will be made available to the Contractor. Should the testing or inspection reveal any material that does not comply with the approved Plans and Specifications, the noncompliant material shall be removed from the project.

5. Record Drawings

   Prior to final acceptance of the Project by the City, the Contractor shall provide the City with construction record drawings. The record drawings shall reflect actual construction information such as dimensions, elevations, locations, materials, etc. of items used on the project. The specific record drawing information required for the different types of construction on the project shall be, but not limited to, the following:

   a. General

      Where an underground utility is uncovered the following information shall be shown on the record drawing:

      (1) The utility type, size, pipe or conduit material and top elevation.
The location of the utility shall be shown on the plan and profile view on the approved Plans. The general direction the utility is laying shall also be shown.

The actual clearance between the existing utility and the proposed utility shall also be indicated on the profile view of the approved Plans.

b. Sanitary Sewer Construction

(1) Manhole size, type, top elevation and invert elevations of all entering or exiting pipes.

(2) Pipe size, type, length and slope.

(3) Service line size, type, length, slope, depth at clean out, and the station from the downstream manhole where connected to the sewer main.

(4) Survey from a Registered Surveyor showing the location of all manholes and cleanouts. The scale of the survey shall be the same as the approved Plans.

c. Storm Sewer Construction

(1) Manhole size, type, top elevation and invert elevations of all entering or exiting pipes.

(2) Pipe size, type, length and slope.

(3) Catch basin, drop inlet or grate inlet type, size, throat length, top elevation and invert elevations of all entering or exiting pipes.

(4) Headwall or flared end section type, size and invert out elevation.

(5) Survey from a Registered Surveyor showing the location of all manholes, drop inlets, catch basins, grate inlets, headwalls and flared end sections. The scale of the survey shall be the same as the approved Plans.

d. Water Line Construction

(1) Stations of any bends, fittings, blow offs, fire hydrants, air releases or service connections in the water line.

(2) Water line type, depth, size and location.

(3) Service line type, size, depth, and location of any bends or fittings in the service line.

(4) Survey from a Registered Surveyor showing the location of all valves, blow offs, air releases, fire hydrants, detector check vaults, meter boxes and plugs or ends of the water line. The scale of the survey shall be the same as the approved Plans.

The City Engineer reserves the right to request other information, in addition to that listed above, to be shown on the record drawings.
II. Sanitary Sewer Construction

1. Scope Of Work

The work under this Detailed Specification consists of the furnishing of all labor, materials, equipment and services necessary for the construction of sanitary sewer lines, manholes and force mains for the City of Bristol Tennessee. If the project to be constructed includes materials, equipment or services not covered in these specifications the City Engineer must be contacted for details.

2. Pipeline Materials – Gravity Sewers

a. General

The following pipeline materials are approved for installation in the City of Bristol Tennessee sewer system for sizes 15 inches and smaller: (1) ductile iron pipe and (2) polyvinyl chloride pipe. The City Engineer must be consulted on pipe requirements if industrial waste will flow through the pipe.

b. Ductile Iron Pipe

(1) Materials, Manufacture and Joints

Ductile iron pipe shall be centrifugally cast, manufactured and tested in accordance with the latest revision of ANSI/AWWA Standard C150/A21.50. Pipe shall meet the requirements of the latest revision of ANSI/AWWA C151/A21.51.

The pipe shall have a single rubber gasket seal, push on joint conforming to the latest revision of ANSI/AWWA Standard C111/A21.11 unless mechanical joints are specifically required. The pipe shall be furnished with a tar coated outside and the manufacturer’s standard cement lined inside to comply with the latest revisions of ANSI/AWWA Standards C104/A21.4 and C151/A21.51. Thickness class of the pipe shall be Pressure Class 350. The City Engineer must be consulted for thickness requirements of pipes larger than 16-inch. The pipe laying length may be either 18 feet or 20 feet.

(2) Fittings

All fittings for ductile iron pipe shall be pressure Class 350 ductile iron conforming to the latest revision of ANSI/AWWA Standard C111/A21.11 for rubber gasket joints or the latest revision of ANSI/AWWA Standards C110/A21.10 and C153/A21.53 for mechanical joints.

Fittings shall be either mechanical joint or single gasket push-on joint as shown in the design or determined during construction. The fittings required at manholes shall be ductile iron. Fittings for services shall be tees for connections to new lines or tapping saddles with “O” ring gaskets for connections to existing lines.

All fittings shall be furnished with a tar coated outside and the manufacturer’s standard cement lined inside to comply with the latest revision of ANSI/AWWA Standards C104/A21.4 and C151/A21.51.
(3) **Pipe Bedding and Backfill**

Ductile iron pipe used for gravity sewers shall be laid in a bed of crushed stone meeting the gradation requirements of TDOT, Size No. 8 aggregate to a depth of six (6) inches. Backfill utilizing TDOT Size No. 8 aggregate shall be placed around the pipe to a minimum of 12 inches above the top of the pipe. The backfill must be lightly compacted (85 percent Standard Proctor Density) in such a manner as to not displace, crush, egg or damage the pipe. The bedding and backfill must extend the width of the trench.

Bedding and backfill material when the pipe is under or near streets, shoulders, driveways or other travel ways shall be as specified in Paragraph 14. *Pipeline Trenches Within Roadways* of this Detailed Specification and as shown on the Detail Sheet in the approved Plans.

(4) **Markings**

All pipes and fittings shall have plainly marked on the exterior:

(a) Nominal Size  
(b) Class  
(c) Manufacturer  
(d) Approved Mark of Independent Testing Laboratory (if required)  
(e) Quality Control Code

(5) **Mechanically Restrained Joints**

Where required for bored highway crossings, bored railroad crossings or stream or river crossings, mechanically restrained joint ductile iron pipe in accordance with the latest revision of AWWA/ANSI Standards C110/A21.10, C111/A21.11 and C151/A21.51 shall be utilized. Pressure Class 350 mechanically restrained joint ductile iron pipe shall be utilized. The restrained joint pipe shall be American Flex-Ring, U. S. Pipe TR Flex, Griffin Pipe SNAP-LOK or approved equal. The gland shall be a heavy section ductile iron casting. The pipe shall be furnished with a minimum nominal length of 18-feet.

c. **Polyvinyl Chloride Pipe**

(1) **Materials, Manufacture and Joints**

Polyvinyl chloride pipe for sewer lines shall be manufactured from Class 12454-B or 12454-C Polyvinyl Chloride plastic as defined in the latest revision of ASTM Specification D1748 “Rigid Poly (Vinyl Chloride) (PVC) Compounds”

The pipe and fittings shall conform to and/or exceed the latest revision of ASTM Specification D3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings as it applies to Class 12454-B or 12454-C Polyvinyl Chloride plastic pipe. Sanitary sewer pipe shall be SDR 35 or SDR 26 with push-on elastomeric gasket joints designed to allow the pipe to be connected on the job. Push-on joints shall form a watertight seal and lubricants shall conform to the latest revision of ASTM specification D3212. Gaskets shall be vulcanized natural or vulcanized synthetic rubber conforming to the latest revision of ASTM Specification F477.

Upon the completion of installation and backfilling, the PVC pipe shall be capable of passing a City Engineer approved 9-arm mandrel having a diameter equal to 95
percent of the inside diameter of the pipe. A minimum of 30 days shall elapse after backfilling has been completed prior to checking for deflection with the mandrel.

The pipe shall be furnished with a minimum nominal length of 12.5 feet. All fittings and accessories shall have bell and spigot configurations identical to that of the pipe. The pipe supplier shall furnish special fittings (as approved by the City Engineer) for use in connecting PVC pipe to existing pipe or ductile iron pipe where specified.

The pipe and joints shall conform to the ASTM and National Sanitation Foundation Testing Laboratories (NSF) specifications. The Tennessee Department of Environment and Conservation, Division of Water Pollution Control and the City shall approve the pipe and manufacturer.

The City Engineer reserves the right at the end of the one year warranty period to run a go-no-go mandrel through selected line segments chosen by the City Engineer. Failure of a line segment to pass this test will require pipeline removal and replacement by the Contractor.

All PVC pipe shall be stored at the project site in strict accordance with the manufacturer’s recommendations. At all times the Contractor shall be responsible for providing uniform support for each length of pipe stored at the site. PVC pipe that has been bowed by the sun shall not be laid until it has straightened and lies flat without restraint.

(2) Pipe Bedding and Backfill

PVC pipe shall be laid in a bed of compacted crushed stone meeting the gradation requirements of TDOT, Size No. 8 aggregate to a depth of six (6) inches. Paragraph 10. Pipe Bedding – Gravity Sewers of this Detailed Specification covers the requirements of pipe bedding and backfill. A TDOT Size No. 8 aggregate envelope shall be placed around the pipe in 6-inch loose lift layers up to a minimum of 12 inches above the top of the pipe. The backfill must be lightly compacted (85 percent Standard Proctor Density) in such a manner as to not displace, crush, egg or damage the pipe. The bedding and backfill must extend the width of the trench. In addition to the construction procedures outlined in other Paragraphs of this Detailed Specification, PVC pipe shall be installed in full compliance with the latest revision of ASTM Specification D2321, the recommended practice for “Underground Installation of Flexible Thermoplastic Sewer Pipe”.

Bedding and backfill material when the pipe is under or near streets, shoulders, driveways or other travel ways shall be as specified in Paragraph 14. Pipeline Trenches Within Roadways of this Detailed Specification and as shown on the Detail Sheet in the approved Plans.

(3) Markings

As a minimum the pipe and associated fittings shall have the following data applied to each piece:

(a) Nominal Size
(b) Type of Material (PVC Cell Classification)
(c) SDR or Class (Color Coded)
(d) Manufacturer
(e) NSF Seal of Approval
(f) Quality Control Code
3. Pipeline Materials – Sewage Force Main

a. General
The following pipeline materials are approved for installation in the City of Bristol, Tennessee sanitary sewer system for sewage force mains 12-inch and smaller: (1) Pressure Class 350 ductile iron pipe and (2) polyvinyl chloride pipe, DR 14, Pressure Class 200. The City Engineer must be contacted regarding material requirements for sewage force mains larger than 12-inches.

b. Ductile Iron Pipe

(1) Materials, Manufacture and Joints
See Paragraph 2.b.(1) of this Detailed Specification.

(2) Fittings
See Paragraph 2.b.(2) of this Detailed Specification.

(3) Pipe Bedding and Backfill
See Paragraph 2.b.(3) of this Detailed Specification.

(4) Markings
See Paragraph 2.b.(4) of this Detailed Specification.

(5) Mechanically Restrained Joints
See Paragraph 2.b.(5) of this Detailed Specification.

c. Polyvinyl Chloride Pipe

(1) Materials, Manufacture and Joints
Polyvinyl chloride pipe for sewage force mains shall be made from Class 12454-B or 12454-C Polyvinyl Chloride plastic as defined in the latest revision of ASTM Specification D1784, “Specifications for Rigid Poly (Vinyl Chloride) (PVC) Compounds”.

The pipe shall conform to and/or exceed the Commercial Standard CS-256-63 or the latest revision of ASTM specification D2241 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)” as it applies to Class 12454-B or 12454-C Polyvinyl Chloride Pipe. The Pipe shall be DR 14 with a water pressure rating of 200 psi at 23°C (73.4°F). All pipes shall have push-on elastomeric bell end joints designed so that the pipe may be connected on the job without the use of solvent cement or any special equipment. Push-on joints and lubricants shall conform to the latest revision of ASTM Specification D3139. Gaskets shall be vulcanized natural or vulcanized synthetic rubber conforming to the latest revision of ASTM Specification F477-76. The pipe shall be furnished in nominal lengths of 18 or 20 feet.

All PVC pipe shall be stored at the project site in strict accordance with the manufacturer’s recommendations. The Contractor shall be responsible for providing uniform support for each length of pipe stored at the site. PVC pipe that has been bowed by the sun shall not be laid until it has straightened and lies flat without restraint.
(2) **Fittings**

All fittings for PVC pipe shall be Class 350 mechanical joint ductile iron as specified in Paragraph 2.b.(2) of this Detailed Specification.

(3) **Pipe Bedding and Backfill**

See Paragraph 2.c.(2) of this Detailed Specification. If PVC pipe is utilized, locator wire shall be installed 6-inches above the top of the pipe and non-detectable warning tape must be installed 12-inches below the finished grade.

(4) **Markings**

See Paragraph 2.c.(3) of this Detailed Specification.

4. **Highway Crossings**

   a. **Bored Highway Crossings**

   Where bored highway crossings are required on the drawings, the bore shall be made with a casing pipe as specified in Paragraph 5. of this Detailed Specification. The casing pipe shall be jacked through the bored hole with no disturbances to the ground surface. A minimum of four (4) feet of cover is required between the top of the casing pipe and the ground surface. The Contractor must coordinate the work with the highway owner and follow any requirements of the highway owner.

   b. **Tunneled Highway Crossings**

   In those locations where boring of the highway cannot be accomplished and tunneling is the only acceptable method, the Contractor shall contact the City Engineer for the requirements to be utilized.

   c. **Open Cut Highway Crossings**

   Open cut highway crossings can be utilized when permitted. The open cut crossing shall meet the following requirements:

   (1) All backfill, except for the pipe bedding envelope, shall be TDOT Class A, Grade D aggregate. The backfill shall be placed in a maximum of 8-inch lifts and compacted to not less than 95 percent of maximum density determined in accordance with AASHTO T 99, Method D.

   (2) Unless otherwise approved by the City Engineer, at least one-half of the traveled portion of the highway must be open to traffic at all times.

   (3) The Contractor shall keep the pipeline trench width to a minimum to prevent excessive disturbance of the existing pavement. All pavements shall be saw cut.

   (4) Unless otherwise approved, the top of the proposed sewer line shall be at least four (4) feet below State Highways and three (3) feet below Sullivan County or City Streets.

   (5) The Contractor shall post warning signs and flagmen per the requirements of the Manual on Uniform Traffic Control Devices and the City Engineer.
(6) The Contractor must maintain the trench until permanent restoration occurs. Maintenance shall consist of, but not be limited to, dust control and ridability (surface smoothness). The Contractor is strongly encouraged to temporarily pave all highway trenches in order to minimize trench maintenance. If the Contractor fails to adequately maintain the highway trenches, the City Engineer will require temporary pavement to be placed in the trenches.

The Contractor shall be fully responsible for the successful operation, without interruption, of traffic and shall be held responsible for returning the highway to its original condition. The Contractor shall be responsible for any settlement that occurs as a result of his work. Where required, trenches shall be temporarily bridged with a minimum ½-inch steel plate for the convenience of the traveling public.

The City Engineer may require the use of flowable fill for backfilling of open cut trenches in highways. When required, the flowable fill shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 204. The use of flowable fill in trenches may require temporarily bridging the trench with a minimum ½-inch steel plate for the convenience of the traveling public.

5. Railroad Crossings

a. General

Where shown on the Plans, railroad crossings for the gravity sewers shall be bored so as to prevent interruption to train traffic and to prevent later settlement of the railway bed. If the railroad crossing requires tunneling then the Contractor shall contact the City Engineer for the material and installation requirements.

The Contractor must be fully equipped and experienced in the installation of pipelines by boring or tunneling methods. The Contractor shall be fully responsible for the successful operation without interruption of rail traffic and shall be held responsible for any settlement, which occurs as a result of his work.

The Contractor should familiarize himself with the requirements of the railroad within whose rights-of-way the Contractor is working. The Contractor shall pay for any insurance to the amount and extent required by the railroad involved.

b. Steel Casing Pipe

Generally, pipeline crossings of railroads shall be made by boring and jacking a smooth wall steel casing pipe under the roadbed and inserting a carrier pipe. The steel casing pipe shall be manufactured and tested in accordance with the latest revision of ASTM Specification A139 or A53, Grade B with a wall thickness as shown on the Detail Sheet or specified. The steel pipe shall have a minimum yield strength of 35,000 psi and meet the requirements of the American Railway Engineering and Maintenance-of-Way Association (AREMA). The steel casing pipe shall be so constructed as to prevent leakage of any substance form the casing throughout its length except at the ends. The steel casing pipe shall be so installed to prevent the formation of a waterway under the railroad, have an even bearing throughout its length, and shall slope to one end.

Bored installations shall have a bored hole diameter essentially the same as the outside diameter of the casing pipe. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe by more than one (1) inch, remedial measures as approved by the Railway Company and the City Engineer shall be taken. Boring operations shall not be stopped if such stoppage would be detrimental to the railroad.
Steel casing pipe where shown shall be as follows:

<table>
<thead>
<tr>
<th>Diameter Casing Pipe (inches)</th>
<th>Minimum Casing Pipe Wall Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
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<tr>
<td>14</td>
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<td>40</td>
<td>0.594</td>
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</tbody>
</table>

6. Manhole Design

a. General

In order to prevent excessive leakage of water into manholes, special care is warranted in the design and construction of manholes; therefore, this design requires high quality watertight precast concrete manholes. Special emphasis is placed on the connection of the pipeline to the manhole in such a manner as to preclude shearing and/or leakage. For this reason a neoprene boot with an integral expanding band to clamp and seal the boot or an A-lok gasket in the manhole openings is required.

Manholes shall have a minimum inside diameter of four (4) feet for pipe connections of 21-inch and smaller. Manholes shall have a minimum inside diameter of five (5) feet for pipe connections of 24-inch and larger.

Where manholes are replaced or when new lines connect to existing manholes, a flexible coupling as specified in Paragraph 6.a.(5) hereinafter shall be utilized. Where new lines connect to existing manholes, the opening in the existing manhole must be core drilled.

(1) Standard Manhole Frames and Covers

Manhole frames shall be furnished and set in a bed of double mastic as shown on the Detail Sheet. Frames shall be bolted to the concrete where indicated on the Plans and/or required by the City Engineer. The standard frame and cover shall be an East Jordan Iron Works, Inc. Model V-1380. The frame shall have a minimum 24-inch opening. Unless otherwise shown on the Plans the covers shall be the solid, machined, self-sealing type with no holes except for watertight pick notches. The surface between the cover and frame shall be machined and shall fit smoothly without rocking and shall be thoroughly cleaned. The frame shall be set in a bed of double mastic so as to constitute a watertight seal between the concrete and the frame. The words “Sanitary Sewer” shall be cast in the lid.

At the end of all line segments, where shown on the drawings, or where approved by the City Engineer, a vented lid shall be substituted. The words “Sanitary Sewer” shall be cast in the vented lid. Vented lids shall have a 1-square inch opening in each quadrant of the lid for a total of four (4) openings.

(2) Watertight Manhole Frames and Covers

Watertight manhole frames shall be furnished and set in a bed of double mastic and bolted to the concrete manhole as shown on the detail sheet. The watertight frame and cover shall be an East Jordan Iron Works, Inc. Model V-2150-3. The frame shall
have a minimum 24-inch opening. The surface cover shall be the solid type with no holes except watertight pick notches. The surface between the cover and frame shall fit smoothly without rocking and shall be thoroughly cleaned. The inner cover shall be of the solid type with no holes, shall have not less than two lifting handles and shall have a solid neoprene sealing gasket. The inner cover shall be mechanically sealed by means of a removable metal bar located over the inner cover with a centrally located bronze or stainless steel tightening bolt. This bolt shall have a tee-handle or bent-handle for turning. The bolt shall have Acme threads for durability. The inner cover shall have appropriate reinforcing ribs to prevent cracking or distortion when tightened. The inner cover shall have sufficient clearance to allow easy removal from the frame. The frame shall be attached to the manhole barrel by means of four 5/8-inch anchor bolts and shall be set in a bed of double mastic so as to constitute a watertight seal between the barrel and the frame.

(3) Manhole Steps

Manhole steps shall be made of copolymer polypropylene plastic meeting the latest revision of ASTM Specification D4101 and shall have a ½-inch diameter Grade 60 reinforcing rod through its center meeting the latest revision of ASTM Specification A615. Each step shall be 12-inches in width and capable of carrying a load of 1,000 pounds in the center of the step when projected 6-inches from the wall. Each step shall be equipped with non-skid grooves.

(4) Manhole Inverts

Manhole inverts shall be precast into the manhole unless otherwise approved by the City Engineer. The inverts shall conform to the requirements of the Detail Sheet.

Where poured in place inverts are allowed the inverts shall be formed from TDOT Class “A” concrete. Poured in place inverts for “Straight-through” manholes may be formed by laying the pipe straight through the manhole, pouring the concrete invert and then removing the top half of the pipe. Poured in place curved inverts shall form a smooth, even, half-pipe section. The inverts shall conform to the requirements of the Detail Sheet.

(5) Connection of Sewer Lines to Manholes

The connection of the manhole to the sewer line(s) shall be accomplished utilizing flexible couplings such as A-lok, Kor-N-Seal or an approved equal.

The A-lok gasket shall be a neoprene gasket cast into the manhole wall capable of providing the manufacturer's recommended pipe deflection while maintaining a watertight seal. The Kor-N-Seal connection shall consist of a neoprene boot with an internal expanding opening and stainless steel band and clamp.

Where main lines enter the manhole two (2) feet or more above the invert, an external drop connection shall be installed. External drop connections shall be made of flanged or mechanical joint, pressure class 350, ductile iron pipe as indicated on the Detail Sheet. The drop connection shall be encased in TDOT Class A concrete and constructed per the Detail Sheet.

b. Precast Concrete Manholes

Precast manholes shall be constructed on a reinforced concrete foundation. Dry cast or wet cast manholes as modified herein shall be utilized. The bottom section of the manhole shall be precast integrally with the precast ring, shall be a minimum of four (4)
feet in diameter and shall have a minimum base thickness of six (6) inches to the outside wall of the pipe. All concrete shall be TDOT Class “D” concrete (4,000 psi). Precast concrete rings shall be constructed using standard forms and shall conform to the latest revision of ASTM Specification C478 except that:

(1) Reinforcing steel shall be as required for a Class II “A” wall by the latest revision of ASTM Specification C76.

(2) Permissible variations shall be as required by the latest revision of ASTM Specification C76.

(3) The concrete mixture shall contain no less than 705 pounds per cubic yard (7.5 bag mix) of Portland Cement for dry cast manholes and no less than 594 pounds per cubic yard (6.3 bag mix) of Portland Cement for wet cast manholes.

(4) An eccentric top cone will be allowed provided it meets this Detailed Specification.

(5) All joints shall conform to the latest revision of Section 8 of the ASTM Specification C361 except the Contractor shall utilize a double seal of mastic such as Ram-Neck as shown on the detail sheet.

(6) The use of fly ash in lieu of Portland Cement is not allowed.

The Precast section shall be manufactured and installed in a manner such that there is no visible leakage in the manholes. All manholes shall be installed plumb and level. The manhole sections shall be manufactured in lengths such that a finished manhole will have the least possible number of joints. Where practical, only one section less than four (4) feet in length will be allowed per manhole and that being the section required to bring the manhole to grade. No holes for lifting will be allowed. The precast rings shall be jointed using a double seal of mastic such as Ram-Neck, as shown on the detail sheet, and the joint shall be grouted smooth.

The outside surface of all precast manholes shall be coated with two (2) layers of bitumastic coating. If the manufacturer does not install the coating, the Contractor shall apply two (2) layers of the bitumastic coating at right angles to each other.

Should a grade ring become necessary to bring the manhole to grade, it shall be set in a bed of double mastic so as to form a watertight seal with the manhole cone. Grade rings shall be no more than a total of 12-inches in height.

7. Lines and Grades

Unless otherwise directed by the City Engineer, lines and grades shall be set to conform to those shown on the Plans approved by the City of Bristol Tennessee and the Tennessee Department of Environment and Conservation, Division of Water Pollution Control.

Lines and grades shall meet the minimum requirements set out by the Tennessee Department of Environment and Conservation, Division of Water Pollution Control.

a. Horizontal Separation

Sewers shall be laid at minimum of ten (10) feet horizontally from any existing or proposed water line. The distance shall be measured from edge to edge. Should local conditions prevent a horizontal separation of ten (10) feet, the sewer may be laid closer than the required ten (10) feet if it is laid in a separate trench and if the elevation of the top of the sewer pipe is at least 18 inches below the bottom of the water main.
b. **Vertical Separation**

Whenever sewers must cross under water mains, the sewer shall be laid at such elevation that the top of the sewer pipe is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of ten (10) feet on each side of the sewer. One full length of water main should be center over the sewer so that both joints will be as far from the sewer as possible.

c. **General**

When it is impractical to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to the water main pipe and shall be pressure-tested to assure water tightness. Such arrangements are discouraged and adequate reason shall be provided to justify the design.

The Tennessee Department of Environment and Conservation, Division of Water Pollution Control and the City Engineer must approve any variations from the requirements in this section.

8. **Excavation for Pipeline Trenches and Manholes**

a. **General**

Prior to commencing any excavation, the Contractor must contact Tennessee One Call (1-800-351-1111) and allow appropriate time for any existing underground utilities to be located and marked. The Contractor is encouraged to also contact the respective utilities separately to request utility locating and marking.

The Contractor shall install proper erosion and sediment control devices prior to commencing any excavation. Erosion and sediment control device installation and maintenance shall meet the requirements of the latest revision of the *Tennessee Erosion and Sediment Control Handbook* and the City Engineer.

The Contractor shall install traffic control devices prior to commencing work in a public or private right-of-way or travel way. Traffic control device installation and maintenance shall meet the requirements of the latest revision of the *Manual on Uniform Traffic Control Devices* and the City Engineer.

Unless otherwise indicated, trenches shall be excavated in open cut to the depths indicated on the approved Plans and/or as directed by the City Engineer to permit proper bedding of the pipe. The Contractor shall provide adequate facilities for promptly removing water from all excavations. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe. Unless specifically authorized by the City Engineer, trenches shall not be excavated wider than a total of 24-inches plus the nominal outside diameter of the pipe at the level of the top of the pipe. The clearance between the side of the pipe and the trench wall must be a minimum of 6-inches and cannot exceed 18-inches but the total clearance on both sides of the pipe cannot exceed 24-inches.

Unless specifically directed otherwise by the City Engineer or where required to uncover or determine the presence of underground obstructions, not more than 300 feet of trench shall be opened ahead of the pipe laying and not more than 200 feet of open trench shall be left behind the pipe laying. Before laying the pipe, the Contractor shall open the trench far enough ahead to reveal obstructions and verify existing utility locations that
may necessitate changing the line or grade of the pipe. Should the Contractor fail to locate obstructions or uncover existing utilities in advance of the pipe laying, any revisions to change the alignment of the pipe due to the obstruction or utility shall be at no expense to the City.

All barricades, lanterns, watchmen, and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions shall be provided by the Contractor.

When so required by the TDOT, Sullivan County Highway Department or the City of Bristol Tennessee, one-half of the road crossings shall be excavated, and then temporary bridges consisting of a minimum ½-inch steel plate shall be placed over the trench for the safety and convenience of the traveling public. The remainder of the excavation can then be carried out. All backfilled ditches shall be maintained in such a manner that they offer minimal hazard to the passage of traffic. The Contractor must maintain the trench until permanent restoration occurs. Maintenance shall consist of, but not be limited to, dust control and ridability (surface smoothness). The Contractor is strongly encouraged to temporarily pave all highway trenches in order to minimize trench maintenance. If the Contractor fails to adequately maintain the highway trenches, the City Engineer will require temporary pavement to be placed in the trenches. The safety and convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged.

In excavations for masonry and concrete structures, including manholes, the required width shall be such as to permit forms to be constructed in the proper manner and to permit proper backfilling upon completion of the structures. Depth of excavation for footings shall be as shown on the approved Plans and/or as directed by the City Engineer to obtain sufficient bearing.

All excavated material not needed for backfilling purposes shall be disposed in a manner satisfactory to the City of Bristol Tennessee. Prior to disposing of the excess material the Contractor should ensure the proposed fill site has been properly permitted by the appropriate governmental agency. The City will not allow disposal of excess material on non-permitted sites.

In all public or private rights-of-way or easements, excavations must be limited to the footage of pipe that can be laid and the trench/excavation backfilled in the same day. No trench or excavation can be left open overnight in these areas. All other rules and regulations of the TDOT, Sullivan County Highway Department and the City of Bristol Tennessee shall apply.

All excavations shall be accomplished in accordance with applicable safety laws and regulations. The City of Bristol Tennessee does not assume responsibility of any degree or sort for acts of the Contractor.

b. Unstable Trench Bottom Material and Undercutting

If wet, mucky and/or unstable material is encountered in a trench bottom, the City Engineer may require additional excavation to ensure a firm foundation for the pipe. The quantity of undercutting will be determined by the City Engineer but as a rule of thumb will be a minimum of two (2) feet deep the width of the trench. In such cases, the trench bottom shall be brought back up to proper grade with TDOT Size No. 8 aggregate. However, if subgrade stabilization is not occurring, the City Engineer will direct the Contractor to refill the ditch with TDOT Size No. 3 (2-inch) aggregate until subgrade stabilization is achieved. In general, where No. 3 aggregate is required due to unstable
pipeline trench conditions other than voids or caverns, the ditch shall be capped off with TDOT Size No. 8 aggregate as shown on the Plans.

In those areas where voids can be filled without difficulty, the Contractor shall use TDOT rubble-stone riprap (plain) to fill the void, then TDOT Size No. 3 aggregate and finally the TDOT Size No. 8 aggregate. The TDOT Size No. 8 aggregate is considered bedding material. For all other void or cavernous areas, Paragraph 18. Construction Methods when Voids or Caverns are Encountered shall apply.

c. Sewage Force Mains

The excavation for sewage force mains shall be carried to the depths indicated on the Plans and/or directed by the City Engineer to permit proper bedding of the pipe. Trenches shall be excavated such that the top of the pipe is not less than 36-inches below the surface of the ground. In State Highway rights-of-way, the top of the pipe shall not be less than 48-inches below the surface of the ground.

d. Excavation Near Potable Water Lines

(1) Horizontal Separation

Sewers shall be laid at minimum of ten (10) feet horizontally from any existing or proposed water line. The distance shall be measured from edge to edge. Should local conditions prevent a horizontal separation of ten (10) feet, the sewer may be laid closer than the required ten (10) feet if it is laid in a separate trench and if the elevation of the top of the sewer pipe is at least 18 inches below the bottom of the water main.

(2) Vertical Separation

Whenever sewers must cross under water mains, the sewer shall be laid at such elevation that the top of the sewer pipe is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of ten (10) feet on each side of the sewer. One full length of water main should be center over the sewer so that both joints will be as far from the sewer as possible.

(3) General

When it is impractical to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to the water main pipe and shall be pressure-tested to assure water tightness. Such arrangements are discouraged and adequate reason shall be provided to justify the design.

The Tennessee Department of Environment and Conservation, Division of Water Pollution Control and the City Engineer must approve any variations from the requirements in this section.

e. Excavation on Easements

Excavation of pipeline trenches on easements shall be performed in such a manner that the private property owner’s facilities and grounds shall be restored to as near to their original condition as possible considering the work performed. The grass cover of the areas disturbed due to the excavation shall be the same type as the original undisturbed cover.
Before any excavation is begun or before drilling and blasting, up to a minimum of nine (9) inches of the existing topsoil shall be removed from the work area. The topsoil must be excavated and stockpiled in a manner that prevents contamination with any other material or debris. Should topsoil not be present, a minimum of nine (9) inches of the existing ground cover shall be removed from the work area and stockpiled in a manner as not to contaminate with other materials or debris.

Excavated materials suitable for backfill shall be placed at a distance far enough from the ditch to allow excavated rock to be placed next to the trench; however, stockpiling outside the easement shall be done only with the property owner's written permission.

f. Removal of Water

The Contractor shall at all times during construction provide and maintain means and devices with which to promptly dispose of all water entering the excavations or other parts of the work. All excavations must be kept dry until the structures to be installed therein are completed. No concrete shall be placed in water nor shall water be allowed to rise over structures if there is a danger of flotation or of setting up unequal pressures in the concrete until the concrete has set at least 24 hours and the danger of flotation has been removed.

The Contractor shall dispose of water from the work zone in a suitable manner without damage to adjacent property or sewers. No water shall be drained into work built or under construction. The discharge of trench water must meet all requirements of the latest revision of the *Tennessee Erosion and Sediment Control Handbook*, the Tennessee Department of Environment and Conservation, and the City Engineer.

During the laying of sewers and until the sewer pipe has been bedded in place with at least two (2) feet of backfill over the pipe, the Contractor shall keep the groundwater table below the bottom of the trench. Installation of the sewer pipe will not be permitted except in a dry trench. Under no circumstances will trench water be allowed to enter/discharge into existing or proposed sewer lines. The Contractor must take every precaution to prevent water from entering the sewer line.

9. Pipe Bedding – Gravity Sewers

a. General

All gravity sewers shall be laid on a bed of crushed stone meeting the requirements of the TDOT Size No. 8 aggregate. The aggregate shall be free of silt and clay. In general, the trench shall be opened below the bottom of the pipe to the depth previously specified and refilled with the bedding material to provide a firm bed for the bottom quadrant of the pipe at the proper grade and line.

When rock is encountered, the trench shall be excavated to a depth of at least six (6) inches below the bottom of the pipe and refilled with the bedding material to provide a firm bed for the bottom quadrant of the pipe.

Material as specified hereinbefore shall be brought up evenly along each side of the pipe and tamped so as to secure the line and grade of the pipeline and to prevent damage thereto.

b. Bedding and Backfill of Ductile Iron Gravity Sewer Line

Ductile iron gravity sewer lines shall be excavated and backfilled as specified in *Paragraph 2.b.(3) Pipe Bedding and Backfill*, Paragraph 13. *Backfilling of Pipeline*
Trenches, and where applicable Paragraph 14. Pipeline Trenches Within Roadways of this Detailed Specification.

c. **Bedding and Backfill for Polyvinyl Chloride Sewer Line**

PVC gravity sewer lines shall be excavated and backfilled as specified in Paragraph 2.c.(2) Pipe Bedding and Backfill, Paragraph 13. Backfilling of Pipeline Trenches, and where applicable Paragraph 14. Pipeline Trenches Within Roadways of this Detailed Specification.

d. **Unstable Trench Bottom Material or Undercutting**

If wet, mucky and/or unstable or unsuitable material is encountered in the trench bottom, the City Engineer may require additional excavation to ensure a firm foundation for the pipe. In such cases, the trench bottom shall be brought back up to proper grade with bedding material as provided in Paragraph 8.b. Unstable Trench Bottom Material and Undercutting.

The City Engineer shall determine when it is necessary to use such material and the Contractor shall be responsible for calling such unstable trench bottom conditions to the attention of the City Engineer.

10. **Pipe Installation – Gravity Sewers**

The trench shall be excavated to the required depth and width and bell holes dug in the bedding in advance of pipe laying. A minimum of 3-feet of cover must be provided between the outside of the pipe to the finished grade except under State Highways where the minimum cover shall be four (4) feet.

The laying of gravity sewer pipes in finished trenches shall be commenced at the lowest point so that the spigot ends point in the direction of the flow. All pipes shall be laid with ends abutting and true to the line and grade indicated on the approved Plans or as directed by the City Engineer.

The pipe shall be fitted and matched so that when installed the pipe will form a sewer with a smooth and uniform invert. Supporting of pipes shall be as set out above under Paragraph 9. Pipe Bedding – Gravity Sewers and Paragraph 13. Backfilling of Pipeline Trenches. Under no circumstances will the supporting of pipes on blocks or earth mounds be permitted.

Fittings and laterals for sewer lines shall be provided and laid as shown on the approved Plans or directed by the City Engineer. All open ends of the pipe and of all fittings and laterals shall be sealed with stoppers or bulkheads firmly held in place so as to be watertight and easily removable.

Open ends of unfinished pipelines shall be securely plugged or closed at the end of each day’s work or when the line is left unattended. The Contractor shall be responsible for taking proper precautions to prevent pipeline flotation.

11. **Pipe Installation – Sewage Force Mains**

a. **General**

Sewage force mains shall be laid on the line and grade as shown on the approved Plans with extra depth where shown to facilitate the removal of air. The minimum depth requirements for the force main are shown in Paragraph 8.c. of this Detailed Specification.
The trench shall be excavated to the required depth and width, bell holes and/or jointing holes shall be dug in advance of pipe laying. The bed of each piece of pipe shall be carefully prepared so that each individual piece of pipe shall have a uniform bearing. Pipes shall be laid in a straight line and grade without kinks or sags. Bell holes and/or jointing holes shall be large enough so that the bell or hub will clear the ground and leave ample room for installing the joint and inspection of joints.

Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected and swabbed out to insure the cleanliness of the pipe interior. Each piece of pipe shall be lowered separately into the trench unless the City Engineer grants special permission.

Care shall be taken to prevent damage to the pipe coating both inside and out. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines.

If any defective pipe or fitting shall be discovered after the pipeline is laid, the defective item shall be removed and replaced with a satisfactory pipe or fitting at no cost to the City. In case a length of pipe is cut to fit a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe as per the latest revision of ANSI/AWWA Standard C600.

All angles or bends in the pipe lines, either vertical or horizontal, shall be satisfactorily braced or anchored against the tendency of movement with joint harness, concrete or equal anchors as shown on the approved Plans and to the satisfaction of the City Engineer.

Open ends of unfinished pipe lines shall be securely plugged or closed at the end of each day’s work or when the lines are left unattended. The maximum horizontal or vertical deflection for laying pipe shall be 1° per pipe section unless the manufacturer’s printed instructions permits a greater deflection.

When rock is encountered, the trench shall be excavated to a depth at least six (6) inches below the bottom of the pipe and refilled with the bedding material to provide a firm bed for the bottom quadrant of the pipe. Bedding material shall be the TDOT size No. 8 aggregate.

b. Bedding and Backfill Protection for Polyvinyl Chloride Pipe Sewage Force Mains

PVC pipe for sewage force mains shall be excavated and backfilled as specified in Paragraph 2.c.(2) Pipe Bedding and Backfill, Paragraph 12. Backfilling of Pipeline Trenches, and where applicable Paragraph 13. Pipeline Trenches Within Roadways of this Detailed Specification.

c. Bedding and Backfill Protection for Ductile Iron Pipe Sewage Force Mains

Ductile iron pipe for sewage force mains shall be excavated and backfilled as specified in Paragraph 2.b.(3) Pipe Bedding and Backfill, Paragraph 12. Backfilling of Pipeline Trenches, and where applicable Paragraph 13. Pipeline Trenches Within Roadways of this Detailed Specification.

d. Unstable Trench Bottom Material or Undercutting

If wet, mucky and/or unstable or unsuitable material is encountered in the trench bottom, the City Engineer may require additional excavation to insure a firm foundation for the pipe. In such cases, the trench bottom shall be brought back up to proper grade with bedding material as provided in Paragraph 8.b. Unstable Trench Bottom Material and Undercutting.
The City Engineer shall determine when it is necessary to use such material and the Contractor shall be responsible for calling such unstable trench bottom conditions to the attention of the City Engineer.

12. Backfilling of Pipeline Trenches

a. Outside of Paved or Graveled Roads, Shoulders, Driveways, Parking Areas or Other Travel Ways

In the backfilling of the trenches outside of paved or graveled roads, shoulders, driveways, parking areas or other travel ways, material reasonably free from rock and acceptable to the City Engineer shall be used. Rock fragments greater than 18-inches in any dimension will not be allowed as backfill material under any circumstances. TDOT Size No. 8 aggregate shall be used to bed the pipe as required in this Detailed Specification and as shown on the gravity sewer and force main bedding details on the approved Plans. This procedure shall be required for all sewers of all materials.

Except as may be necessary in tamping or backfilling, walking or working on the completed pipeline shall not be permitted until the trench has been backfilled to a height of at least 12-inches above the top of the pipe. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed or damaged. Extra care shall be exercised until the backfill reaches a point 12-inches above the top of the pipe.

In filling the remainder of the trench, the backfill material may be shoveled into the trench in layers not to exceed 12-inches and firmly tamped into place by tampers or rammers. The backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the City Engineer, this method of backfilling will not inconvenience the public or property owner.

b. Backfill in Paved or Graveled Roads, Shoulders, Driveways, Parking Areas or Other Travel Ways

Where sewers are to be installed within paved or graveled roads, shoulders, driveways, parking areas or other travel ways, the backfill material shall be TDOT Class A, Grade D base aggregate. TDOT Size No. 8 aggregate shall be used to bed the pipe as required in this Detailed Specification and as shown on the gravity sewer and force main bedding details on the approved Plans. This procedure shall be required for all sewers of all materials.

Except as may be necessary in tamping or backfilling, walking or working on the completed pipeline shall not be permitted until the trench has been backfilled to a height of at least 12-inches above the top of the pipe. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed or damaged. Extra care shall be exercised until the backfill reaches a point 12-inches above the top of the pipe.

In filling the remainder of the trench, the backfill material shall be placed into the trench in layers not to exceed 8-inches and compacted by tampers or rammers. The backfill material must be compacted to not less than 95 percent of maximum density determined in accordance with AASHTO T 99, Method D.

The City Engineer may require the use of flowable fill for backfilling of open cut trenches in highways. When required, the flowable fill shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section
204. The use of flowable fill in trenches may require temporarily bridging the trench with a minimum ½-inch steel plate for the convenience of the traveling public.

c. Backfilling Operations Conducted on Easements

Backfilling of trenches or excavations on easements shall be performed in such a manner that the private property owner’s facilities and grounds shall be restored to as near as possible their original condition. Restoration should be commenced immediately after pipe laying on the property has been completed.

TDOT Size No. 8 aggregate shall be used to bed the pipe as required in this Detailed Specification and as shown on the gravity sewer and force main bedding details on the approved Plans. This procedure shall be required for all sewers of all materials. Next, any excavated rock less than 18-inches in diameter can be placed in the trench. Excavated rock shall not be placed any closer than 18-inches from the finished grade and any excess rock shall be removed by the Contractor and disposed of as directed. Rock fragments greater than 18-inches in any dimension will not be allowed as backfill material under any circumstances.

The residue of the stockpiled bedding material shall be cleaned up and placed into the trench, leaving no bedding stone scattered over the area. The previously excavated materials suitable for backfill shall be placed into the ditch only upon clean up and backfill of the bedding material. In filling the remainder of the trench, the backfill material may be shoveled into the trench in layers not to exceed 12-inches and firmly tamped into place by tampers or rammers. The top portion of the trench or excavation shall be filled using topsoil. The backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the City Engineer, this method of backfilling will not be a safety hazard or inconvenience the public or the property owner.

If the backfilling operation is performed during extremely dry weather, the Contractor should leave some stockpiled topsoil to use later as additional fill after settlement has occurred.

The Contractor will be held responsible for the condition of grass cover and the condition of the ground surface at the time of final inspection unless the property owner has plowed or excavated the ground.

d. Disposal of Excess Material

The Contractor shall be responsible for the off-site disposal of any and all excess or unsuitable material excavated in the construction of the project. The Contractor shall be responsible for obtaining any and all permits, license fees, etc. associated with the disposal of excess material. The City will not allow disposal of excess material on non-permitted sites.

13. Pipeline Trenches Within Roadways

Where excavation is within the traveled portion of State, County or City streets, all native earth and/or rock shall be removed and hauled away and disposed of by the Contractor. The resulting backfill material shall be as specified in Paragraph 12.b. of this Detailed Specification.

14. Unauthorized Excavation and Over-Breakage

Whenever the excavation is carried beyond or below the lines and grades shown on the drawings or given by the City Engineer, the Contractor shall refill such excavated space with
material approved by the City Engineer in such a manner as will insure stability of the structure or line involved, including the use of crushed stone or TDOT Class “A” concrete.

Over-breakage is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the City Engineer, including slides. All over-breakage shall be removed by the Contractor and disposed of as directed.

15. Installation of Gravity Sewer Pipe to be Encased with TDOT Class “A” Concrete

Where shown on the Plans or directed by the City Engineer, the gravity sewer pipe shall be encased in TDOT Class “A” concrete. Where concrete encasement is to be used, pipe shall be placed on 6-inch concrete blocks positioned behind each pipe bell. After jointing the pipe, it shall be brought to the established grade by driving wooden wedges between the pipe and the concrete block. After the pipe has been brought to grade and is affixed in place for true alignment, the pipe trench shall be backfilled with TDOT Class "A" concrete to a point above the pipe as shown on the approved Plans or directed. Expansion joints shall be provided at not less than 20-foot intervals by making a vertical gap in the concrete of 1 to 3 inches. These joints shall coincide with a pipe joint. After 24 hours, the backfill will then be completed as specified in Paragraph 12. Backfilling of Pipeline Trenches of this Detailed Specification.

16. Check Dams and/or Collars

Check dams and/or collars shall be installed in the bedding and backfill of all new or replaced sewer lines to limit the drainage area subject to the French drain effect of gravel bedding. Check dams and/or collars shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Alternatively, TDOT Class “A” concrete may be used, keyed into the trench walls. Check dams and/or collars shall be placed no more than 500-feet apart. The required location is upstream of each manhole. All stream crossings will include check dams and/or collars on both sides of the crossing.

17. Concrete Cradles, Collars, Check Dams, Anchors, and Encasement

Concrete cradles, collars, check dams, anchors, and encasement for the sewer lines shall be placed where indicated on the Plans or as directed by the City Engineer. Concrete for the cradles, collars, check dams, anchors, and encasement shall be TDOT Class “A”. Concrete shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed when used for cradles, anchors or encasement. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or damage the joints or pipe.

18. Construction Methods when Voids or Caverns are Encountered

Where a void or cavern is encountered during construction, the Contractor shall immediately contact the City Engineer. However, in general, the Contractor shall fill the void or cavern with rubble stone and TDOT Size No. 3 (2-inch) aggregate. If it is impracticable to fill the void or cavern, the Contractor shall construct a specially designed bridge slab to support the pipeline. A registered engineer shall design the bridge slab. The area to be bridged shall be excavated and measured. The City Engineer shall be called to the site to examine the bearing area available for the slab.

19. Rock Excavation

The methods used to excavate rock where encountered is the sole responsibility of the Contractor. The methods utilized should not jeopardize the safety of the construction crews or the public. The methods utilize should protect existing structures, utilities, property, etc.
from damage. The Contractor is responsible for obtaining the appropriate Federal, State and Local permits when utilizing blasting for rock removal. The Contractor must utilize only people licensed by the State for blasting. Inside the City limits, the Contractor must obtain a Blasting Permit from the Fire Department.

20. Sheeting, Shoring and Bracing of Excavation

Sheeting, shoring and bracing of an excavation is the sole responsibility of the Contractor. The Contractor is responsible for determining when and where sheeting, shoring and bracing are required. The Contractor must follow all Federal, State and Local safety regulations regarding proper sheeting, shoring and bracing of excavated areas.

21. Connections to Existing Sewers

Connections to existing sewers shall be made at the location shown on the Plans. Actual connections shall be coordinated with the City so as to prevent spillage of raw sewage and so as to allow quality control test to be performed unless an emergency dictates a temporary connection.

Connections to existing sewer manholes shall be core drilled and a flexible boot installed. Where the connection to an existing manhole damages the existing invert of the manhole, the existing invert shall be removed and reworked to the satisfaction of the City Engineer.

22. Abandoning Existing Sewers

Where shown on the Plans, existing sewer lines and manholes shall be abandoned. The methods utilized to abandon the sewer lines and manholes shall be approved by the City Engineer.

In general when abandoning manholes, the top four (4) feet of the manhole must be removed. TDOT Class “A” concrete shall then be placed in the manhole to a depth of at least 12-inches above the top of any pipe connected to the manhole. The remainder of the manhole can then be backfilled with material and methods as specified in the Paragraph 12. Backfilling of Pipeline Trenches of this Detailed Specification.

In general when abandoning a sewer line, a cap or plug must be utilized on the sewer line. TDOT Class “A” concrete shall then be placed around the cap, plug and pipe so as to encapsulate the end of the pipe.

23. Service Connection Piping

Service connecting piping shall be either ductile iron pipe meeting the requirements of Paragraph 2.b. of this Detailed Specification or PVC pipe meeting the requirements of Paragraph 2.c. of this Detailed Specification. When the service line connects to a new sewer line, the service pipe should be of the same material as the new sewer line. Service pipes that connect to existing sewer lines should be of the material shown on the Plans or of material approved by the City Engineer. Joints shall be rubber gasketed slip-on type. Service connections to the sewer line shall be made as shown on the Plans. The end of the service line shall terminate in a clean out with a watertight plug inserted where the properties service line will connect to the clean out tee.

The installation of service pipes shall follow immediately or be concurrent with the construction of the main sewer. This requirement shall apply particularly where traveled streets are involved so that street closures will be minimized.
24. Inspection of Gravity Sewer Lines and Sewage Force Mains for Quality, Line and Grade

The Contractor shall notify the City Engineer when pipe will be received on the job so that arrangements may be made for inspecting the unloading and stringing, as well as inspecting the pipe proper and examining for the manufacturer’s identification. Pipe shall be unloaded and stored in accordance with the manufacturer’s recommendations. No pipe or other materials or equipment shall be stored on private property without the written permission of the property owner.

Before the Contractor backfills any of the lines, the lines shall be inspected by the City Engineer. The City Engineer shall give the Contractor permission to proceed with backfilling of the lines. If any joints, pipes, or other workmanship or materials are found to be defective, they shall be removed and replaced by the Contractor.

After the sewer lines have been brought to completion, and prior to final inspection, the Contractor shall clean out the entire system. The Contractor shall utilize appropriate tools and methods for the removal from the lines and manholes of any and all debris and obstructions. The City Engineer must approve of the tools and methods utilized to remove debris.

During the final inspection, the City Engineer will inspect each individual line, from manhole to manhole, to determine whether the completed lines are true to line and grade as shown on the Plans. All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to be defective, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced by the Contractor.

25. Inspection of Gravity Sewer Lines for Deflection

Upon the completion of installation and backfilling, the PVC pipe shall be capable of passing a City Engineer approved 9-arm mandrel having a diameter equal to 95 percent of the inside diameter of the pipe. A minimum of 30 days shall elapse after backfilling has been completed prior to checking for deflection with the mandrel.

26. Inspection of Gravity Sewer Lines for Infiltration and Inflow

a. General

Prior to final acceptance of completed gravity sewer lines, the lines will be inspected or shall be tested to insure compliance with the following provisions.

b. Allowable Pipeline Leakage

Generally, the Contractor will be required to lay sewer lines so that the groundwater infiltration shall not average more than 50 gallons per 24 hours per inch of nominal diameter per mile of sewer, including manholes and plugged services and as measured in a high groundwater condition approximately at the surface of the ground. These requirements may be applied to the entire system or may be applied to any single section of line between two manholes. The more restrictive provisions set forth for specified items shall govern those items.

In order to test for infiltration and inflow, the City Engineer will require that the Contractor plug the open end of all lines at a manhole so that the measurements may be made at each section of the sewer line. Temporary pumps may also be required to route existing sewer flows around the plugged line. The Contractor will be expected to locate and repair leaks even if the location of the leaks requires television inspection. The City may choose to complete a television inspection of the lines prior to acceptance of the lines.
Any defects found during the television inspection shall be repaired by the Contractor utilizing methods acceptable to the City Engineer. Manholes or flexible connectors shall have no visible leaks.

c. Testing Manholes

The Contractor shall vacuum test all manholes to a minimum of 10-inches of mercury. The test shall be considered acceptable if the vacuum remains at 10-inches of mercury or drops to no less that nine (9) inches of mercury within one (1) minute. The test shall be conducted with the frame secured to the manhole. Backfilling around the manhole may occur prior to the vacuum test upon approval of the City Engineer.

If the manhole fails the initial test, the Contractor shall locate the leak(s) and make the appropriate repairs that are acceptable to the City Engineer and the manhole shall then be retested.

If the manhole fails the second test, the manhole shall be disassembled and then reassembled and the manhole retested.

If the manhole fails the third test, the manhole shall be removed from the project and a new manhole installed.

The Contractor is responsible for furnishing all equipment necessary for the vacuum test.

d. Testing of Sewer Lines

The Contractor will be required to perform a low pressure air test on all new sewer lines, including plugged service lines, as a condition of final acceptance. The line shall be tested from manhole to manhole. The test shall consist of installing a special pneumatic plug in the line at each manhole and pressurizing the line to about 4 psi. After a two-minute temperature stabilization period, the line pressure shall be brought to 3.5 psi. The time required for a drop in pressure of 1.0 psi will be recorded. The minimum allowable time in seconds for this pressure drop to occur shall not exceed the times listed in the following table:

<table>
<thead>
<tr>
<th>Less Than 500 LF Of Gravity Sewer Line</th>
<th>Minimum Time Required For 1.0 PSI Pressure Drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-inch</td>
<td>05 min, 40 sec</td>
</tr>
<tr>
<td>10-inch</td>
<td>07 min, 05 sec</td>
</tr>
<tr>
<td>12-inch</td>
<td>08 min, 30 sec</td>
</tr>
<tr>
<td>15-inch</td>
<td>10 min, 38 sec</td>
</tr>
<tr>
<td>18-inch</td>
<td>17 min, 00 sec</td>
</tr>
<tr>
<td>20-inch</td>
<td>18 min, 20 sec</td>
</tr>
<tr>
<td>21-inch</td>
<td>19 min, 50 sec</td>
</tr>
<tr>
<td>24-inch</td>
<td>22 min, 40 sec</td>
</tr>
</tbody>
</table>

If the time for the one (1) psi pressure drop is less than the value shown in the above table, the line shall be repaired and retested until it passes the test.

If groundwater is present, the test pressure shall be increased one (1) psi for each 2.3-feet of water above the pipeline.
The tests shall be conducted in the presence of the City Engineer and a complete tabulated report of the test for each section of the sewer shall be prepared by the Contractor and submitted to the City Engineer.

In the event of a marginal test at the time of the final inspection, the City Engineer may recommend that a portion of the Contractor’s final acceptance be withheld pending another inspection of the lines during the worst anticipated seasonable groundwater conditions.

27. Leakage Testing of Force Mains

Testing of force mains shall comply with the provisions listed below, or similar procedures approved by the City Engineer and that will insure equal or better results.

Force mains of any material shall be tested at the pressures shown in the following table. The allowable leakage shall not exceed the requirements of the latest revision of ANSI/AWWA Standard C600 as follows:

<table>
<thead>
<tr>
<th>Pipe Size (inch)</th>
<th>Minimum Test Pressure (psig)</th>
<th>Test Pressure (psig)</th>
<th>Allowable Leakage per 1000 feet of Line (gallons per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>150</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>150</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>150</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>150</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>150</td>
<td>1.10</td>
<td></td>
</tr>
</tbody>
</table>

Pressure shall be measured at the low point on the section of the pipeline. The Contractor shall furnish all gauges, meters, pumps and other equipment required to perform the testing. The equipment shall be maintained in satisfactory condition for accurate testing as determined by the City Engineer.

Where leaks are visible at exposed joints and/or evident on the surface when the joints are covered, the leaks shall be repaired and the leakage minimized regardless of total leakage as shown by the test.

Duration of the test shall not be less than two (2) hours. The City Engineer may require a longer length of test, up to a maximum of eight (8) hours to more accurately measure leakage.

Lines that fail to meet the leakage requirements shall be repaired and retested until the test requirements are met. All pipe, fittings and other materials found to be defective shall be removed and replaced by the Contractor.
28. Bypass Pumping

Bypassing pumping of sewage shall be considered a subsidiary obligation of the work.

Where flow stoppage may be necessary and the flow is so great as to require bypass pumping, the Contractor shall bypass the sewage around the section or sections of line that are being repaired by plugging an existing upstream manhole and pumping the sewage into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow.

Under no circumstances will the discharging of raw sewage be allowed anywhere except into an approved sanitary sewer system. Any accidental discharge of raw sewage into anything but an approved sanitary sewer system shall be immediately reported to the City Engineer.

Except as may be approved otherwise by the City Engineer, at the end of each working day the Contractor shall make temporary connections so that overnight pumping is not required.
III. Storm Sewer Construction

1. Scope of Work

The work under this Detailed Specification consists of the furnishing of all labor, materials, equipment and services necessary for the construction of storm sewer lines, manholes, inlets and associated appurtenances for the City of Bristol Tennessee. If the project to be constructed includes materials, equipment or services not covered in this Detailed Specification, the City Engineer must be contacted for details.

2. Pipeline Materials

The following pipeline materials are approved for installation in the City of Bristol Tennessee storm sewer system: (1) reinforced concrete pipe and (2) high density polyethylene pipe.

   a. Reinforced Concrete Pipe (RCP)

      (1) Materials and Manufacture

      Unless otherwise approved by the City Engineer, concrete pipe shall be a minimum of 15-inch diameter, Class 3, reinforced concrete pipe. The reinforced concrete pipe shall be manufactured per the latest revision of the *Virginia Department of Transportation Road and Bridge Specifications, Section 232*.

      (2) Pipe Bedding

      Reinforced concrete pipe shall be laid in a bed of crushed stone meeting the gradation requirements of TDOT Size No. 8 aggregate. The bedding aggregate shall be a minimum of four (4) inches thick and shall be installed per the requirements of the latest revisions of the *Virginia Department of Transportation Road and Bridge Specifications, Section 302* and the *Virginia Department of Transportation Road and Bridge Standards*. The bedding must extend the width of the trench.

      Bedding and backfill material when the pipe is under or near streets, shoulders, driveways or other travel ways shall be as specified in Paragraph 11. Pipeline Trenches Within Roadways of this Detailed Specification and as shown on the Detail Sheet in the approved plans.

   b. High Density Polyethylene (HDPE)

      (1) Materials and Manufacture

      The product supplied under this specification shall be high-density polyethylene corrugated exterior/smooth interior pipe. The HDPE pipe can have a size range of 15-inches to 36-inches and shall conform to the latest revision of AASHTO M294, Type S. The HDPE pipe shall be Hi-Q as manufactured by Hancor, N-12 as manufactured by Advanced Drainage Systems, Smooth Core as manufactured by Crumpler Plastic Pipe, or an equal product approved by the City Engineer. The equal product must have similar material and structural characteristics as the aforementioned products.

      (2) Joints and Fittings

      Pipe joints and fittings shall conform to the latest revision of AASHTO M252 or AASHTO M294, or be approved by the City Engineer.
Coupling bands shall cover at least one full corrugation on each section of pipe such as Hi-Q Band couplers manufactured by Hancor, Split Couplers as manufactured by Crumpler Plastic Pipe, or the Standard Split Coupler manufactured by Advanced Drainage Systems. All coupling bands shall meet or exceed the soil-tightness requirements of the latest revision of the AASHTO Standard Specifications for Highway Bridges, Section 23, Paragraph 23.3.1.5.4(e).

Fittings shall conform to the requirement of the latest revision of AASHTO M294.

(3) Pipe Bedding and Backfill

(a) General

The improved bedding material approved for use with HDPE in the pipe bedding envelope shall be Class IA, IB, II, III or IVA as shown in Table 1. The bedding envelope will extend from a minimum of six (6) inches below the outside wall of the HDPE pipe to a minimum of 12-inches above the outside wall of the HDPE pipe. Soil Classification Certification from a Geotechnical Engineer must be submitted to the City Engineer for approval when using Class III and IVA materials.

Place Class IA, IB, II, III or IVA embedment materials by methods that will not disturb or damage the pipe. Work in and tamp the haunching material in the area between the bedding and the underside of the pipe before placing and compacting the remainder of the embedment in the pipe zone. The entire embedment envelope must be compacted to a minimum of 95% standard proctor density within 3 percentage points of optimum moisture. All the embedment material must be installed in a maximum of six (6) inch lifts. The Contractor shall not permit compaction equipment to contact and damage the pipe. The Contractor shall use compaction equipment and techniques that are compatible with the materials used and the location of the trench. Before using heavy compaction or construction equipment directly over the pipe, place sufficient backfill to prevent damage, excessive deflections, or other disturbance of the pipe.

(b) Class III and IVA Bedding

The following are additional requirements for use of Class III and IVA materials as the improved bedding:

(i) Soil Classification

A soil classification/analysis must be performed by a Geotechnical Engineer to certify the soil classification based on the latest revision of the ASTM Specification D 2487. The City must be provided with a copy of the analysis and certification prior to allowing use of the material as improved bedding.

(ii) Compaction Testing

A Geotechnical Engineer must certify that the improved bedding was installed per the requirements of this Detailed Specification. The City must be provided with a copy of the compaction certification and associated testing reports. Compact test are required a minimum of fifty foot intervals at the spring line and top of the improved bedding envelope.
(iii) Trench Conditions

Class III and IVA material can only be used in dry trench conditions.

### TABLE 1 Classes of Embedment and Backfill Materials

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Soil Group Symbol</th>
<th>Description</th>
<th>Percentage Passing Sieve Sizes</th>
<th>Atterberg Limits</th>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>D 2487</td>
<td></td>
<td>1½ in. (40 mm)</td>
<td>No. 4 (4.75 mm)</td>
<td>No. 200 (0.075 mm)</td>
</tr>
<tr>
<td>IA</td>
<td>Manufactured Aggregates; open-graded, clean</td>
<td>None</td>
<td>Angular, crushed stone or rock, crushed gravel, broken coral, crushed slag, cinders or ashes, large void content, contain little or no fines.</td>
<td>100% ≤10% ≤5%</td>
<td>Non Plastic</td>
<td></td>
</tr>
<tr>
<td>IB</td>
<td>Manufactured, Processed Aggregates; dense-graded, clean</td>
<td>None</td>
<td>Angular, crushed stone or (other Class IIA materials) and stone/sand mixtures with gradations selected to minimize migration of adjacent soils, contain little or no fines (see X1.8).</td>
<td>100% ≤50% ≤5%</td>
<td>Non Plastic</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Coarse-Grained Soils, clean</td>
<td>GW</td>
<td>Well-graded gravels and gravel-sand mixtures, lime or no fines.</td>
<td>100% &lt;50% of &quot;Coarse Fraction&quot;</td>
<td>&lt;5%</td>
<td>Non Plastic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GP</td>
<td>Poorly-graded gravels and gravel-sand mixtures, lime or no fines.</td>
<td>&gt;50% of &quot;Coarse Fraction&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SW</td>
<td>Well-graded sands and gravelly sands, lime or no fines.</td>
<td>&gt;50% of &quot;Coarse Fraction&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SP</td>
<td>Poorly-graded sands and gravelly sands, lime or no fines.</td>
<td>&gt;50% of &quot;Coarse Fraction&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coarse-Grained Soils; borderline clean to w/lines</td>
<td>e.g. GW-GC, GP, SW, SP</td>
<td>Sands and gravels which are borderline between clean and with lines.</td>
<td>100%</td>
<td>Varies</td>
<td>5% to 12%</td>
</tr>
<tr>
<td>IA</td>
<td>Coarse-Grained Soils With Fines</td>
<td>GM</td>
<td>Silty gravels, gravel-sand mixtures.</td>
<td>100% &lt;50% of &quot;Coarse Fraction&quot;</td>
<td>12% to 50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>GC</td>
<td>Clayey silts, gravel-sand mixtures.</td>
<td>&gt;50% of &quot;Coarse Fraction&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SM</td>
<td>Silts, sand-silt mixtures.</td>
<td>&gt;50% of &quot;Coarse Fraction&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SC</td>
<td>Clayey sands, sand-silt mixtures.</td>
<td>&gt;50% of &quot;Coarse Fraction&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVA*</td>
<td>Fine-Grained Soils (inorganic)</td>
<td>ML</td>
<td>Inorganic silts and very fine sands, rock flour, silt, or clayey fine sands, silts with slight plasticity</td>
<td>100%</td>
<td>100% &gt;50% &lt;50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CL</td>
<td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silt, clays, lean clays.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVB</td>
<td>Fine-Grained Soils (organic)</td>
<td>MH</td>
<td>Inorganic clays, micaceous or diatomaceous fine sandy or silty soils, artificial slags,</td>
<td>100%</td>
<td>100% &gt;50% &gt;50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH</td>
<td>Inorganic clays of high plasticity, fat clays.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Organic Soils</td>
<td>OL</td>
<td>Organic silts and organic silt clays of low plasticity.</td>
<td>100%</td>
<td>100% &gt;50% &lt;50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>UM</td>
<td>Organic clays of medium to high plasticity, organic silts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PT</td>
<td>Peat and other high organic soils.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Includes Test Method D 2487 borderline classifications and basic symbols depending on plasticity index and liquid limits.  
Note: "Coarse Fraction" as used in this table is defined as material retained on a No. 200 sieve.
3. Highway Crossings

Open cut highway crossings can be utilized when installing storm sewer pipe unless otherwise shown on the Plans or where other installation methods are required by the City Engineer. Only reinforced concrete pipe can be placed under streets, roads, highways or other travel ways. The open cut crossing shall meet the following requirements:

a. All backfill, except for the pipe bedding, shall be TDOT Class A, Grade D aggregate. The backfill shall be placed in a maximum of 8-inch lifts and compacted to not less than 95 percent of maximum density determined in accordance with AASHTO T 99, Method D.

b. Unless otherwise approved by the City Engineer, at least one-half of the traveled portion of the highway must be open to traffic at all times.

c. The Contractor shall keep the pipeline trench width to a minimum to prevent excessive disturbance of the existing pavement. All pavements shall be saw cut.

d. Unless otherwise approved, the top of the proposed storm sewer pipe shall be at least three (3) feet below the highway.

e. The Contractor shall post warning signs and flagmen per the requirements of the Manual on Uniform Traffic Control Devices and the City Engineer.

f. The Contractor must maintain the trench until permanent restoration occurs. Maintenance shall consist of, but not be limited to, dust control and ridability (surface smoothness). The Contractor is strongly encouraged to temporarily pave all highway trenches in order to minimize trench maintenance. If the Contractor fails to adequately maintain the highway trenches, the City Engineer will require temporary pavement to be placed in the trenches.

The Contractor shall be fully responsible for the successful operation, without interruption, of traffic and shall be held responsible for returning the highway to its original condition. The Contractor shall be responsible for any settlement that occurs as a result of his work. Where required trenches shall be temporarily bridged with ½-inch steel plate for the convenience of the traveling public.

The City Engineer may require the use of flowable fill for backfilling of open cut trenches in highways. When required, the flowable fill shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 204. The use of flowable fill in trenches may require temporarily bridging the trench with a minimum ½-inch steel plate for the convenience of the traveling public.

When crossing State Highways, the Contractor shall contact the City Engineer for specific construction details.

4. Structures and Inlets

All storm water inlets and structures shall be precast concrete. Storm water inlets and structures shall be designed and installed per the latest revisions of the Virginia Department of Transportation Road and Bridge Specifications, Section 302 and the Virginia Department of Transportation Road and Bridge Standards.

Structures shall have a minimum inside diameter of four (4) feet for pipe connections of 24-inches or smaller. Structures for pipe connections larger than 24-inches shall have an inside diameter as shown in the Plans and as approved by the City Engineer.
c. **Standard Frames and Covers**

Manhole frames shall be furnished and set in a bed of double mastic as shown on the detail sheet. Frames shall be bolted to the concrete where indicated on the plans and/or required by the City Engineer. The standard frame and cover shall be an East Jordan Iron Works, Inc. Model V-1380. The frame shall have a minimum 24-inch opening. Unless otherwise shown on the drawings the covers shall be the solid self-sealing type with no holes except for watertight pick notches. The surface between the cover and frame shall fit smoothly without rocking and shall be thoroughly cleaned. The frame shall be set in a bed of mastic so as to constitute a watertight seal between the concrete and the frame. The words “Storm Sewer” shall be cast in the lid.

d. **Structure Inlets**

All structure inlets (i.e. drop inlets, grate inlets, yard inlets, etc.) shall be manufactured and installed per the latest revisions of the *Virginia Department of Transportation Road and Bridge Specifications, Section 302* and the *Virginia Department of Transportation Road and Bridge Standards*. The words “Storm Sewer” shall be cast in the access lid of structure inlets.

e. **Structure Inverts**

Structure inverts shall be poured in place or precast. Where poured in place, inverts shall be constructed per the latest revisions of the *Virginia Department of Transportation Road and Bridge Specifications, Section 302* and the *Virginia Department of Transportation Road and Bridge Standards*.

f. **Connection of Storm Sewer Lines to Structures**

The connection of the storm sewer lines to the structures shall be per the latest revisions of the *Virginia Department of Transportation Road and Bridge Specifications, Section 302* and the *Virginia Department of Transportation Road and Bridge Standards*.

The pipes shall be cut flush with the structure interior walls unless otherwise approved by the City Engineer. The void between pipe and structure walls shall be grouted both on the interior and exterior of the structure per the latest revisions of the *Virginia Department of Transportation Road and Bridge Specifications, Section 302* and the *Virginia Department of Transportation Road and Bridge Standards*.

5. **Headwalls and Flared End Sections**

 Manufacture and installation of headwalls and flared end sections for storm sewer pipes must meet the requirements of the latest revisions of the *Virginia Department of Transportation Road and Bridge Specifications, Section 302* and the *Virginia Department of Transportation Road and Bridge Standards*.

All pipe inlets and outlets require a poured in place or precast concrete headwall or flared end section. Inlets and outlets for HDPE pipe must be a poured in place or precast concrete headwall.

6. **Lines and Grades**

Unless otherwise directed by the City Engineer, lines and grades shall be set to conform to those shown on the plans approved by the City of Bristol Tennessee.
Lines and grades shall meet the following minimum requirements set out by the Tennessee Department of Environment and Conservation, Division of Water Pollution Control when installed near water lines.

a. **Horizontal Separation**

   Storm sewers shall be laid at minimum of ten (10) feet horizontally from any existing or proposed water line. The distance shall be measured from edge to edge. Should local conditions prevent a horizontal separation of ten (10) feet, the storm sewer may be laid closer than the required ten (10) feet if it is laid in a separate trench and if the elevation of the top of the sewer pipe is at least 18 inches below the bottom of the water main.

b. **Vertical Separation**

   Whenever storm sewers must cross under water mains, the storm sewer shall be laid at such elevation that the top of the storm sewer pipe is at least 18 inches below the bottom of the water main. When the elevation of the storm sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of ten (10) feet on each side of the sewer. One full length of water main should be center over the sewer so that both joints will be as far from the sewer as possible.

c. **General**

   When it is impractical to obtain proper horizontal and vertical separation as stipulated above, the storm sewer shall be designed and constructed equal to the water main pipe and shall be pressure-tested to assure water tightness. Such arrangements are discouraged and adequate reason shall be provided to justify the design.

The Tennessee Department of Environment and Conservation, Division of Water Pollution Control and the City Engineer must approve any variations from the requirements in this section.

7. **Excavation for Pipeline Trenches and Structures**

   a. **General**

      Prior to commencing any excavation, the Contractor must contact Tennessee One Call (1-800-351-1111) and allow appropriate time for any existing underground utilities to be located and marked. The Contractor is encouraged to also contact the respective utilities separately to request utility locating and marking.

      The Contractor shall install proper erosion and sediment control devices prior to commencing any excavation. Erosion and sediment control device installation and maintenance shall meet the requirements of the latest revision of the *Tennessee Erosion and Sediment Control Handbook* and the City Engineer.

      The Contractor shall install traffic control devices prior to commencing work in a public or private right-of-way or travel way. Traffic control device installation and maintenance shall meet the requirements of the latest revision of the *Manual on Uniform Traffic Control Devices* and the City Engineer.

      Excavation for pipeline trenches and structures shall meet the requirements of the latest revisions of the *Virginia Department of Transportation Road and Bridge Specifications, Section 302* and the *Virginia Department of Transportation Road and Bridge Standards*. 
Unless otherwise indicated, trenches shall be excavated in open cut to the depths indicated on the approved plans and/or as directed by the City Engineer to permit proper bedding of the pipe. The Contractor shall provide adequate facilities for promptly removing water from all excavations. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe. Unless specifically authorized by the City Engineer, trenches shall not be excavated wider than a total of 24-inches plus the nominal outside diameter of the pipe at the level of the top of the pipe. The clearance between the side of the pipe and the trench wall must be a minimum of 6-inches and cannot exceed 18-inches but the total clearance on both sides of the pipe cannot exceed 24-inches for RCP less than 36-inches in diameter. For pipes 36-inches in diameter and larger, the total clearance cannot exceed 36-inches.

Unless specifically directed otherwise by the City Engineer or where required to uncover or determine the presence of underground obstructions, not more than 300 feet of trench shall be opened ahead of the pipe laying and not more than 200 feet of open trench shall be left behind the pipe laying. Before laying the pipe, the Contractor shall open the trench far enough ahead to reveal obstructions and verify existing utility locations that may necessitate changing the line or grade of the pipe. Should the Contractor fail to locate obstructions or uncover existing utilities in advance of the pipe laying, any revisions to change the alignment of the pipe due to the obstruction or utility shall be at no expense to the City.

All barricades, lanterns, watchmen, and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions shall be provided by the Contractor.

When so required by the TDOT, Sullivan County Highway Department or the City of Bristol Tennessee, one-half of the road crossings shall be excavated, and then temporary bridges consisting of a minimum ½-inch steel plate shall be placed over the trench for the safety and convenience of the traveling public. The remainder of the excavation can then be carried out. All backfilled ditches shall be maintained in such a manner that they offer minimal hazard to the passage of traffic. The Contractor must maintain the trench until permanent restoration occurs. Maintenance shall consist of, but not be limited to, dust control and ridability (surface smoothness). The Contractor is strongly encouraged to temporarily pave all highway trenches in order to minimize trench maintenance. If the Contractor fails to adequately maintain the highway trenches, the City Engineer will require temporary pavement to be placed in the trenches. The safety and convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged.

In excavations for masonry and concrete structures, the required width shall be such as to permit forms to be constructed in the proper manner and to permit proper backfilling upon completion of the structures. Depth of excavation for footings shall be as shown on the approved plans and/or as directed by the City Engineer to obtain sufficient bearing.

All excavated material not needed for backfilling purposes shall be disposed in a manner satisfactory to the City of Bristol Tennessee. Prior to disposing of the excess material the Contractor should ensure the proposed fill site has been properly permitted by the appropriate governmental agency. The City will not allow disposal of excess material on non-permitted sites.

In all public or private rights-of-way or easements, excavations must be limited to the footage of pipe that can be laid and the trench/excavation backfilled in the same day. No trench or excavation can be left open overnight in these areas. All other rules and regulations of the TDOT, Sullivan County Highway Department and the City of Bristol Tennessee shall apply.
All excavations shall be accomplished in accordance with applicable safety laws and regulations. The City of Bristol Tennessee does not assume responsibility of any degree or sort for acts of the Contractor.

b. **Unstable Trench Bottom Material and Undercutting**

If wet, mucky and/or unstable material is encountered in a trench bottom, the City Engineer may require additional excavation to ensure a firm foundation for the pipe. The quantity of undercutting will be determined by the City Engineer but as a rule of thumb will be a minimum of two (2) feet deep the width of the trench. In such cases, the trench bottom shall be brought back up to proper grade with TDOT Size No. 8 aggregate. However, if subgrade stabilization is not occurring, the City Engineer will direct the Contractor to refill the ditch with TDOT Size No. 3 (2-inch) aggregate until subgrade stabilization is achieved. In general, where TDOT Size No. 3 aggregate is required due to unstable pipeline trench conditions other than voids or caverns, the ditch shall be capped off with TDOT Size No. 8 aggregate as shown on the plans.

In those areas where voids can be filled without difficulty, the Contractor shall use TDOT rubble-stone riprap (plain) to fill the void, then TDOT Size No. 3 aggregate and finally the TDOT Size No. 8 aggregate. The TDOT Size No. 8 aggregate is considered bedding material. For all other void or cavernous areas, *Paragraph 13. Construction Methods when Voids or Caverns are Encountered* shall apply.

c. **Excavation Near Potable Water Lines**

(1) **Horizontal Separation**

Storm sewers shall be laid at minimum of ten (10) feet horizontally from any existing or proposed water line. The distance shall be measured from edge to edge. Should local conditions prevent a horizontal separation of ten (10) feet, the storm sewer may be laid closer than the required ten (10) feet if it is laid in a separate trench and if the elevation of the top of the sewer pipe is at least 18 inches below the bottom of the water main.

(2) **Vertical Separation**

Whenever storm sewers must cross under water mains, the storm sewer shall be laid at such elevation that the top of the storm sewer pipe is at least 18 inches below the bottom of the water main. When the elevation of the storm sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of ten (10) feet on each side of the sewer. One full length of water main should be center over the storm sewer so that both joints will be as far from the sewer as possible.

(3) **General**

When it is impractical to obtain proper horizontal and vertical separation as stipulated above, the storm sewer shall be designed and constructed equal to the water main pipe and shall be pressure-tested to assure water tightness. Such arrangements are discouraged and adequate reason shall be provided to justify the design.

The Tennessee Department of Environment and Conservation, Division of Water Pollution Control and the City Engineer must approve any variations from the requirements in this section.
d. Excavation on Easements

Excavation of pipeline trenches on easements shall be performed in such a manner that the private property owner’s facilities and grounds shall be restored to as near to their original condition as possible considering the work performed. The grass cover of the areas disturbed due to the excavation shall be the same type as the original undisturbed cover.

Before any excavation is begun or before drilling and blasting, up to a minimum of nine (9) inches of the existing topsoil shall be removed from the work area. The topsoil must be excavated and stockpiled in a manner that prevents contamination with any other material or debris. Should topsoil not be present, a minimum of nine (9) inches of the existing ground cover shall be removed from the work area and stockpiled in a manner as not to contaminate with other materials or debris.

Excavated materials suitable for backfill shall be placed at a distance far enough from the ditch to allow excavated rock to be placed next to the trench; however, stockpiling outside the easement shall be done only with the property owner’s written permission.

e. Removal of Water

The Contractor shall at all times during construction provide and maintain means and devices with which to promptly dispose of all water entering the excavations or other parts of the work. All excavations must be kept dry until the structures to be installed therein are completed. No concrete shall be placed in water nor shall water be allowed to rise over structures if there is a danger of flotation or of setting up unequal pressures in the concrete until the concrete has set at least 24 hours and the danger of flotation has been removed.

The Contractor shall dispose of water from the work zone in a suitable manner without damage to adjacent property or storm sewers. No water shall be drained into work built or under construction. The discharge of trench water must meet all requirements of the latest revision of the *Tennessee Erosion and Sediment Control Handbook*, the Tennessee Department of Environment and Conservation, and the City Engineer.

During the laying of storm sewers and until the storm sewer pipe has been bedded in place with at least two (2) feet of backfill over the pipe, the Contractor shall keep the groundwater table below the bottom of the trench. Installation of the storm sewer pipe will not be permitted except in a dry trench.

f. HDPE Pipe Excavation Special Provisions

When excavating for HDPE pipe, the following special provisions are required in addition to the provisions listed in *Paragraph 7* of this Detailed Specification.

The minimum trench width allowed is the outside diameter of the pipe plus sixteen (16) inches. The space between the pipe and trench wall must be of sufficient width to utilize the compaction equipment in the pipe zone, but under no circumstances should the trench be wider than allowed in *Paragraph 7.a. of this Detailed Specification*.

Where the trench bottom is unstable or shows a “quick” tendency, excavate to a minimum depth of two (2) feet and replace with a foundation of TDOT Size No. 8 aggregate. Place and compact the foundation material to a minimum of 95% standard proctor density in a maximum of six (6) inch lifts. For severe conditions, the City Engineer may require a special foundation.
If the trench bottom is over excavated below the intended grade, fill the over excavation with TDOT Size No. 8 aggregate and compact to 95% standard proctor density in a maximum of six (6) inch lifts.

If the trench sidewalls slough off during any part of excavation or installation of the HDPE pipe, remove all sloughed and loose material from the trench.

8. Pipe Bedding
   a. General

   In general, the trench shall be opened below the bottom of the pipe to the depth previously specified and refilled with the appropriate bedding material to provide a firm, stable and uniform bed for the bottom quadrant of the pipe at the proper grade and line.

   When rock is encountered, the trench shall be excavated to a depth of at least six (6) inches below the bottom of the pipe and refilled with the bedding material to provide a firm bed for the bottom quadrant of the pipe.

   Material as specified hereinbefore shall be brought up evenly along each side of the pipe and tamped so as to secure the line and grade of the pipeline and to prevent damage thereto.

   b. Bedding and Backfill of RCP

   Reinforced concrete pipe shall be excavated and backfilled as specified in Paragraph 2.a.(2) Pipe Bedding, Paragraph 10. Backfilling of Pipeline Trenches, and where applicable Paragraph 11. Pipeline Trenches Within Roadways of this Detailed Specification.

   c. Bedding and Backfill of HDPE

   HDPE pipe shall be excavated and backfilled as specified in Paragraph 2.b.(3) Pipe Bedding and Backfill, Paragraph 10. Backfilling of Pipeline Trenches, and where applicable Paragraph 11. Pipeline Trenches Within Roadways of this Detailed Specification.

   d. Unstable Trench Bottom Material and Undercutting

   If wet, mucky and/or unstable material is encountered in a trench bottom, the City Engineer may require additional excavation to ensure a firm foundation for the pipe. The quantity of undercutting will be determined by the City Engineer but as a rule of thumb will be a minimum of two (2) feet deep the width of the trench. In such cases, the trench bottom shall be brought back up to proper grade with TDOT Size No. 8 aggregate. However, if subgrade stabilization is not occurring, the City Engineer will direct the Contractor to refill the ditch with TDOT Size No. 3 (2-inch) aggregate until subgrade stabilization is achieved. In general, where No. 3 aggregate is required due to unstable pipeline trench conditions other than voids or caverns, the ditch shall be capped off with TDOT Size No. 8 aggregate as shown on the Plans.

   In those areas where voids can be filled without difficulty, the Contractor shall use TDOT rubble-stone riprap (plain) to fill the void, then TDOT Size No. 3 aggregate and finally the TDOT Size No. 8 aggregate. The TDOT Size No. 8 aggregate is considered bedding material. For all other void or cavernous areas, Paragraph 18. Construction Methods when Voids or Caverns are Encountered shall apply.
9. Pipe Installation

a. General

The trench shall be excavated to the required depth and width and bell holes dug in the bedding in advance of pipe laying. A minimum of 3-feet of cover must be provided between the outside of the pipe to the finished grade except under State Highways where the minimum cover shall be four (4) feet.

The installation of storm sewer pipes in finished trenches shall be commenced at the lowest point so that the spigot ends point in the direction of the flow. All pipes shall be installed with ends abutting and true to the line and grade indicated on the approved plans or as directed by the City Engineer.

The pipe shall be fitted and matched so that when installed the pipe will form a storm sewer with a smooth and uniform invert. Supporting of pipes shall be as set out above under Paragraph 8. Pipe Bedding and Paragraph 10. Backfilling of Pipeline Trenches. Under no circumstances will the supporting of pipes on blocks or earth mounds be permitted.

b. RCP Installation

RCP shall be installed per the requirements of this Detailed Specification and the latest revisions of the Virginia Department of Transportation Road and Bridge Specifications, Section 302 and the Virginia Department of Transportation Road and Bridge Standards.

c. HDPE Pipe Installation

HDPE pipe shall be installed per the requirements of this Detailed Specification, per the latest revision of ASTM D2321 and as recommend by the pipe manufacturer.

Localized loadings and differential settlement shall be minimized wherever the pipe crosses other utilities or subsurface structures, or whenever there are special foundations such as concrete capped piles or sheeting. Provide a cushion of bedding between the pipe and any such point of localized loading.

Place the pipe and fittings in the trench with the invert conforming to the required elevations, slopes and alignment. Provide bell holes in the pipe bedding, no larger than necessary, in order to ensure uniform pipe support. Fill voids under the bell by “working in” the bedding material.

Comply with the manufacturer’s recommendations for assembly of joint components, lubrication and making of joints. When pipe installation is interrupted, secure piping against movement and seal open ends to prevent the entrance of water, mud, or foreign material.

e. Unstable Trench Bottom Material and Undercutting

If wet, mucky and/or unstable material is encountered in a trench bottom, the City Engineer may require additional excavation to ensure a firm foundation for the pipe. The quantity of undercutting will be determined by the City Engineer but as a rule of thumb will be a minimum of two (2) feet deep the width of the trench. In such cases, the trench bottom shall be brought back up to proper grade with TDOT Size No. 8 aggregate. However, if subgrade stabilization is not occurring, the City Engineer will direct the Contractor to refill the ditch with TDOT Size No. 3 (2-inch) aggregate until subgrade stabilization is achieved. In general, where No. 3 aggregate is required due to unstable
pipeline trench conditions other than voids or caverns, the ditch shall be capped off with TDOT Size No. 8 aggregate as shown on the Plans.

In those areas where voids can be filled without difficulty, the Contractor shall use TDOT rubble-stone riprap (plain) to fill the void, then TDOT Size No. 3 aggregate and finally the TDOT Size No. 8 aggregate. The TDOT Size No. 8 aggregate is considered bedding material. For all other void or cavernous areas, Paragraph 12. Construction Methods when Voids or Caverns are Encountered shall apply.

10. Backfilling of Pipeline Trenches

a. Outside of Paved or Graveled Roads, Shoulders, Driveways, Parking Areas or Other Travel Ways

In the backfilling of the trenches outside of paved or graveled roads, shoulders, driveways, parking areas or other travel ways, material reasonably free from rock and acceptable to the City Engineer shall be used. Rock fragments greater than 18-inches in any dimension will not be allowed as backfill material under any circumstances. The pipe shall be bedded as previously specified in this Detailed Specification and as shown on the Plans.

Except as may be necessary in tamping or backfilling, walking or working on the completed pipeline shall not be permitted until the trench has been backfilled to a height of at least 12-inches above the top of the pipe. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed or damaged. Extra care shall be exercised until the backfill reaches a point 12-inches above the top of the pipe.

In filling the remainder of the trench, the backfill material may be shoveled into the trench in layers not to exceed 12-inches and firmly tamped into place by tampers or rammers. The backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the City Engineer, this method of backfilling will not inconvenience the public or property owner.

b. Backfill in Paved or Graveled Roads, Shoulders, Driveways, Parking Areas or Other Travel Ways

Where storm sewers are to be installed within paved or graveled roads, shoulders, driveways, parking areas or other travel ways, the backfill material shall be TDOT Class A, Grade D base aggregated. The pipe shall be bedded as previously specified in this Detailed Specification and as shown on the Plans.

Except as may be necessary in tamping or backfilling, walking or working on the completed pipeline shall not be permitted until the trench has been backfilled to a height of at least 12-inches above the top of the pipe. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed or damaged. Extra care shall be exercised until the backfill reaches a point 12-inches above the top of the pipe.

In filling the remainder of the trench, the backfill material shall be placed into the trench in layers not to exceed 8-inches and compacted by tampers or rammers. The backfill material must be compacted to not less than 95 percent of maximum density determined in accordance with AASHTO T 99, Method D.
The City Engineer may require the use of flowable fill for backfilling of open cut trenches in highways. When required, the flowable fill shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 204. The use of flowable fill in trenches may require temporarily bridging the trench with a minimum ½-inch steel plate for the convenience of the traveling public.

c. Backfilling Operations Conducted on Easements

Backfilling of trenches or excavations on easements shall be performed in such a manner that the private property owner’s facilities and grounds shall be restored to as near as possible their original condition immediately after pipe laying on the property has been completed.

The pipe shall be bedded as previously specified in this Detailed Specification and as shown on the Plans. Next, any excavated rock less than 18-inches in diameter can be placed in the trench. Excavated rock shall not be placed any closer than 18-inches from the finished grade and any excess rock shall be removed by the Contractor and disposed of as directed. Rock fragments greater than 18-inches in any dimension will not be allowed as backfill material under any circumstances.

The residue of the stockpiled bedding material shall be cleaned up and placed into the trench, leaving no bedding stone scattered over the area. The previously excavated materials suitable for backfill shall be placed into the ditch only upon clean up and backfill of the bedding material. In filling the remainder of the trench, the backfill material may be shoveled into the trench in layers not to exceed 12-inches and firmly tamped into place by tampers or rammers. The top portion of the trench or excavation shall be filled using topsoil. The backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the City Engineer, this method of backfilling will not inconvenience the public or the property owner.

If the backfilling operation is performed during extremely dry weather, the Contractor should leave some stockpiled topsoil to use later as additional fill after settlement has occurred.

The Contractor will be held responsible for the condition of grass cover and the condition of the ground surface at the time of final inspection unless the property owner has plowed or excavated the ground.

d. Disposal of Excess Material

The Contractor shall be responsible for the off-site disposal of any and all excess or unsuitable material excavated in the construction of the project. The Contractor shall be responsible for obtaining any and all permits, license fees, etc. associated with the disposal of excess material. The City will not allow disposal of excess material on non-permitted sites.

11. Pipeline Trenches Within Roadways

Where excavation is within the traveled portion of State, County or City streets, all native earth and/or rock shall be removed and hauled away and disposed of by the Contractor. The resulting backfill material shall be as specified in Paragraph 10.b. of this Detailed Specification.
12. Unauthorized Excavation and Over-Breakage

Whenever the excavation is carried beyond or below the lines and grades shown on the drawings or given by the City Engineer, the Contractor shall refill such excavated space with material approved by the City Engineer in such a manner as will insure stability of the structure or line involved, including the use of crushed stone or TDOT Class “A” concrete.

Over-breakage is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the City Engineer, including slides. All over-breakage shall be removed by the Contractor and disposed of as directed.

13. Construction Methods when Voids or Caverns are Encountered

Where a void or cavern is encountered during construction, the Contractor shall immediately contact the City Engineer. However, in general, the Contractor shall fill the void or cavern with rubble stone and TDOT Size No. 3 (2-inch) aggregate. If it is impracticable to fill the void or cavern, the Contractor shall construct a specially designed bridge slab to support the pipeline. A registered engineer shall design the bridge slab. The area to be bridged shall be excavated and measured. The City Engineer shall be called to the site to examine the bearing area available for the slab.

When a void or cavern is encountered during installation of HDPE pipe, the City Engineer must be contacted immediately for the correct construction method to be utilized in filling or bridging the void or cavern.

14. Rock Excavation

The methods used to excavate rock where encountered is the sole responsibility of the Contractor. The methods utilized should not jeopardize the safety of the construction crews or the public. The methods utilize should protect existing structures, utilities, property, etc. from damage. The Contractor is responsible for obtaining the appropriate Federal, State and Local permits when utilizing blasting for rock removal. The Contractor must utilize only people licensed by the State for blasting. Inside the City limits, the Contractor must obtain a Blasting Permit from the Fire Department.

15. Sheeting, Shoring and Bracing of Excavation

Sheeting, shoring and bracing of an excavation is the sole responsibility of the Contractor. The Contractor is responsible for determining when and where sheeting, shoring and bracing are required. The Contractor must follow all Federal, State and Local safety regulations regarding proper sheeting, shoring and bracing of excavated areas.

16. Connections to Existing Storm Sewers

Connections to existing storm sewers shall be made at the location shown on the Plans. Connections to existing storm sewer structures shall be core drilled unless otherwise approved by the City Engineer. Where the connection to an existing storm sewer structure damages the existing invert of the structure, the existing invert shall be removed and reworked to the satisfaction of the City Engineer.

17. Abandoning Existing Storm Sewers

Where shown on the Plans, existing storm sewer lines and structures shall be abandoned. The methods utilized to abandon the storm sewer lines and structures shall be approved by the City Engineer.
In general when abandoning structures, the top four (4) feet of the structure must be removed. TDOT Class “A” concrete shall then be placed in the structure to a depth of at least 12-inches above the top of any pipe connected to the structure. The remainder of the structure can then be backfilled with material and methods as specified in Paragraph 10. Backfilling of Pipeline Trenches.

In general when abandoning a storm sewer line TDOT Class “A” concrete shall be used to encapsulate the end of the line to the satisfaction of the City Engineer.

18. Inspection of Storm Sewer Lines and Structures

a. General

The Contractor shall notify the City Engineer when pipe or structures will be received on the job so that arrangements may be made for inspecting, unloading and stringing, as well as inspecting the pipe and structure proper and examining for the manufacturer’s identification. Pipe and structures shall be unloaded and stored in accordance with the manufacturer’s recommendations. No pipe, structures, or other materials or equipment shall be stored on private property without the written permission of the property owner.

Before the Contractor backfills any lines or structures, the lines and structures shall be inspected by the City Engineer. The City Engineer shall give the Contractor permission to proceed with backfilling of the lines and structures. If any joints, pipes, structures or other workmanship or materials are found to be defective, they shall be removed and replaced by the Contractor.

After the storm sewer lines and structures have been brought to completion, and prior to final inspection, the Contractor shall clean out the entire system. The Contractor shall utilize appropriate tools and methods for the removal from the lines and structures of any and all debris and obstructions. The City Engineer must approve of the tools and methods utilized to remove debris.

During the final inspection, the City Engineer will inspect each individual line, from structure to structure, to determine whether the completed lines are true to line and grade as shown on the Plans. All lines or sections of lines that are found to be laid improperly with respect to line or grade, found to be defective, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced by the Contractor.

b. HDPE Pipe

The City Engineer must inspect installation of the pipe including subgrade preparation, bedding and backfilling to one (1) foot above the top of the pipe on a full time basis. The installation process described in the previous sentence will not be allowed unless observed by the City Engineer. The City Engineer must be contacted prior to commencing installation of HDPE pipe so inspection services can be scheduled.

19. Inspection of HDPE Lines for Deflection

Upon the completion of installation and backfilling, the HDPE pipe shall be capable of passing a City Engineer approved 9-arm mandrel having a diameter equal to 95 percent of the inside diameter of the pipe. No section of pipe will be accepted that exhibits a deflection in excess of 5%. A minimum of 30 days shall elapse after backfilling has been completed prior to checking for deflection with the mandrel.
IV. Water Line Construction

1. Scope Of Work

The work under this Detailed Specification consists of the furnishing of all labor, materials, equipment and services necessary for the construction of water lines and appurtenances for the City of Bristol Tennessee. If the project to be constructed includes materials, equipment or services not covered in these specifications, the City Engineer must be contacted for details.

2. Location of Water Line

The approximate location of the water line in relation to the limits of rights-of-way, pavement, etc., is shown on the Plans approved by the Tennessee Department of Environment and Conservation and the City of Bristol Tennessee. The Contractor shall construct the water line as close to the alignment shown on the approved Plans. The final location may be varied by the Contractor with the approval of the City Engineer provided that (1) the proposed location is within the construction easement or right-of-way shown on the approved Plans, and (2) the proposed location is approved by the Tennessee Department of Transportation, Sullivan County Highway Department, City of Bristol Tennessee or other legal entity having jurisdiction over placement of the water line in the right-of-way. The final location in any event may be varied by necessity due to construction conditions at the direction of the City Engineer.

3. Pipeline Materials for Water Lines

a. General

All water lines shall be ductile iron pipe unless otherwise approved by the City Engineer. PVC pipe will not be permitted unless approved by the City Engineer.

b. Ductile Iron Pipe

Ductile Iron Pipe shall be centrifugally cast, manufactured and tested in accordance with the latest revision of ANSI/AWWA Standard C150/A21.50. Pipe shall meet the requirements of the latest revision of ANSI/AWWA Standard C151/A21.51.

Ductile iron pipe shall have a working pressure of 350 psi plus a surge allowance of 100 psi. The nominal wall thickness for each pipe size of Pressure Class 350 pipe shall be as shown in the latest revision of ANSI/AWWA C151/A21.51.

The pipe shall be manufactured and tested in accordance with the requirements of the latest revision of ANSI/AWWA C151/A21.51.

The pipe shall be push-on type joint incorporating a single molded rubber ring gasket conforming to the latest revision of ANSI/AWWA Standard C111/A21.11 unless otherwise indicated. The pipe shall be furnished with a tar coated outside and the manufacturer’s standard cement lined inside to comply with the latest revision of ANSI/AWWA C104/A21.4 and C151/A21.51.

c. Ductile Iron Fittings

All fittings for ductile iron pipe shall be Class 350 mechanical joint conforming to the latest revision of ANSI/AWWA Standard C110/A21.10, C121/A21.51, and shall meet the current requirements for the manufacturer’s standards. Fittings shown on the Standard
Detail Sheet are intended to convey the general configuration but the Contractor shall furnish all fittings required.

All fittings shall be furnished with a tar coated outside and the manufacturer's standard cement lined inside to comply with the latest revision of ANSI/AWWA C104/A21.4 and C151/A21.51.

Each fitting shall be certified by the manufacturer to have been tested and to have met the requirements of the governing standard specifications.

d. **Mechanically Restrained Joints**

Ductile iron pipe with mechanically restrained joints shall be Pressure Class 350. Restrained joint ductile iron pipe shall conform to the latest revision of ANSI/AWWA Standards C110/A21.10, C111/A21.11 and C151/A21.51. The pipe shall be installed at stream and creek crossings, in casing pipes or where shown on the Plans or directed by the City Engineer. The pipe shall be U. S. Pipe TR Flex, American Flex-Ring, Griffin Pipe SNAP-LOK or an approved equal.

e. **Testing**

All ductile iron pipe and fittings shall be tested in accordance with all applicable ANSI, AWWA and ASTM standards.

f. **Markings**

Each length of pipe and all fittings shall have the following information plainly marked on the pipe’s exterior:

1. Nominal Size
2. Class
3. Manufacturer
4. Quality Control Code
5. National Sanitation Foundation (NSF) Standard 61 Stamp Seal of Approval
6. Independent Testing Laboratory Stamp

4. **Lines and Grades**

Unless otherwise directed by the City Engineer, lines and grades shall be set to conform to those shown on the approved Plans. The Contractor shall take special care setting the lines and grades where air release valves are to be located to ensure that the air release is placed at the high point in the water line and has sufficient depth to function properly. The Contractor shall take special care setting the lines and grades where blow offs are to be located to ensure the blow offs are placed at the low points in the water line.

The Contractor shall lay water lines to maintain a minimum vertical separation of 18-inches between the water lines and any existing sanitary sewer or storm sewer lines where they cross. The Contractor shall lay water lines to maintain a minimum horizontal separation of 10-feet between the water lines and any existing sanitary sewer or storm sewer lines where they are parallel.
5. Excavation of Pipeline Trenches for Water Lines

a. General

Prior to commencing any excavation, the Contractor must contact Tennessee One Call (1-800-351-1111) and allow appropriate time for any existing underground utilities to be located and marked. The Contractor is encouraged to also contact the respective utilities separately to request utility locating and marking.

The Contractor shall install proper erosion and sediment control devices prior to commencing any excavation. Erosion and sediment control device installation and maintenance shall meet the requirements of the latest revision of the *Tennessee Erosion and Sediment Control Handbook* and the City Engineer.

The Contractor shall install traffic control devices prior to commencing work in a public or private right-of-way or travel way. Traffic control device installation and maintenance shall meet the requirements of the latest revision of the *Manual on Uniform Traffic Control Devices* and the City Engineer.

The excavation shall be carried to the depths indicated on the approved plans and/or directed by the City Engineer to permit proper bedding of the pipe. Trenches shall be opened to a depth where the top of the pipe shall not be less than 36-inches below any ground surface. When installing pipe in a State right-of-way, the trenches shall be opened to a depth where the top of the pipe shall not be less than 48-inches below any ground surface. The City Engineer may require the pipe to be placed at depths greater than shown above based on actual field conditions. All depths of cover are measured to the top of the pipe.

Trenches shall be of sufficient width to provide free working space on each side of the pipe and permit proper backfilling around the pipe. Unless specifically authorized by the City Engineer, trenches shall not be excavated wider than a total of 24-inches plus the nominal outside diameter of the pipe at the level of the top of the pipe. The clearance between the side of the pipe and the trench wall can be a minimum of 6-inches and must not exceed 18-inches but the total clearance on both sides of the pipe must not exceed 24-inches.

Unless specifically directed otherwise by the City Engineer or where required to uncover or determine the presence of underground obstructions, not more than 300 feet of trench shall be opened ahead of the pipe laying and not more than 200 feet of open trench shall be left behind the pipe laying. Before laying the pipe, the Contractor shall open the trench far enough ahead to reveal obstructions and verify existing utility locations that may necessitate changing the line or grade of the pipe. Should the Contractor fail to locate obstructions or uncover existing utilities in advance of the pipe laying, any revisions to change the alignment of the pipe due to the obstruction or utility shall be at no expense to the City.

All barricades, lanterns, watchmen, and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions shall be provided by the Contractor.

When so required by the TDOT, Sullivan County Highway Department or the City of Bristol Tennessee, one-half of the road crossings shall be excavated, and then temporary bridges consisting of ½-inch steel plate shall be placed over the trench for the convenience of the traveling public. The remainder of the excavation can then be carried out. All backfilled trenches shall be maintained in such a manner that they offer minimal hazard to the passage of traffic. The Contractor must maintain the trench until
permanent restoration occurs. Maintenance shall consist of, but not be limited to, dust control and ridability (surface smoothness). The Contractor is strongly encouraged to temporarily pave all highway trenches in order to minimize trench maintenance. If the Contractor fails to adequately maintain the highway trenches, the City Engineer will require temporary pavement to be placed in the trenches. The convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged.

In excavations for masonry and concrete structures, including manholes, the required width shall be such as to permit forms to be constructed in the proper manner and to permit proper backfilling upon completion of the structures. Depth of excavation for footings shall be as shown on the approved plans and/or as directed by the City Engineer to obtain sufficient bearing.

All excavated material not needed for backfilling purposes shall be disposed in a manner satisfactory to the City of Bristol Tennessee. Prior to disposing of the excess material the Contractor should ensure the proposed fill site has been properly permitted by the appropriate governmental agency.

In all public or private rights-of-way or easements, excavations must be limited to the footage of pipe that can be laid and the trench/excavation backfilled in the same day. No trench or excavation can be left open overnight in these areas. All other rules and regulations of the TDOT, Sullivan County Highway Department and the City of Bristol Tennessee shall apply.

All excavations shall be accomplished in accordance with applicable safety laws and regulations. The City of Bristol Tennessee does not assume responsibility of any degree or sort for acts of the Contractor.

b. Unstable Trench Bottom Material and Undercutting

If wet, mucky and/or unstable material is encountered in a trench bottom, the City Engineer may require additional excavation to insure a firm foundation for the pipe. The quantity of undercutting will be determined by the City Engineer but as a rule of thumb will be a minimum of two (2) feet deep the width of the trench. In such cases, the trench bottom shall be brought back up to proper grade with TDOT Size No. 8 aggregate. However, if subgrade stabilization is not occurring, the City Engineer will direct the Contractor to refill the ditch with TDOT Size No. 3 (2-inch) aggregate until subgrade stabilization is achieved. In general, where TDOT Size No. 3 aggregate is required due to unstable pipeline trench conditions other than voids or caverns, the ditch shall be capped off with TDOT Size No. 8 aggregate as shown on the Plans.

In those areas where voids can be filled without difficulty, the Contractor shall use TDOT rubble-stone riprap (plain) to fill the void, then TDOT Size No. 3 aggregate and finally the TDOT Size No. 8 aggregate. The TDOT Size No. 8 aggregate is considered bedding material. For all other void or cavernous areas, Paragraph 18. Construction Methods when Voids or Caverns are Encountered shall apply.

c. Excavation on Easements

Excavation of pipeline trenches on easements shall be performed in such a manner that the private property owner’s facilities and grounds shall be restored to as near to their original condition as possible considering the work performed. The grass cover of the areas disturbed due to the excavation shall be the same type as the original undisturbed cover.
Before any excavation is begun or before drilling and blasting, up to a minimum of nine (9) inches of the existing topsoil shall be removed from the work area. The topsoil must be excavated and stockpiled in a manner that prevents contamination with any other material or debris. Should topsoil not be present, a minimum of nine (9) inches of the existing ground cover shall be removed from the work area and stockpiled in a manner as not to contaminate with other materials or debris.

Excavated materials suitable for backfill shall be placed at a distance far enough form the ditch to allow excavated rock to be placed next to the trench; however, stockpiling outside the easement shall be done only with the property owner's written permission.

d. Removal of Water

The Contractor shall at all times during construction provide and maintain means and devices with which to promptly dispose of all water entering the excavations or other parts of the work. All excavations must be kept dry until the structures to be installed therein are completed. No concrete shall be placed in water nor shall water be allowed to rise over structures if there is a danger of flotation or of setting up unequal pressures in the concrete until the concrete has set at least 24 hours and the danger of flotation has been removed.

The Contractor shall dispose of water from the work zone in a suitable manner without damage to adjacent property. No water shall be drained into work built or under construction. The discharge of trench water must meet all requirements of the latest revision of the *Tennessee Erosion and Sediment Control Handbook*, the Tennessee Department of Environment and Conservation, and the City Engineer.

During the laying of water lines and until the water pipe has been bedded in place with at least two (2) feet of backfill over the pipe, the Contractor shall keep the groundwater table below the bottom of the trench. Installation of the water pipe will not be permitted except in a dry trench. Under no circumstances will trench water be allowed to enter existing or proposed water lines. The Contractor must take every precaution to prevent trench water from entering the water line.

6. Pipe Installation and Bedding for Water Lines

a. General

The trench shall be excavated to the required depth and width, bell holes and/or jointing holes shall be dug in advance of pipe laying.

The bed of each pipe shall be carefully prepared so that each individual piece of pipe shall have a uniform bearing. Pipes shall be laid in a straight line and grade without kinks or sags and shall be laid in a workmanlike manner. Bell holes and/or jointing holes shall be large enough so that the bell or hub will clear the ground and leave ample room for making joints and inspection of joints.

Before each piece of pipe is lowered into the trench, it shall be thoroughly swabbed out to ensure a clean pipe interior. Each piece of pipe shall be lowered separately. Lowering multiple pieces of pipe at one time is not allowed unless specifically approved by the City Engineer.

Care shall be taken to prevent injury to the pipe and both the interior and exterior coatings. No piece of pipe or fitting which is known to be defective shall be laid or placed on the project.
If any defective pipe or fittings shall be discovered after the pipeline is laid, they shall be removed and replaced with a satisfactory pipe or fittings by the Contractor. If a length of pipe is cut to fit a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe as per the latest version of ANSI/AWWA Standard C600.

All angles or bends in the pipelines, either vertical or horizontal, shall be satisfactorily braced and anchored against the tendency of movement with joint harnesses, concrete thrust blocks or approved equal anchors. All braces and anchors must be installed to the satisfaction of the City Engineer and as shown on the Plans. Prior to installing any concrete thrust block, all fitting hardware must be covered with a material approved by the City Engineer to prevent direct contact of the fitting hardware with the concrete. Care should be taken when placing the concrete to minimize the fitting hardware covered by the concrete.

Open ends of unfinished pipelines shall be securely plugged or closed at the end of each day’s work or when the line is left temporarily at any other time.

The maximum horizontal or vertical deflection for laying pipe shall be 3-degrees per pipe section (18-inches for 18 feet length of pipe) unless the manufacturer’s printed instructions permit a greater deflections and the greater deflection is approved by the City Engineer. The Contractor shall minimize the use of bends when installing the water line by deflecting the pipe as allowed above.

The Contractor shall coordinate the areas of pipe laying and construction techniques utilized so as not to introduce bends, couplings or sleeves into the new water lines that are not shown on the Plans or approved by the City Engineer. The use of bends, couplings or sleeves to connect water lines shall not be allowed unless approved by the City Engineer. Should the connection of water lines require a bend, coupling or sleeve due to construction techniques utilized by the Contractor, the Contractor will be required to relay the water lines so as to eliminate the need for the bend, coupling or sleeve.

b. Crushed Stone for Pipe Bedding in Rock

When rock is encountered, the trench shall be excavated to a depth of at least 6-inches below the bottom of the pipe and refilled with bedding material to a sufficient depth to provide a firm bed for the bottom quadrant of the pipe. Bedding material shall be TDOT Class A Grade D aggregate.

c. Unstable Trench Bottom Material and Undercutting

If wet, mucky and/or unstable or unsuitable material is encountered in the trench bottom, the City Engineer may require additional excavation to ensure a firm foundation for the pipe. In such cases, the trench bottom shall be excavated and brought back up to proper grade as specified in Paragraph 5.b. Unstable Trench Bottom Material and Undercutting of this Detailed Specification.

The City Engineer shall determine when it is necessary to use such material and the Contractor shall be responsible for calling such unstable trench bottom conditions to the attention of the City Engineer.

d. Ductile Iron Pipe

Ductile iron pipe shall be laid on a soil foundation by placing select backfill material on the excavated trench bottom to a depth of not less than 4-inches as per the latest revision of ANSI/AWWA Standard C150/A21.50 Laying Condition Type 3. Bell holes shall be provided to ensure that the pipe is uniformly supported over its entire length. Any
unyielding material such as rock within the pipe foundation shall be removed and the foundation shall be brought back up to grade as specified in Paragraph 6.b. Crushed Stone for Pipe Bedding in Rock of this Detailed Specification. No rock larger than 2-inches in any dimension shall be permitted within 12-inches of the pipe.

7. **Concrete Cradles, Collars, Check Dams, Anchors, Kickers and Encasement**

Concrete cradles, collars, check dams, anchors, kickers and encasement for the water lines shall be placed where shown on the Plans or as directed by the City Engineer. Concrete for the cradles, collars, check dams, anchors, kickers and encasement shall be TDOT Class “A”. Concrete shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed when used for cradles, anchors or encasement. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or damage the joints or pipe.

8. **Backfilling Pipeline Trenches**

   a. **Outside of Paved or Graveled Roads, Shoulders, Driveways, Parking Areas or Other Travel Ways**

   In the backfilling of the trenches outside of paved or graveled roads, shoulders, driveways, parking areas or other travel ways, material reasonably free from rock and acceptable to the City Engineer shall be used. Rock fragments greater than 18-inches in any dimension will not be allowed as backfill material under any circumstances. TDOT Class “A”, Grade “D” aggregate shall be used to bed the pipe when in rock as required in this Detailed Specification and as shown on the water line bedding details on the approved Plans. This procedure shall be required for all water lines of all materials.

   Except as may be necessary in tamping or backfilling, walking or working on the completed pipeline shall not be permitted until the trench has been backfilled to a height of at least 12-inches above the top of the pipe. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed or damaged. Extra care shall be exercised until the backfill reaches a point 12-inches above the top of the pipe.

   In filling the remainder of the trench, the backfill material may be shoveled into the trench in layers not to exceed 12-inches and firmly tamped into place by tampers or rammers. The backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the City Engineer, this method of backfilling will not inconvenience the public or property owner.

   b. **Backfill in Paved or Graveled Roads, Shoulders, Driveways, Parking Areas or Other Travel Ways**

   Where water lines are to be installed within paved or graveled roads, shoulders, driveways, parking areas or other travel ways, the backfill material shall be TDOT Class “A”, Grade “D” base aggregate. TDOT Class “A”, Grade “D” aggregate shall be used to bed the pipe when in rock as required in this Detailed Specification and as shown on the water line bedding details on the approved Plans. This procedure shall be required for all water lines of all materials.

   Except as may be necessary in tamping or backfilling, walking or working on the completed pipeline shall not be permitted until the trench has been backfilled to a height of at least 12-inches above the top of the pipe. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed or damaged. Extra care shall be exercised until the backfill reaches a point 12-inches above the top of the pipe.
In filling the remainder of the trench, the backfill material shall be placed into the trench in layers not to exceed 8-inches and compacted by tampers or rammers. The backfill material must be compacted to not less than 95 percent of maximum density determined in accordance with AASHTO T 99, Method “D”.

The City Engineer may require the use of flowable fill for backfilling of open cut trenches in highways. When required, the flowable fill shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 204. The use of flowable fill in trenches may require temporarily bridging the trench with a minimum ½-inch steel plate for the convenience of the traveling public.

c. Backfilling Operations Conducted on Easements

Backfilling of trenches or excavations on easements shall be performed in such a manner that the private property owner’s facilities and grounds shall be restored to as near as possible their original condition immediately after pipe laying on the property has been completed.

TDOT Class “A”, Grade “D” aggregate shall be used to bed the pipe when in rock as required in this Detailed Specification and as shown on the water line bedding details on the approved Plans. This procedure shall be required for all water lines of all materials. Next, any excavated rock less than 18-inches in diameter can be placed in the trench. Excavated rock shall not be placed any closer than 18-inches from the finished grade and any excess rock shall be removed by the Contractor and disposed of as directed. Rock fragments greater than 18-inches in any dimension will not be allowed as backfill material under any circumstances.

The residue of the stockpiled bedding material shall be cleaned up and placed into the trench, leaving no bedding stone scattered over the area. The previously excavated materials suitable for backfill shall be placed into the ditch only upon clean up and backfill of the bedding material. In filling the remainder of the trench, the backfill material may be shoveled into the trench in layers not to exceed 12-inches and firmly tamped into place by tampers or rammers. The top portion of the trench or excavation shall be filled using a minimum of 6-inches of topsoil. The backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the City Engineer, this method of backfilling will not inconvenience the public or the property owner.

If the backfilling operation is performed during extremely dry weather, the Contractor should leave some stockpiled topsoil to use later as additional fill after settlement has occurred.

The Contractor will be held responsible for the condition of grass cover and the condition of the ground surface at the time of final inspection unless the property owner has plowed or excavated the ground.

d. Disposal of Excess Material

The Contractor shall be responsible for the off-site disposal of any and all excess or unsuitable material excavated in the construction of the project. The Contractor shall be responsible for obtaining any and all permits, license fees, etc. associated with the disposal of excess material. The City will not allow disposal of excess material on non-permitted sites.
9. Unauthorized Excavation and Over-Breakage

Whenever the excavation is carried beyond or below the lines and grades shown on the drawings or given by the City Engineer, the Contractor shall refill such excavated space with material approved by the City Engineer in such a manner as will insure stability of the structure or line involved, including the use of crushed stone or Class “A” concrete.

Over-breakage is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the City Engineer, including slides. All over-breakage shall be removed by the Contractor and disposed of as directed.

10. Installation of Water Pipe to be Encased with TDOT Class “A” Concrete

Where shown on the plans or directed by the City Engineer, the water pipe shall be encased in TDOT Class “A” concrete. Where concrete encasement is to be used, pipe shall be placed on 6-inch concrete blocks positioned behind each pipe bell. After jointing the pipe, it shall be brought to the established grade by driving wooden wedges between the pipe and the concrete block. After the pipe has been brought to grade and is affixed in place for true alignment, the pipe trench shall be backfilled with TDOT Class “A” concrete to a point above the pipe as shown on the approved Plans or directed by the City Engineer. Expansion joints shall be provided at not less than 20-foot intervals by making a vertical gap in the concrete of 1 to 3 inches. These joints shall coincide with a pipe joint. After 24 hours, the backfill will then be completed as specified in Paragraph 8. Backfilling of Pipeline Trenches of this Detailed Specification.

11. Check Dams and/or Collars

Check dams and/or collars shall be installed where directed by the City Engineer in the bedding and backfill of all new or replaced water lines to limit the drainage area subject to the French drain effect of gravel bedding. Check dams and/or collars shall consist of compacted clay bedding and backfill at least three (3) feet thick to the top of the trench and cut into the walls of the trench two (2) feet. Alternatively, TDOT Class “A” concrete may be used, keyed into the trench walls. All stream crossings will include check dams and/or collars on both sides of the crossing.

12. Construction Methods when Voids or Caverns are Encountered

Where a void or cavern is encountered during construction, the Contractor shall immediately contact the City Engineer. However, in general, the Contractor shall fill the void or cavern with rubble stone and TDOT Size No. 3 (2-inch) aggregate. If it is impracticable to fill the void or cavern, the Contractor shall construct a specially designed bridge slab to support the pipeline. A registered engineer shall design the bridge slab. The area to be bridged shall be excavated and measured. The City Engineer shall be called to the site to examine the bearing area available for the slab.

13. Rock Excavation

The methods used to excavate rock where encountered is the sole responsibility of the Contractor. The methods utilized should not jeopardize the safety of the construction crews or the public. The methods utilize should protect existing structures, utilities, property, etc. from damage. The Contractor is responsible for obtaining the appropriate Federal, State and Local permits when utilizing blasting for rock removal. The Contractor must utilize only people licensed by the State for blasting. Inside the City limits, the Contractor must obtain a Blasting Permit from the Fire Department.
14. Sheeting, Shoring and Bracing of Excavation

Sheeting, shoring and bracing of an excavation is the sole responsibility of the Contractor. The Contractor is responsible for determining when and where sheeting, shoring and bracing are required. The Contractor must follow all Federal, State and Local safety regulations regarding proper sheeting, shoring and bracing of excavated areas.

15. Connections to Existing Water Lines

Connections to existing water lines shall be made at the location shown on the Plans. The connections shall be coordinated with the City so as to minimize the risk of contamination of the existing water system, minimize water loss from the existing water system and minimize interruption of service to existing customers.

16. Abandoning Existing Water Lines

Where shown on the Plans, existing water lines and services shall be abandoned. The methods utilized to abandon the water lines and services shall be approved by the City Engineer.

In general when abandoning water lines and services, the water lines and services shall be capped or plugged utilizing material approved by the City Engineer. TDOT Class “A” concrete shall then be placed around the cap, plug and pipe so as to encapsulate the end of the pipe.

17. Inspection of Water Lines During Construction

The Contractor shall notify the City Engineer when pipe or fittings will be received on the job so that arrangements may be made for inspecting, unloading and stringing, as well as inspecting the pipe proper and examining for the manufacturer’s identification. Pipe shall be unloaded and stored in accordance with the manufacturer’s recommendations. No pipe (or other materials or equipment) shall be stored on private property without the written permission of the property owner.

Before the Contractor backfills any of the lines, the lines shall be inspected by the City Engineer. The City Engineer shall give the Contractor permission to proceed with backfilling of the lines. If any joints, fittings, pipes, or other workmanship or materials are found to be defective, they shall be removed and replaced by the Contractor.

18. Testing of Water Lines

Testing of water lines shall comply with the provisions listed below or similar procedures approved by the City Engineer that will ensure equal or better results.

Pipelines of all materials, when tested under a pressure of 1.5 times the normal working pressure of the pipe or a minimum of 150 psi, whichever is greater, measured at the lowest elevation of the pipe shall not show leakage exceeding the values shown in the following table as prescribed in the latest revision of ANSI/AWWA Standard C600.
### Allowable Leakage Per 1000-feet of Pipeline - (gallons per hour)

<table>
<thead>
<tr>
<th>Avg. Test Pressure (psi)</th>
<th>Nominal Pipe Diameter - (inches)</th>
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</thead>
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<tr>
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</tr>
<tr>
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<td>0.45</td>
</tr>
<tr>
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<td>0.47</td>
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</table>

When determining the allowable leakage for the water line when testing at a pressure between those listed above, the allowable leakage to be used in determining if the water line passes the test will be at the next lowest pressure listed in the table. For example: If testing at a pressure of 188 psi, the allowable leakage will be the leakage shown for the 175 psi test pressure in the above table.

The Contractor shall furnish all gauges, meters, pumps, and other equipment required and shall maintain the equipment in a condition satisfactory to the City Engineer for accurate testing. Where practical, pipelines shall be tested between valves and in lengths between valves or plugs of no more than 3,000 feet. Where leaks are visible at exposed joints and/or evident on the surface when joints are covered, the pipe shall be rejoined and the leakage eliminated regardless of total leakage allowed by the test.

Duration of the test shall not be less than two (2) hours. The City Engineer may require a longer length of test, up to a maximum of eight (8) hours to more accurately measure leakage.

If the water line does not pass the pressure test, the leak(s) shall be located and repaired using a method acceptable to the City Engineer. Lines that fail to meet the leakage requirements shall be repaired and retested until the test requirements are met. All pipe, fittings and other materials found to be defective shall be removed and replaced by the Contractor.

### 19. Disinfection of Water Lines

The new water lines shall not be placed in service, either temporarily or permanently, until they have been thoroughly disinfected in accordance with the latest revision of ANSI/AWWA Standard C651.

After pressure testing, the water shall be thoroughly flushed at a minimum velocity of 2.5 ft/sec to remove any sediment and debris in the line. Once the water line has been flushed to the satisfaction of the City Engineer, a solution of hypochlorite using HTH or equal shall be introduced into the section of the lines being disinfected in an amount sufficient enough to insure a chlorine dosage of at least 50 ppm in the lines. While the solution is being applied, the water shall be allowed to escape at the ends of the lines until tests indicate that a dosage of at least 50 ppm has been obtained throughout the pipe.

The chlorinated water shall remain in the pipe for a minimum of 24-hours. A residual of at least 25 ppm should be present in the pipe at the end of the 24-hour period. After the chlorinated water has remained in the line for 24-hours, the line must be flushed and refilled...
and a bacteriological sample will be taken by the City. If a negative sample is obtained the line shall be thoroughly flushed at a minimum velocity of 2.5 ft/sec and once completed the line may then be connected to the existing system. If a positive sample is obtained, the disinfection procedure must be repeated until a negative sample is obtained.

20. Highway Crossings

a. Bored Highway Crossings

Where bored highway crossings are required on the drawings, the bore shall be made with a casing pipe as specified in Paragraph 6 of this Detailed Specification. The pipe shall be jacked through a bored hole with no disturbances to the ground surface. A minimum of four (4) feet of cover is required between the top of the casing pipe and the ground surface. The Contractor must coordinate the work with the highway owner and follow any requirements of the highway owner.

b. Tunneled Highway Crossings

In those locations where boring of the highway cannot be accomplished and tunneling is the only acceptable method, the Contractor shall contact the City Engineer for the requirements to be utilized.

c. Open Cut Highway Crossings

Open cut highway crossings can be utilized when permitted. The open cut crossing shall meet the following requirements:

(1) All backfill, except for the pipe bedding envelope, shall be TDOT Class A, Grade D aggregate. The backfill shall be placed in a maximum of 8-inch lifts and compacted to not less than 95 percent of maximum density determined in accordance with AASHTO T 99, Method D.

(2) Unless otherwise approved by the City Engineer, at least one-half of the traveled portion of the highway must be open to traffic at all times.

(3) The Contractor shall keep the pipeline trench width to a minimum to prevent excessive disturbance of the existing pavement. All pavements shall be saw cut.

(4) Unless otherwise approved, the top of the proposed water line shall be at least four (4) feet below State Highways and three (3) feet below County and City Streets.

(5) The Contractor shall post warning signs and flagmen per the requirements of the Manual on Uniform Traffic Control Devices and the City Engineer.

(6) The Contractor must maintain the trench until permanent restoration occurs. Maintenance shall consist of, but not be limited to, dust control and ridability (surface smoothness). The Contractor is strongly encouraged to temporarily pave all highway trenches in order to minimize trench maintenance. If the Contractor fails to adequately maintain the highway trenches, the City Engineer will require temporary pavement to be placed in the trenches.

The Contractor shall be fully responsible for the successful operation, without interruption, of traffic and shall be held responsible for returning the highway to its original condition. The Contractor shall be responsible for any settlement that occurs as a result of his work. Where required trenches shall be temporarily bridged with ½-inch steel plate for the convenience of the traveling public.
The City Engineer may require the use of flowable fill for backfilling of open cut trenches in highways. When required, the flowable fill shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 204. The use of flowable fill in trenches may require temporarily bridging the trench with a minimum ½-inch steel plate for the convenience of the traveling public.

21. Railroad Crossings

a. General

Where shown on the Plans, railroad crossings for the water lines shall be bored so as to prevent interruption to train traffic and to prevent later settlement of the railway bed. If the railroad crossing requires tunneling then the Contractor shall contact the City Engineer for the material and installation requirements.

The Contractor must be fully equipped and experienced in the installation of pipelines by boring or tunneling methods. The Contractor shall be fully responsible for the successful operation without interruption of rail traffic and shall be held responsible for any settlement, which occurs as a result of his work.

The Contractor should familiarize himself with the requirements of the railroad within whose rights-of-way the Contractor is working. The Contractor shall pay for any insurance to the amount and extent required by the railroad involved.

b. Steel Casing Pipe

Generally, pipeline crossings of railroads shall be made by boring and jacking a smooth wall steel casing pipe under the roadbed and inserting a carrier pipe. The steel casing pipe shall be manufactured and tested in accordance with the latest revision of ASTM specification A139 or A53, Grade B with a wall thickness as shown on the Detail Sheet or specified. The steel pipe shall have a minimum yield strength of 35,000 psi and meet the requirements of the American Railway Engineering and Maintenance-of-Way Association (AREMA). The steel pipe shall be so constructed as to prevent leakage of any substance form the casing throughout its length except at the ends. The steel casing pipe shall be so installed to prevent the formation of a waterway under the railroad, have an even bearing throughout its length, and shall slope to one end.

Bored installations shall have a bored hole diameter essentially the same as the outside diameter of the casing pipe. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe by more than one (1) inch, remedial measures as approved by the Railway Company and the City Engineer shall be taken. Boring operations shall not be stopped if such stoppage would be detrimental to the railroad.
Steel casing pipe where shown shall be as follows:

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<th>Diameter Casing Pipe (inches)</th>
<th>Minimum Casing Pipe Wall Thickness (inches)</th>
</tr>
</thead>
<tbody>
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</table>

22. Water Lines for Stream or River Crossings

Where shown on the Plans or required by the City Engineer for crossing of streams, the Contractor shall install pressure Class 350 restrained joint ductile iron pipe as specified in Paragraph 3.d. of this Detailed Specification. If major river crossings are required, the Contractor shall contact the City Engineer for specific material and construction requirements.

23. Gate Valves

Gate valves shall conform to the latest revision of ANSI/AWWA Standard C509 as modified herein. All gate valves shall be of the resilient seated type and shall have a ductile iron body, non-rising stem and be suitable for a water working pressure of 250 psi. Gate valves shall be of a standard manufacture and of highest quality both as to material and workmanship. An affidavit of compliance from the manufacturer is required. The bolting materials shall be non-corrosive. The stem sealing shall be by an O-ring.

All gate valves shall be furnished with mechanical joint end-connections, unless otherwise shown on the Detail Sheet or specified herein. The end-connections furnished shall be suitable for connection to the pipe furnished.

All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working pressure cast on the body of the valve. The interior and exterior of the valve shall be furnished with an epoxy coating and touched up in the field as required.

All gate valves shall be provided with a 2-inch square operating nut and shall open by turning to the left (counter-clockwise). Resilient seats shall apply to both sides of the gate. Gate valves shall be as manufactured by American Flow Control, U. S. Pipe, Kennedy Valve, M & H, Clow, or and approved equal.

24. Butterfly Valves

Butterfly valves shall be suitable for 150 psi working pressure, shall be designed for underground service and shall meet the latest revision of ANSI/AWWA Standard C504 as modified hereinafter. Butterfly valves shall be M & H Style 4500 or an approved equal. Butterfly valves may be either of the “short” or “long” laying length type where this meets the service conditions.

Butterfly valves shall be furnished with mechanical joint end connections unless flanged connections are required by the Plans or approved by the City Engineer. The end connections shall be suitable for connections to ductile iron pipe. “Slip-on” joints will not be allowed.
Valve operators shall consist of a geared 2-inch square nut and shall conform to ANSI/AWWA Standard C504 and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. The gearbox shall be fully sealed and grease packed. Valve operators shall take at least 32 turns to open and shall be capable of resisting an input of at least 300 foot pounds without damage. Valves shall open by turning counter-clockwise.

25. Valve Boxes

Valve boxes shall be two (2) piece, cast iron, traffic bearing, adjustable screw type with a drop cover marked “Water”. Valve boxes shall be set vertically and properly adjusted so that the cover shall be in the same plane as the finished surface of the ground or street. The bottom of the valve box shall as a minimum be of sufficient size to completely cover the valve stuffing box and avoid directly bearing on any part of the valve. For ease of location and identification, valve boxes located outside of paved areas shall have a 2-foot square, or 2-foot diameter, by 6” thick concrete pad place around the top of the valve box as shown on the Detail Sheet.

26. Tapping Sleeves and Valves

Tapping sleeves shall have mechanical joint ends and a flanged connection for the tapping valve. The tapping valve shall conform to the specifications in Paragraph 24 of this Detailed Specification except that the tapping valve shall have one flanged and one mechanical joint. Tapping sleeves shall have a minimum pressure rating of 250 psi and shall be ductile iron. The Contractor shall verify in the field the type of existing pipe that the tapping sleeve will be used in connection with. Tapping sleeves shall be as manufactured by American Flow Control or approved equal.

27. Air Release Valves and Manholes

Air release valves and manholes shall be installed on water mains at all high points in the lines as shown on the approved Plans. The exact location of air release valves will be determined in the field by the City Engineer.

Air release valves shall have a 2-inch inlet diameter for 10-inch pipe and smaller, a 4-inch inlet diameter must be provided for 12-inch through 16-inch pipe. For air release valves on pipelines larger than 16-inch, the Contractor shall contact the City Engineer for the special sizing requirements.

Air release valves shall meet the requirements of the latest revision of ANSI/AWWA Standard C512. The body and cover or the air release shall be of cast or ductile iron, the trim shall be brass or stainless steel and the float shall be of stainless steel. The air release valves shall have a working pressure rating of a minimum of 200 psi. Air release valves shall be APCO Model 200, Crispin Model PL10A or Val-Matic Model 38.6 or and approved equal for 2-inch air release valves. Air release valves shall be APCO Model 149C, Crispin Model UL42 or Val-Matic Model 204C or an approved equal for 4-inch air release valves. A protective hood or cowl shall be installed on the outlet of 4-inch air release valves.

Air release valves shall be installed in standard 4-foot diameter precast concrete manhole, meeting the same specifications as a precast sanitary sewer manhole, with a flattop and standard frame and cover. The word “Water” shall be cast into the cover. The manhole shall conform to standard specifications for precast manholes with fiatop, except that arch shaped cutouts in the barrel section shall be fit over the water main instead of installing the water main through sealed openings in the manhole wall. The top of the any part of the air release valve assembly shall be a minimum of 18-inches below the inside top of the manhole. The manhole shall be set on a reinforced concrete footing as shown on the Detail Sheet.
TDOT Size No. 8 aggregate shall be placed and compacted in the manhole from the bottom of the footing to the top of the water main.

Piping and fittings for installation of the air release assembly shall be brass or pressure class 350 ductile iron. The use of galvanized pipe shall not be permitted. All strapping and hardware used to install the air release assembly shall be stainless steel. Pipe, fittings, valves and the air release valve for 2-inch air release assemblies shall be screwed (NPT) joints. Pipe, fittings, valves and the air release for 4-inch air release assemblies must have flanged joints.

All 2-inch air release valves shall be connected to the water main utilizing a tapping saddle. The tapping saddle shall be of the double strap banded type with a ductile iron body and epoxy coating. The bands and bolts shall be made of stainless steel. Tapping saddles shall be Ford FC202 with AWWA/CC tapered thread or and approved equal.

All 4-inch air release valves shall be connected to the water main utilizing a mechanical joint by flanged joint ductile iron tee. The ductile iron tee shall meet the requirements of Paragraph 3.c. of this Detailed Specification.

Gate valves shall meet the requirements of Paragraph 24. of this Detailed Specification.

Where 2-inch ball valves are required they shall be rated for 200 psi working pressure. The valves shall be bronze and of one piece body design, blowout proof stem, reinforced Teflon seats and seals, threaded ends and lever operated. The 2-inch ball valves shall be as manufactured by American Valve or an approved equal.

Where 4-inch ball valves are required they shall be rated for 200 psi working pressure. The valves shall have a ductile iron body design, blowout proof stem, reinforced Teflon seats and seals, flanged ends and lever operated. The 4-inch ball valve shall be as manufactured by American Valve Model 4000D or an approved equal.

28. Blow-Off Hydrants

Blow-off hydrants shall be installed on water mains at all low points in the lines as shown on the approved Plans. The exact location of blow-offs will be determined in the field by the City Engineer.

Blow-off hydrants shall the Kupferle Foundry Company’s Mainguard No. 78 Blow-off Hydrant and shall be installed per the Detail Sheet. The outlet to the blow-off hydrant shall be fitted with a cam and groove adapter with a dust cap. The cam and groove adapter shall be a 2-inch Dixon Andrews/Boss-Lock Cam and Groove Adapter, Aluminum, Type F. The dust cap shall be a 2-inch Dixon Andrews Aluminum, Type DC Dust Cap.

The associated service piping and fittings shall be brass or ductile iron. The blow off shall be connected to the main using a tapping saddle or tee. The tapping saddle shall be of the double strap banded type with a ductile iron body and epoxy coating. The bands and bolts shall be made of stainless steel. Tapping saddles shall be Ford FC202 with AWWA/CC tapered thread or and approved equal. The tee shall meet the requirements of Paragraph 3.c. of this Detailed Specification.

29. Fire Hydrants

Fire hydrants shall be the dry-barrel type conforming to the latest revision of ANSI/AWWA Standard C502.
The hydrants shall have 6-inch mechanical joint inlets, 5 ¼-inch valve opening, 6 ½-inch inside diameter riser barrel, bury depth as required, standard operating nuts opening left (counter-clockwise) and safety flanges located a minimum of 2 ½-inches and a maximum 3 ½-inches above the finished grade. The hydrant shall be equipped with two (2) 2 ½-inch hose nozzles and one (1) 4 ½-inch steamer nozzle. The hydrants shall have exterior surfaces painted red.

Fire hydrants shall be M & H Style 129, American Flow Control Model B-84-B or Mueller Centurion. All hydrants should be ordered with the appropriate bury depth in order to minimize the use of hydrant extensions.

The hydrants shall be connected to the gate valve and the gate valve shall be connected to the water main tee utilizing Anchor Couplings as manufactured by McWane Inc., Hydrant Connecting Pieces as manufactured by U. S. Pipe, or an approved equal. Where anchor couplings cannot be utilized, the gate valve shall be “rodden” to the tee utilizing a minimum of four (4), ¾-inch, stainless steel, all thread rods. The nuts or extension nuts shall also be ¾-inch stainless steel.

30. Service Connection Piping, Water Meters and Appurtenances

a. Water Meters

All new water meters shall meet the requirements of the latest revision of ANSI/AWWA Standard C700. Meters shall be of 5/8-inch by 3/4-inch size as manufactured by Badger Meter Manufacturing Company Model 25 with a register in gallons, tamper proof seal screw, cast iron bottom, plastic register housing and bronze body.

The Contractor shall contact the City Engineer for material and construction information on water meters when larger than 3/4-inch.

b. Coppersetters

The meter shall be installed in a coppersetter as manufactured by Ford Model VH72-7W-41-33.

The Contractor shall contact the City Engineer for material and construction information on coppersetters for water meters larger than 3/4-inch.

c. Meter Boxes

All 3/4-inch meters and line setters shall be placed in a meter box as shown on the Detail Sheet. The meter box shall be a Rhino Model MB-1.5 with hook bar cast iron one-piece lid (Item No. 10) and plastic box (Item No. 05). The meter box shall be placed on a brick foundation (minimum 6 per box) as shown in the Detail Sheet. The top of the meter box shall be flush with the proposed ground elevation.

The Contractor shall contact the City Engineer for material and construction information on meter boxes for water meters larger than 3/4-inch.

d. Service Connection Piping

Service connection piping shall be Type K copper meeting the latest revision of ASTM Specification B 88 and acceptable to the National Sanitation Foundation.

The service connection piping shall be of the necessary length to run a direct line from the main to the site of the meter without fittings or couplings. Special care shall be taken
to protect the service piping with earthen material free from sharp and hard objects. Cover is to be at least 30-inches at all points. The Contractor will be responsible for providing and installing all service connections up to and including the meter, meter box and coppersetter. The Contractor shall also provide the corporation cock at the water line that shall be left in the open position.

e. Service Connection Fittings

All fittings shall meet the requirements of the latest revision of ANSI/AWWA Standard C800.

Corporation stops shall be a Ford Meter Box Company FB1000, Mueller Company B-25008 or approved equal. Corporation stops shall be brass and have a ball valve. The corporation stop inlet shall have an AWWA/CC taper thread and the outlet shall have a compression connection for CTS tubing. Corporation stops shall be tapped directly into the water main for 3/4-inch through 1 ½-inch service lines. For taps larger than 1 ½-inches, tapping saddles shall be used in making the connection to the water main.

Fittings in service connection lines shall be brass and have compression connections for CTS tubing. Fittings shall be as manufactured by the Ford Meter Box Company, Mueller Company or and approved equal.

f. Service Lines Crossing Highways

Service Lines that cross highways shall be installed as specified in Paragraph 20. of this Detailed Specification.
V. Road Construction

1. Scope of Work

The work under this Detailed Specification consists of the furnishing of all labor, materials, equipment and services necessary for the construction of roads and appurtenances for the City of Bristol Tennessee. If the project to be constructed includes materials, equipment or services not covered in these specifications, the City Engineer must be contacted for details.

All road construction shall meet the requirements of the City of Bristol Tennessee, and the latest revision of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. In addition, when outside the corporate limits, road construction shall also meet the requirements of the Sullivan County Highway Commissioner. Where standards conflict with each other, the most stringent standard shall be used during construction.

2. Road Materials

   a. General

   All road construction materials shall meet the requirements of the City of Bristol Tennessee, and the latest revision of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction. In addition, when outside the corporate limits, road construction shall also meet the requirements of the Sullivan County Highway Commissioner. Where standards conflict with each other, the most stringent standard shall be used during construction.

   b. Base Aggregate

   Base aggregate shall be TDOT Type A mineral aggregate (Class A, Grade D) meeting the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 303.

   c. Prime Coat

   Prime coat shall meet the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 402.

   d. Base Course

   Base course shall be TDOT Bituminous Plant Mix Base (Hot Mix), Grade B meeting the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 307.

   e. Tack Coat

   Tack coat shall meet the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 403.
f. **Surface Course**

Surface course shall be TDOT Asphaltic Concrete Surface (Hot Mix), Grade D meeting the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 411*.

g. **Concrete Pavement**

Rigid concrete pavement or concrete base slabs shall be TDOT Class D Concrete meeting the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 501*.

h. **Concrete Curbs, Gutters and Combined Curb and Gutter**

Concrete curbs, gutters and combined curb and gutter shall be TDOT Class A Concrete meeting the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 702*.

i. **Concrete Sidewalks, Driveways and Medians**

Concrete Sidewalks, Driveways and Medians shall be TDOT Class A Concrete meeting the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 701*.

j. **Reinforcing Steel**

Reinforcing steel shall meet the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 907*.

k. **Pavement Markings**

Pavement Markings shall be thermoplastic and shall meet the requirements of the latest revisions of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 716* and the *Manual on Uniform Traffic Control Devices*.

l. **Street and Traffic Regulation Signs**

Street and traffic regulation signs shall meet the requirements of the latest revisions of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 713* and the *Manual on Uniform Traffic Control Devices*.

3. **Lines and Grades**

Unless otherwise directed by the City Engineer, lines and grades shall be set to conform to those shown on the approved Plans.

4. **Underground Utilities**

Prior to commencing any excavation, the Contractor must notify Tennessee One Call (1-800-351-1111) to request locating of existing underground utilities. The Contractor shall make every effort to have underground utilities located and is encouraged to directly contact the utility companies to request locating their utilities.
5. **Traffic Control**

When working in a public or private right-of-way, the Contractor must install and maintain proper traffic control devices. Traffic control devices shall be installed and maintained per the requirements of the City Engineer and the latest revision of the *Manual on Uniform Traffic Control Devices*.

6. **Erosion and Sediment Control**

Prior to commencing any clearing, grubbing or earthwork, the Contractor shall install appropriate erosion and sediment control devices as shown on the approved Plans. Erosion and sediment control device installation and maintenance shall meet the requirements of the latest revision of the *Tennessee Erosion and Sediment Control Handbook*, the Tennessee Department of Environment and Conservation and the City Engineer. The Contractor shall maintain the erosion and sediment control devices during construction. Erosion and sediment control devices shall be inspected weekly and after each rainfall. During prolonged rainfall, daily checking is necessary. Any defects found in the erosion and sediment control devices shall be repaired immediately. The Contractor shall comply with all Federal, State and Local regulations regarding erosion and sediment control.

Once the project has been completed and a vegetative cover has been established on all denuded areas and accepted by the City Engineer, the Contractor shall remove all erosion and sediment control devices. Any soil areas disturbed by removal of the erosion and sediment control devices shall be restored per Paragraph 24 of this Detailed Specification.

7. **Clearing and Grubbing**

Clearing and Grubbing shall be completed per the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 201*. The Contractor shall make every effort to minimize the areas disturbed during construction and shall in general comply with the construction limits shown on the approved Plans.

8. **Removal of Structures and Obstructions**

Removal of structures and obstructions shall be completed per the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 202*.

9. **Excavation and Undercutting**

Excavation and undercutting shall be completed per the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 203*.

The Contractor shall pay special attention to the final road geometry and typical section shown on the Plans to ensure adequate excavation. The Contractor should remember that unless otherwise approved by the City Engineer, the final grade between the back of curbs and the right-of-way shall slope ¼-inch vertical per one (1) foot horizontal toward the top of the curb. The cut or fill slope shall not be in the right-of-way and should be no greater than two (2) foot horizontal to one (1) foot vertical unless approved by the City Engineer.

The Contractor shall be responsible for having a Geotechnical Engineer provide appropriate compaction testing of the excavation. Compaction testing shall be taken at a frequency determined by the Geotechnical Engineer but the City Engineer reserves the right to require test to be taken in questionable areas. The Geotechnical Engineer must provide the City with
compaction testing results and certify that all excavations were constructed per TDOT requirements. The Geotechnical Engineer must be a licensed engineer and place his seal and signature on the certification. The certification must be received by the City Engineer prior to construction of any pavement sections, curbs, gutters or other structures on the excavations.

10. Embankments

Road embankments shall be constructed per the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 205.

The Contractor shall pay special attention to the final road geometry and typical section shown on the Plans to ensure adequate excavation. The Contractor should remember that unless otherwise approved by the City Engineer, the final grade between the back of curbs and the right-of-way shall slope ¼-inch vertical per one (1) foot horizontal toward the top of the curb. The cut or fill slope shall not be in the right-of-way and should be no greater than two (2) foot horizontal to one (1) foot vertical unless approved by the City Engineer.

The Contractor shall be responsible for having a Geotechnical Engineer provide appropriate compaction testing of the embankment construction. Compaction testing shall be taken at a frequency determined by the Geotechnical Engineer but the City Engineer reserves the right to require test to be taken in questionable areas. The Geotechnical Engineer must provide the City with compaction testing results and certify that all embankments were constructed per TDOT requirements. The Geotechnical Engineer must be a licensed engineer and place his seal and signature on the certification. The certification must be received by the City Engineer prior to construction of any pavement sections, curbs, gutters or other structures on the embankments.

11. Final Dressing

Final dressing shall be completed per the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 206.

12. Subgrade Construction and Preparation

Subgrade construction and preparation shall be per the requirements of latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 207.

The Contractor shall pay special attention to the final road geometry and typical section shown on the Plans to ensure adequate excavation. The Contractor should remember that unless otherwise approved by the City Engineer, the final grade between the back of curbs and the right-of-way shall slope ¼-inch vertical per one (1) foot horizontal toward the top of the curb. The cut or fill slope shall not be in the right-of-way and should be no greater than two (2) foot horizontal to one (1) foot vertical unless approved by the City Engineer. The Contractor should note that the subgrade should have a minimum slope of ¼-inch vertical per one (1) foot horizontal away from the centerline of the road.

The Contractor shall be responsible for having a Geotechnical Engineer provide appropriate compaction testing of the subgrade construction. Compaction testing shall be taken at a frequency determined by the Geotechnical Engineer but the City Engineer reserves the right to require test to be taken in questionable areas. The Geotechnical Engineer must provide the City with compaction testing results and certify that the subgrades were constructed per TDOT requirements. The Geotechnical Engineer must be a licensed engineer and place his
seal and signature on the certification. The certification must be received by the City Engineer prior to construction of any pavement sections, curbs, gutters or other structures on the embankments.

13. Base Aggregate

The mineral aggregate base shall be constructed per the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 303.

The depth of mineral aggregate base shall be as shown on the approved Plans but in no instance shall be less than six (6) inches. The Contractor shall make sure the mineral aggregate base has the appropriate crown.

The Contractor shall be responsible for having a Geotechnical Engineer provide appropriate compaction testing of the mineral aggregate base construction. Compaction testing shall be taken at a frequency determined by the Geotechnical Engineer but the City Engineer reserves the right to require test to be taken in questionable areas. The Geotechnical Engineer must provide the City with compaction testing results and certify that the mineral aggregate base was constructed per TDOT requirements. The Geotechnical Engineer must be a licensed engineer and place his seal and signature on the certification. The certification must be received by the City Engineer prior to construction of any pavement sections, curbs, gutters or other structures on the base aggregate.

14. Prime Coat

When require by the City Engineer, the prime coat installation shall meet the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 402.

15. Base Course

The base course construction shall meet the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 307.

The depth of the base course shall be as shown on the approved Plans but in no instance shall be less than three (3) inches. The Contractor shall make sure the base course has the appropriate crown.

16. Tack Coat

When require by the City Engineer, the tack coat shall meet the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 403.

17. Surface Course

The surface course construction shall meet the requirements of the latest revision of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 411.

The depth of the surface course shall be as shown on the approved Plans but in no instance shall be less than one (1) inch. The Contractor shall make sure the surface course has the appropriate crown and that no depressions exist in the surface that will allow ponding of water.
18. Concrete Pavement

Rigid concrete pavement or concrete base slabs shall be constructed per the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 501*.

The depth of the concrete pavement or concrete base slab shall be as shown on the approved Plans but in no instance shall be less than six (6) inches. Where rigid concrete pavement is required, the Contractor shall make sure the surface has the appropriate crown and that no depressions exist in the surface that will allow ponding of water. A minimum of four (4) inches of compacted TDOT Class A, Grade D aggregate is required as a base for all concrete pavement work.

19. Concrete Curbs, Gutters and Combined Curb and Gutter

Concrete curbs, gutters and combined curb and gutter shall be constructed per the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 702*.

20. Concrete Sidewalks, Driveways and Medians

Concrete Sidewalks, Driveways and Medians shall be constructed per the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 701*.

A minimum of four (4) inches of compacted TDOT Class A, Grade D aggregate is required as a base for all concrete flatwork.

21. Reinforcing Steel

Reinforcing steel shall be constructed per the requirements of the latest revision of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 907*.

22. Pavement Markings

Pavement Markings shall be installed per the requirements of the City Transportation Engineer, the latest revisions of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 716* and the *Manual on Uniform Traffic Control Devices*.

The Contractor must coordinate installation of pavement markings with the City Transportation Engineer. Failure to do so may result in the removal and replacement of the pavement markings by the Contractor.

23. Street and Traffic Regulation Signs

Street and traffic regulation signs shall be installed per the requirements of the City Transportation Engineer, the latest revisions of the *Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, Section 713* and the *Manual on Uniform Traffic Control Devices*.

The Contractor must coordinate installation of street and traffic regulation signs with the City Transportation Engineer. Failure to do so may result in the removal and replacement of the street and traffic regulation signs by the Contractor.
24. Seeding and Restoration of Soil Areas

All areas disturbed by the road construction, which are not a part of pavements, shall be seeding and landscaped.

All seeding, fertilizing and mulching shall be completed in accordance with the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.32, Permanent Seeding. The seed mixture shall be as shown in Table 3.32-C of the Virginia Erosion and Sediment Control Handbook for the appropriate type of land use or as required by the City Engineer.

The Contractor is responsible for placement of 6-inches of topsoil in all areas to receive seeding. Topsoil shall be fertile, friable loam and free of subsoil, clay lumps, brush, weeds, roots larger than ½-inch diameter, stones larger than ½-inch, bedding stone, trash, construction debris and any other material toxic or harmful to growth. Areas to be seeded shall be dressed to a smooth firm surface free from washes and gullies and shall be filled to conform to the desired cross-section before beginning actual seedbed preparation.

Prior to commencing seedbed preparation, fertilizer and lime shall be uniformly applied at the rates specified in the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.32, Permanent Seeding. On sites where equipment can operate on slopes safely, the seedbed shall be adequately loosened a minimum of 6-inches deep and smoothed. On sites where equipment cannot operate safely, the seedbed shall be prepared by hand methods by scarifying to provide a roughened soil surface. All seedbeds in residential, commercial or industrial high maintenance lawn areas shall be hand raked to remove unsuitable debris and to leave a smooth surface. The resultant seedbed shall be smooth, firm, well prepared, free of lumps or clods, and suitable for placement of small seed. The completed seedbed shall be suitable for maintenance with farm equipment or lawn type equipment free from debris that will interfere with seeding and maintenance operations. The seedbed preparation shall be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the City Engineer.

Immediately after the seedbed has been prepared and approved by the City Engineer, the seed shall be applied to the areas per the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.32, Permanent Seeding. Mulch shall then be placed over the seed per the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.35, Mulching. Straw mulch must be anchored immediately after spreading to prevent displacement utilizing methods listed in the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.35, Mulching or approved by the City Engineer.

The Contractor shall maintain all seeded areas for one (1) year from the date of final acceptance of the project and shall restore or replace any portion of the seeding work that is found defective or which becomes damaged prior to establishment of the vegetative cover. Restoration or replacement work shall include the reestablishment of the grade or profile of the area, replacement of topsoil, refertilization, reseeding and remulching as directed by the City Engineer. The Contractor is responsible for watering the areas as required to keep the soil moist during establishment of the vegetative cover. The Contractor is responsible for mowing that is required to properly maintain the seeded areas until establishment of the vegetative cover. If the construction work is brought to completion when, in the opinion of the City Engineer, the season is not favorable for the seeding of the grounds, then the Contractor shall delay this item of work until the proper season for such seeding as directed by the City Engineer.
25. Riprap

Riprap where directed by the City engineer shall be TDOT Machined Riprap, Class A-1. The riprap shall be placed to a depth of not less than 18-inches. Materials and construction methods for placement of the riprap shall conform to the requirements of the *TDOT Standard Specifications for Road and Bridge Construction, Section 709.*
VI. Landscaping and Restoration

1. Scope Of Work

The work under thisDetailed Specification consists of the furnishing of all labor, materials, equipment and services necessary for the restoration of construction areas for the City of Bristol Tennessee. The intent of these detailed regulations is to require the Contractor to restore all disturbed areas to as good or better condition than that which existed prior to his operations. If the restoration work requires materials, equipment or services not covered in this Detailed Specification, the City Engineer must be contacted for detail.

2. Replacement of Existing Street and Roadways

The Contractor shall replace all existing streets, alleys, and roadways that may be removed, disturbed or damaged in connection with their construction activities on the project. The Contractor shall reconstruct same to the original lines and grades in such a manner as to leave all such surfaces in fully as good or better condition than that which existed prior to his operations. The reuse of materials removed in making excavations will not be permitted. Gravel, crushed limestone, bituminous materials, concrete or other materials used in the resurfacing of streets shall meet the current requirements of Standard Specifications for Road and Bridge Construction of the Tennessee Department of Transportation (TDOT) and the requirements of this Detailed Specification.

At least one-half of the traveled portion of any open cut roadways must be open to traffic at all times unless approved by the City Engineer. The Contractor shall coordinate all work in traveled roadways with the road owner, emergency service providers for the area of the work and the City of Bristol Tennessee. The Contractor shall furnish all warning signs, barricades, channelization devices, and other traffic control devices as required by the latest revision of the Manual on Uniform Traffic Control Devices, the road owner and the City of Bristol Tennessee. TDOT requires that flagmen be used to direct traffic on any State Route. All traffic control devices shall meet the requirements of the latest revision of the Manual on Uniform Traffic Control Devices. The Contractor is solely responsible for job safety and shall hold the road owner and the City of Bristol Tennessee Harmless from any claims arising thereof.

a. Mineral Aggregate Base Course

Replacement of streets and roadways after construction shall be handled in the following manner:

After the backfill has been compacted to within about 12-inches of finished grade, the Contractor shall place approximately 12-inches of TDOT Class A Grade D aggregate in 6-inch lifts as a mineral aggregate base course. The mineral aggregate base course must be compacted to an average density of not less than 95 percent of maximum density determined in accordance with AASHTO T 99, Method D. Further, no individual test shall be less than 92 percent of the maximum density. The mineral aggregate base course installation shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 303.

All backfilled trenches shall be maintained in such a manner that they offer minimal hazard to the passage of traffic. The Contractor must maintain the trench until permanent restoration occurs. Maintenance shall consist of, but not be limited to, dust control and ridability (surface smoothness). The Contractor is strongly encouraged to temporarily pave all highway trenches in order to minimize trench maintenance. If the
Contractor fails to adequately maintain the highway trenches, the City Engineer will require temporary pavement to be placed in the trenches. The safety and convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration.

b. Flowable Fill

The City Engineer may require the use of flowable fill for backfilling of open cut trenches in highways. When required, the flowable fill shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 204. The use of flowable fill in trenches may require temporarily bridging the trench with a minimum ½-inch steel plate for the convenience of the traveling public.

The flowable fill shall be installed to the same elevation as required when utilizing an aggregate base course, and the binder course shall be placed directly on the flowable fill.

c. Subgrade for Final Resurfacing

The mineral aggregate base course described above shall comprise the aggregate base course for all types of resurfacing.

When in the opinion of the City Engineer, the trench has reached a condition of settlement satisfactory for final resurfacing, the Contractor shall first strip the appropriate depth of crushed stone backfill and or temporary pavement from the trench area to obtain the proper subgrade elevation. The subgrade shall then be compacted with approved equipment per the requirements of Paragraph 2.a. of this Detailed Specification. Any depressions shall be filled with TDOT Class A Grade D aggregate and then compacted. This process shall continue until the subgrade has a smooth and uniform surface. The mineral aggregate base course subgrade installation shall meet the requirements of the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 303.

d. Binder Course

A minimum of four (4) inches of compacted TDOT Bituminous Plant Mix Base (Hot Mix), Grade B binder shall be required in all trenches within a travel way except that a minimum of eight (8) inches is required within a travel way on a State Highway. The binder course preparation and installation shall be as specified in the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 307. The binder course shall be placed in a maximum of 4-inch compacted lifts in order to achieve appropriate compaction and prevent pumping.

The City Engineer may require placement of a prime coat or tack coat in the trench prior to installation of the binder course. The prime coat shall meet the requirements of the latest edition of the TDOT Standard Specifications for Road and Bridge Construction, Section 402. The tack coat shall meet the requirements of the latest edition of the TDOT Standard Specifications for Road and Bridge Construction, Section 403.

e. Surface Course

Where an asphaltic concrete surface pavement is to be replaced, a minimum of two (2) inches of compacted TDOT Asphaltic Concrete Surface (Hot Mix), Grade D surface course shall be installed. Preparation and installation of the surface course shall be as specified in the latest revision of the TDOT Standard Specifications for Road and Bridge Construction, Section 411. Prior to placement of the surface course, the existing asphalt
shall be neatly cut back a minimum of one (1) foot outside the trench and the new pavement tied into the existing.

The surface course pavement shall be placed upon the binder course. The binder course shall be thoroughly cleaned and broomed and a tack coat shall be uniformly applied per the TDOT Standard Specifications for Road and Bridge Construction, Section 403. The surfaces of other structures adjacent to the area being treated shall be protected in such a manner as to prevent their being splattered or marred. The tacked surface shall be allowed to dry until it is in a proper condition to receive the surface course.

f. Concrete Base Slabs

Where concrete base slabs are present in the travel way or where required by the City Engineer, a new concrete base slab shall be installed in the trench. The concrete base slab shall be a minimum of six (6) inches thick and the top of the slab shall be flush with the top of the existing slab. The concrete base slab shall be TDOT Class D Concrete and be prepared and installed per the requirements of the Plan Detail Sheet, the TDOT Standard Specifications for Road and Bridge Construction, Section 501, and the City of Bristol Tennessee.

Where the existing concrete base slab contains reinforcing steel, the new concrete base slab must contain reinforcing steel and also be doweled into the existing concrete base slab. The reinforcing steel preparation and installation shall meet the requirements of the Plan Detail Sheet, the TDOT Standard Specifications for Road and Bridge Construction, Section 907, and the City of Bristol Tennessee.

g. Rigid Concrete Pavement

Where the travel way is rigid concrete pavement, the Contractor shall contact the City Engineer for the restoration requirements. In general, the rigid concrete pavement must be replaced with new rigid concrete pavement. The rigid concrete pavement shall be TDOT Class D Concrete and be prepared and installed per the TDOT Standard Specifications for Road and Bridge Construction, Section 501, and the City of Bristol Tennessee.

The new rigid concrete pavement must contain reinforcing steel and also be doweled into the existing concrete base slab. The reinforcing steel preparation and installation shall meet the requirements of the Plan Detail Sheet, the TDOT Standard Specifications for Road and Bridge Construction, Section 907, and the City of Bristol Tennessee.

h. Double Bituminous Surface Treatment (Chip and Seal)

Where double bituminous surface treatment (chip and seal) is present in the travel way, the trench shall be restored per Paragraph 2.c., and Paragraph 2.d. of this Detailed Specification.

i. Crushed Stone Surfaces

Where the existing travel way is untreated crushed stone, the Contractor shall replace the surfacing that is disturbed or removed with compacted TDOT Class A, Grade D aggregate as specified in Paragraph 2.a. of this Detailed Specification.

3. Replacement of Existing Concrete Curbs

The Contractor shall replace existing concrete curbs that have been disturbed or damaged due to construction of the project. The new curbs shall be of similar geometry as the existing
curbs or as required by the City Engineer. All concrete curb installation shall meet the requirements of the *TDOT Standard Specifications for Road and Bridge Construction, Section 702*, and the City of Bristol Tennessee.

4. Replacement of Existing Concrete Sidewalks and Medians

The Contractor shall replace existing concrete sidewalks and medians that have been disturbed or damaged due to construction of the project. The new sidewalks and medians shall be of similar geometry as the existing sidewalks and medians, or as required by the City Engineer. All new sidewalk and median construction shall meet the requirements of the Americans With Disabilities Act. The installation of all concrete sidewalks and medians shall meet the requirements of the *TDOT Standard Specifications for Road and Bridge Construction, Section 701*, and the City of Bristol Tennessee. A minimum of four (4) inches of compacted TDOT Class A, Grade D aggregate shall be placed under all concrete sidewalks and medians.

5. Replacement of Existing Driveways

a. Concrete Driveways

The Contractor shall replace existing concrete driveways that have been disturbed or damaged due to construction of the project. The new driveways shall be of similar geometry as the existing driveway or as required by the City Engineer. The installation of all concrete driveways shall meet the requirements of the *TDOT Standard Specifications for Road and Bridge Construction, Section 701*, and the City of Bristol Tennessee. A minimum of four (4) inches of compacted TDOT Class A, Grade D aggregate shall be placed under all concrete driveways.

b. Asphalt Driveways

The Contractor shall replace existing asphalt driveways that have been disturbed or damaged due to construction of the project. The driveways shall be replaced per the requirements of Paragraph 2.d. of this Detailed Specification. The asphalt driveway thickness shall be the same as the existing thickness but under no circumstances shall less than of two (2) inches of compacted asphalt be installed. The driveway asphalt shall be TDOT Asphaltic Concrete Surface (Hot Mix), Grade D. Preparation and installation of the surface course shall be as specified in the latest revision of the *TDOT Standard Specifications for Road and Bridge Construction, Section 411*. Prior to placement of the asphalt driveway, the existing asphalt shall be neatly cut back a minimum of one (1) foot outside the trench and the new pavement tied into the existing. A minimum of four (4) inches of compacted TDOT Class A, Grade D aggregate shall be placed under all asphalt driveways.

6. Seeding and Restoration of Soil Areas

All areas disturbed by construction, which are not a part of pavements, shall be seeding and landscaped to as good or better condition than that which existed prior to construction of the project.

All seeding, fertilizing and mulching shall be completed in accordance with the latest revision of the *Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.32, Permanent Seeding*. The seed mixture shall be as shown in Table 3.32-C of the Virginia Erosion and Sediment Control Handbook for the appropriate type of land use or as required by the City Engineer. The property owner’s preference of grasses shall be used when seeding pastures, or hayfields.
The Contractor is responsible for placement of 6-inches of topsoil in all areas to receive seeding. Topsoil shall be fertile, friable loam and free of subsoil, clay lumps, brush, weeds, roots larger than ½-inch diameter, stones larger than ½-inch, bedding stone, trash, construction debris and any other material toxic or harmful to growth. Areas to be seeded shall be dressed to a smooth firm surface free from washes and gullies and shall be filled to conform to the desired cross-section before beginning actual seedbed preparation.

Prior to commencing seedbed preparation, fertilizer and lime shall be uniformly applied at the rates specified in the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.32, Permanent Seeding. On sites where equipment can operate on slopes safely, the seedbed shall be adequately loosened a minimum of 6-inches deep and smoothed. On sites where equipment cannot operate safely, the seedbed shall be prepared by hand methods by scarifying to provide a roughened soil surface. All seedbeds in residential, commercial or industrial high maintenance lawn areas shall be hand raked to remove unsuitable debris and to leave a smooth surface. The resultant seedbed shall be smooth, firm, well prepared, free of lumps or clods, and suitable for placement of small seed. The completed seedbed shall be suitable for maintenance with farm equipment or lawn type equipment free from debris that will interfere with seeding and maintenance operations. The seedbed preparation shall be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the City Engineer.

Immediately after the seedbed has been prepared and approved by the City Engineer, the seed shall be applied to the areas per the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.32, Permanent Seeding. Mulch shall then be placed over the seed per the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.35, Mulching. Straw mulch must be anchored immediately after spreading to prevent displacement utilizing methods listed in the latest revision of the Virginia Erosion and Sediment Control Handbook, Standard and Specification 3.35, Mulching or approved by the City Engineer.

The Contractor shall maintain all seeded areas for one (1) year from the date of final acceptance of the project and shall restore or replace any portion of the seeding work that is found defective or which becomes damaged prior to establishment of the vegetative cover. Restoration or replacement work shall include the reestablishment of the grade or profile of the area, replacement of topsoil, refertilization, reseeding and remulching as directed by the City Engineer. The Contractor is responsible for watering the areas as required to keep the soil moist during establishment of the vegetative cover. The Contractor is responsible for mowing that is required to properly maintain the seeded areas until establishment of the vegetative cover. If the construction work is brought to completion when, in the opinion of the City Engineer, the season is not favorable for the seeding of the grounds, then the Contractor shall delay this item of work until the proper season for such seeding as directed by the City Engineer.

7. Riprap

Riprap where directed by the City engineer shall be TDOT Machined Riprap, Class A-1. The riprap shall be placed to a depth of not less than 18-inches. Materials and construction methods for placement of the riprap shall conform to the requirements of the TDOT Standard Specifications for Road and Bridge Construction, Section 709.
BACKFILL MATERIAL AS SPECIFIED

6" MIN., 18" MAX. TOTAL OF BOTH MUST NOT EXCEED 24".

T.D.O.T. NO. 8 CRUSHED STONE

ALL PIPE

STANDARD SANITARY SEWER LINE BEDDING
MIN. 2” SURFACE COURSE
MIN. 4” BASE COURSE
(8” BASE COURSE REQUIRED
IN STATE HIGHWAYS)

12” MIN

1’-0”
(MIN.)

1’-0”
(MIN.)

12”
(MIN.)

T.D.O.T.
CLASS "A", GRADING "D"
COMPACTED CRUSHED
STONE

6” MIN., 18” MAX.
TOTAL OF BOTH
MUST NOT EXCEED 24”.

TDOT #8 COMPACTED CRUSHED STONE

ASPHALT OR BITUMINOUS SURFACE

OPEN CUT ROAD CROSSING DETAILS

City of Bristol Tennessee
Standard Construction Detail

Dwg No.
SAN-2
8/02
CONCRETE PAVEMENT

BITUMINOUS SURFACE CONCRETE BASE

OPEN CUT ROAD CROSSING DETAILS

T.D.O.T. CLASS "D" CONCRETE

T.D.O.T. CLASS "A", GRADING "D" COMPACTED CRUSHED STONE

T.D.O.T. #8 COMPACTED CRUSHED STONE

#5 DOWELS @ 12" O.C. (TYP.)

#4's @ 8" O.C.

#5's @ 8" O.C.

MIN. 2" SURFACE COURSE

18" INTO NEW SLAB

DRILL 6" INTO EXISTING SLAB

1" MIN. TYP.

6" MIN. 18" MAX.

6" MIN. 18" MAX.

6" MIN. 18" MAX.

6" MIN. 18" MAX.

TOTAL OF BOTH MUST NOT EXCEED 24"

City of Bristol Tennessee
Standard Construction Detail

Dwg No.
SAN-3
8/02
FLOWABLE FILL

OPEN CUT ROAD CROSSING DETAIL

6" MIN, 18" MAX TOTAL OF BOTH MUST NOT EXCEED 24"

MINIMUM 2" SURFACE COURSE
MINIMUM 4" BASE COURSE
(8" BASE COURSE REQUIRED IN STATE HIGHWAYS)

FLOWABLE FILL AS SPECIFIED

T.D.O.T. NO. 8 COMPACTED CRUSHED STONE
SEWER LINE OR FORCE MAIN
GOING UNDER WATER LINE

SEWER LINE OR FORCE MAIN
GOING UNDER GAS TRANSMISSION LINE

TYPICAL PIPE CROSSING
SEWER LINE

SEWER LINE OR FORCE MAIN
GOING OVER WATER LINE
SEWER LINE

2' MIN. FROM TRENCH WALL

COMPACTED CLAY OR FLOWABLE FILL

12" MAX.

VARIES

COLLAR/CHECK DAM MUST EXTEND BELOW BEDDING STONE AND MUST BE SECURELY MATED TO TRENCH BOTTOM.

SEWER LINE

2' MIN.

MIN. 3'-0"± THICK

BACKFILL AS SPECIFIED

COMPACTED CLAY OR FLOWABLE FILL

NOTE:
COMPACTED CLAY OR FLOWABLE FILL CAN BE USED OUTSIDE OF TRAVEL WAYS. FLOWABLE FILL MUST BE USED UNDER TRAVEL WAYS.
STANDARD PVC SANITARY SEWER
FORCE MAIN BEDDING

BACKFILL MATERIAL
AS SPECIFIED

WARNING TAPE

6" MIN, 18" MAX
TOTAL OF BOTH MUST
NOT EXCEED 24"

12"

DETECTOR
WIRE

12"

CRUSHED STONE

T.D.O.T. NO. 8

Note: WARNING TAPE AND DETECTOR WIRE MUST BE
INSTALLED IN ALL FORCE MAIN TRENCHES
INCLUDING OPEN CUT ROAD CROSSINGS

City of Bristol Tennessee
Standard Construction Detail
STANDARD MANHOLE FRAME AND COVER AS SPECIFIED AND SET IN MASTIC
(IF WATERTIGHT MANHOLE FRAME AND COVER, FRAME SHALL BE ANCHORED TO CONCRETE WITH 4 5/8" DIAMETER ANCHOR BOLTS)

MANHOLE STEPS, AS SPECIFIED

USE PRECAST CONCRETE RINGS TO BRING TO GRADE WHERE NECESSARY (MAX 12")

PAINT OUTSIDE WALLS WITH TWO COATS OF BITUMINOUS PAINT, APPLIED AT RIGHT ANGLES TO EACH OTHER

FILL ANY VOIDS IN THE OUTSIDE JOINTS WITH BITUMINOUS ROOFING MATERIAL

VERTICAL JOINT TYPICAL SEE DETAIL "A" THIS SHEET

FLEXIBLE MANHOLE CONNECTION P.E.-P.E. WALL PIPE

FLEXIBLE COUPLING IF REQUIRED OR PIPE JOINT

6'-6" x 6'-6" T.D.O.T. CLASS "D" CONCRETE PAD FOR MANHOLES 14' DEEP OR DEEPER. 8" MINIMUM T.D.O.T. NO. 8 CRUSHED STONE FOR ALL OTHER MANHOLES AND MANHOLES SET IN ROCK.

6" MIN. (TYP.)

2" CL.

64's @ 12" O.C.E.W.

PRECAST MANHOLE

SECTION A-A

PLAN OF BOTTOM

STANDARD SANITARY SEWER MANHOLE

City of Bristol Tennessee
Standard Construction Detail

Dwg No.
SAN-9
8/02
STANDARD DROP MANHOLE ASSEMBLY

NOTE:
ALL DROP MANHOLE FITTINGS SHALL BE CLASS
CLASS 350 MECHANICAL JOINT DUCTILE IRON PIPE
NOTE:
STANDARD MANHOLE FRAME & COVER SHALL BE AS MANUFACTURED BY EAST JORDAN IRON WORKS
MODEL V-1380-2 STYLE 500
PRODUCT NO. 104711

2" LETTERS (TYP)

(4) HOLE SLOTS EQUALLY SPACED

COVER SECTION

MACHINED SURFACE

FRAME SECTION

STANDARD MANHOLE FRAME & COVER
NOTE:
STANDARD MANHOLE FRAME & COVER SHALL BE AS MANUFACTURED BY EAST JORDAN IRON WORKS
MODEL V-1380-2 STYLE 500 PRODUCT NO. 104711

VENTED MANHOLE FRAME & COVER
OUTER COVER FACE AND BACK

28 3/4" 1 3/4" 3/4" 1 3/8" 1" 8" 1"

INNER COVER PLAN

26 1/2" 1/2" 23 3/8"

RING PLAN

30 1/4" 30 1/4" 29 1/4" 1 3/8" 24" 27 1/8" 37 1/2"

INNER COVER SECTION

A) FRAME
B) OUTER COVER
C) INNER COVER
D) LOCK BAR
E) ADJUSTMENT BOLT S.S.
F) (2) 1" I.D. LIFT EYES
G) 3/8" DIAMETER O-RING
H) 1 1/4" O.D. STAINLESS STEEL BUSHING

RING SECTION

NOTE:
WATERTIGHT MANHOLE FRAME & COVER SHALL BE AS MANUFACTURED BY EAST JORDAN IRON WORKS MODEL V-2150-3

PICKHOLE DETAIL

WATERTIGHT AND LOCKING DETAIL

(1) 1/4"-20NC X 1 1/4" OAL S.S. SQ. HD. SET SCREW
(1) 3/8" SQ. X 4" S.S. BAR WELDED TO BOLT

SECTION DETAIL

STEEL BAR

1 1/4" STAINLESS STEEL BUSHING

STEEL LOCK BAR AND ELEV.

WATERTIGHT MANHOLE FRAME & COVER
VERTICAL STACK CONNECTION (SERVICES OVER 10' DEEP)

COMMON CONNECTION

NOTES:
1. CLEANOUTS SHALL BE PLACED AT THE PROPERTY LINE OR EASEMENT LINE AS DIRECTED BY THE CITY ENGINEER. UNLESS OTHERWISE DIRECTED BY THE CITY ENGINEER, THE MINIMUM SLOPE ALLOWED ON A SERVICE LINE IS 1/4"/12' H.
2. CLEANOUTS IN TRAVEL WAYS OR SIDEWALKS SHALL BE PLACED IN A SQUARE SEWER BOX & COVER. THE SEWER BOX & COVER SHALL BE SOUTHEASTERN DISTRIBUTORS ITEMS #220 & #210 OR AN APPROVED EQUAL.
3. ALL SERVICE CONNECTIONS SHALL BE BACKFILL AND ENCLOSED WITH T.D.O.T. NO. 8 CRUSHED STONE, OR AS DIRECTED BY THE ENGINEER.

4" & 6" TYPICAL SANITARY SEWER SERVICE CONNECTION
2" SEWAGE AIR & VACUUM RELEASE VALVE ASSEMBLY
ABANDONMENT OF EXISTING SEWER LINE AT MANHOLE
NOTES:
1. THE NUMBER OF BLOCKS & SIZE REQUIRED TO PREVENT FLOATATION SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
2. THE CONTRACTOR SHALL INSTALL, THE CASING PIPE A MINIMUM OF 48" INCHES DEEP UNDER ROADS AND 36" DEEP ELSEWHERE TO THE TOP OF THE CASING & ON A CONSTANT GRADE.

BRICK & MORTAR TYPICAL EACH END.
SMOOTH WALL STEEL CASING PIPE.
MIN. 2 SETS OF TREATED WOOD BLOCKING OR APPROVED MANUFACTURES BRACING PER PIPE JOINT.

BORED HIGHWAY CROSSING
NOTE:
The contractor shall be responsible for the installation of the appropriate blocking to prevent carrier pipe flotation.

BRICK & MORTAR (TYPICAL EACH END)

SMAOHT WALL STEEL CASING PIPE.

5'-0" MIN.

UNDISTURBED EARTH

4'-0" MIN.

5'-0" MIN.

6" TYP.

SEWER LINE AS SPECIFIED

2" PVC WEEP HOLE ON LOWER END OF CASING PIPE

GRAVEL, TYPICAL EACH END

MINIMUM 3 WOODEN BLOCKS EQUALLY SPACED AROUND CARRIER PIPE OR APPROVED EQUAL BLOCKING SYSTEM

BORED RAILROAD CROSSING

6" DITCH

C RAILROAD
TUNNEL CROSSING

- Restrainted joint carrier pipe, as specified
- Sand filler
- Pour collar against undisturbed earth
- Grout voids where necessary

NOTE:
Ends of tunnel may be bricked 8" above invert of carrier pipe.

City of Bristol, Tennessee
Standard Construction Detail

Dwg No.
SAN-20
8/02
STANDARD WATER LINE BEDDING
MIN. 2” SURFACE COURSE
MIN. 4” BASE COURSE
(8” BASE COURSE REQUIRED IN STATE HIGHWAYS)

12” MIN

1’-0” (MIN.)

T.D.O.T.
CLASS "A", GRADE "D"
COMPACTED CRUSHED STONE

6” MIN., 18” MAX.
TOTAL OF BOTH MUST NOT EXCEED 24”.

ASPHALT OR BITUMINOUS SURFACE

OPEN CUT ROAD CROSSING DETAILS

City of Bristol Tennessee
Standard Construction Detail
CONCRETE PAVEMENT

12" MIN. 18" MAX.
6" MIN. 18" MAX.

T.D.O.T. CLASS "A", GRADE "D" COMPACTED CRUSHED STONE

#4's @ 8" O.C.
#5's @ 8" O.C.

T.D.O.T. CLASS "D" CONCRETE

#5 DOWELS @ 12" O.C. (TYP.)

MIN. 2" SURFACE COURSE

18" INTO NEW SLAB

DRILL 6" INTO EXISTING SLAB

TOTAL OF BOTH MUST NOT EXCEED 24"

BITUMINOUS SURFACE
CONCRETE BASE

OPEN CUT ROAD CROSSING DETAILS
City of Bristol Tennessee
Standard Construction Detail

Dwg No.
W-3
8/02
FLOWABLE FILL
OPEN CUT ROAD CROSSING DETAIL

6" MIN, 18" MAX
TOTAL OF BOTH MUST
NOT EXCEED 24"

MINIMUM 2" SURFACE COURSE
MINIMUM 4" BASE COURSE
(8" BASE COURSE REQUIRED
IN STATE HIGHWAYS)

FLOWABLE FILL
AS SPECIFIED

CLASS "A" GRADE "D"
COMPACTED CRUSHED
STONE

City of Bristol Tennessee
Standard Construction Detail
Dwg No.
W-4
8/02
TYPICAL PIPE CROSSING

WATER LINE GOING UNDER SEWER
WATER LINE GOING UNDER GAS TRANSMISSION LINE
WATER LINE GOING OVER SEWER
TYPICAL CREEK CROSSING
NOTE: FOR ENCASEMENT OVER 30’ LONG PLACE 3/4” FIBERBOARD EXPANSION JOINT AT PIPE JOINTS BETWEEN POURS APPROXIMATELY EVERY 30’.

STANDARD CONCRETE ENCASEMENT
2'-0" SQ. OR 2'-0"Ø
ROUND CONC. PAD
OUTSIDE OF PAVED AREAS

FINISHED GRADE
FOR MIN. COVER
SEE SPECIFICATIONS

SECTION

2 PIECE CAST IRON VALVE BOX
VALVE W/ M.J.'S

3/4" CHAMFER

12"
12"
12"

OR

PLAN

24°

TYPICAL LINE VALVE SETTING
METER SETTING FOR 3/4" SERVICE RECONNECTIONS
OUTSIDE OF TRAVEL WAYS
NOTE:
MECHANICAL JOINT ANCHOR COUPLINGS SHALL BE USED TO RESTRAIN THE VALVE TO THE TEE AND THE HYDRANT ASSEMBLY TO THE VALVE.

SEE "TYPICAL LINE VALVE SETTING" FOR CONCRETE PAD

2 PIECE CAST IRON VALVE BOX

TYPICAL CONCRETE KICKER

6" GATE VALVE W/M.J.'s

DUCTILE IRON TEE

ANCHOR COUPLING

18" MINIMUM LAYING LENGTH

ANCHOR COUPLING

3 CUBIC FEET TDOT #8 COMPACTED CRUSHED STONE

0" TO 3 1/2"

GRADE

FIRE HYDRANT

TYPICAL FIRE HYDRANT SETTING USING ANCHOR COUPLINGS
NOTE:
REINFORCING OR ALL THREAD RODS SHALL BE UTILIZED BETWEEN THE GATE VALVE AND HYDRANT WHEN AN ANCHOR COUPLING CANNOT BE INSTALLED.

SEE "TYPICAL LINE VALVE SETTING" FOR CONCRETE PAD

TYPICAL CONCRETE KICKER

ANCHOR COUPLING 18" MINIMUM LAYING LENGTH

DUCTILE IRON TEE
6" GATE VALVE W/M.J.'s

ALL THREADED RODS MIN. OF (4) 3/4" S.S.

TYPICAL CONCRETE BLOCKING, LEAVE WEEP HOLE CLEAR

3 CUBIC FEET T.D.O.T. #8 COMPACTED CRUSHED STONE

0" TO 3 1/2"

GRADE

FIRE HYDRANT

TYPICAL FIRE HYDRANT SETTING USING ALL THREAD RODS
BLOW-OFF HYDRANTS SHALL BE NONFREEZING, SELF DRAINING TYPE, WITH AN OVERALL LENGTH OF 2'. SET UNDERGROUND IN METER BOX, THESE HYDRANTS WILL BE FURNISHED WITH A 2" FIP INLET, A NON-OPERATING ROD, AND SHALL OPEN TO THE LEFT. ALL OF THE WORKING PARTS SHALL BE OF BRONZE TO BRONZE DESIGN, AND BE SERVICEABLE FROM ABOVE GRADE WITH NO DIGGING. THE OUTLET SHALL ALSO BE BRONZE AND BE 2 1/2" NST. HYDRANTS SHALL BE LOCKABLE TO PREVENT UNAUTHORIZED USE AS MANUFACTURED BY KUPFERLE FOUNDRY CO., ST. LOUIS, MO, OR APPROVED EQUAL. SPECIFY OVERALL LENGTH APPROX. 3" SHORTER THAN NORMAL DEPTH OF BURY. MINIMUM OPENING IN METER BOX SHOULD BE 10".

2" BLOW-OFF HYDRANT ASSEMBLY
CONCRETE PAD
SEE "TYPICAL LINE VALVE SETTING" FOR DETAILS

GRADE

MAIN LINE BLOW-OFF
TEE-VALVE BOX

4"-45° BEND & KICKER
4" GATE VALVE

4" D.I.P.

FITTINGS AS REQUIRED

STONE APRON
2 CU. YDS.
T.D.O.T. MACHINED
RIP-RAP, CLASS A-1

SLOPE PIPE TO DRAIN TOWARD OUTLET

4" BLOW-OFF VALVE ASSEMBLY
NOTES:

1. PIPE GRADE SHALL BE LOWERED, IF REQUIRED, WHEN APPROACHING AIR RELEASE VALVE TO GIVE VERTICAL SPACE FOR AIR RELEASE APPURtenances (SEE SHOP DRAWINGS).

2. ALL SMALL PIPING SHALL BE RED BRASS.

2" AIR RELEASE VALVE ASSEMBLY
NOTE:
*1. PIPE GRADE SHALL BE LOWERED, IF REQUIRED, WHEN APPROACHING AIR RELEASE VALVE TO GIVE VERTICAL SPACE FOR AIR RELEASE APPURTENANCES (SEE SHOP DRAWINGS).
2. ALL PIPING SHALL BE FLANGED CLASS 350 DUCTILE IRON.

4" COMBINATION AIR RELEASE VALVE ASSEMBLY
NOTES:
1. THE NUMBER OF BLOCKS & SIZE REQUIRED TO PREVENT FLOATATION SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

2. THE CONTRACTOR SHALL INSTALL, THE CASING PIPE A MINIMUM OF 48" INCHES DEEP UNDER ROADS AND 36" DEEP ELSEWHERE TO THE TOP OF THE CASING & ON A CONSTANT GRADE.

BRICK & MORTAR TYPICAL EACH END.

SMOOTH WALL STEEL CASING PIPE.
MIN. 2 SETS OF TREATED WOOD BLOCKING PER PIPE JOINT.

WATER LINE AS SPECIFIED
2" PVC WEEP HOLE
LOW END OF PIPE
MIN. 3 CU. FT. T.D.O.T. #8 GRAVEL, TYPICAL EACH END
MIN. 3" WOODEN BLOCKS EQUALLY SPACED AROUND CARRIER PIPE OR APPROVED MANUFACTURERS BRACING

BORED HIGHWAY CROSSING
NOTE:
The contractor shall be responsible for the installation of the appropriate blocking to prevent carrier pipe flotation.

Bored Railroad Crossing

- Brick & Mortar (typical each end)
- Smooth Wall Steel Casing Pipe
- Undisturbed Earth
- 5'-0" MIN.
- 2'-0" MIN.
- 3'-0" MIN.
- 6'-0" MIN.
- 6" TYP.
- Sewer Line as specified
- 2" PVC Weep Hole on lower end of casing pipe
- Gravel, typical each end
- Minimum 3 wooden blocks equally spaced around carrier pipe or approved equal blocking system

City of Bristol Tennessee
Standard Construction Detail

Dwg No.
W-17
8/02
2" PVC DRAIN

#5's @ 12" o.c.
TYPICAL

3-#4's @ 12" o.c.
TYPICAL

RESTRAINED JOINT CARRIER PIPE, AS SPECIFIED

SAND FILLER

POUR COLLAR AGAINST UNDISTURBED EARTH

T.O.T. CLASS "D"
CONCRETE

NOTE:
ENDS OF TUNNEL MAY BE BRICKED 8" ABOVE INVERT OF CARRIER PIPE.

GROUT voids WHERE NECESSARY

BEDDING AS SPECIFIED

TUNNEL CROSSING
**TYPICAL SECTION**

**PRESSURE = 250 PSI**

**SOIL CONDITIONS:** EARTH - 2,500 PSI  
ROCK - 10,000 PSI

<table>
<thead>
<tr>
<th>90° BEND</th>
<th>45° &amp; 221/2° BENDS</th>
<th>11 1/4° BENDS</th>
<th>TEE</th>
<th>PLUG</th>
</tr>
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<tbody>
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**NOTES**

1. FOR TEE WITH BRANCH UNEQUAL TO RUN USE TEE TYPE Acker with D, L, W Dimensions the same as those for PLUG with same dimension as branch of TEE. SELECT "T" DIMENSION FROM TEE TABLE UNDER COLUMN HEADED BY THE SIZE OF THE BRANCH.

2. IF Exact size of pipe blocking is not shown, use next larger size.

3. Dimension "D" MAY BE GREATER THAN SPECIFIED TO ALLOW WORKING SPACE. CONCRETE BLOCKING MUST BE Poured AGAINST UNDISTURBED EARTH.

---

**CONCRETE BLOCKING FOR PIPE**

City of Bristol Tennessee  
Standard Construction Detail  
Dwg No. W-19  
8/02
45 DEG BEND

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11 1/4 DEG BEND

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SOIL CONDITIONS:
- EARTH = 2500 PSF
- ROCK = 10,000 PSF

PRESSURE = 250 psi

VERTICAL ANCHORING DETAIL

FOR VERTICAL BENDS 5° OR MORE

BEND AS REQUIRED

5/8" x 3" STAINLESS STEEL STRAPS

3/4" STAINLESS STEEL ANCHOR BOLTS

WATER LINE

MIN. 3/4 W EMBEDDED

T.D.O.T. CLASS "A" CONCRETE

SIDE

SECTION

City of Bristol Tennessee Standard Construction Detail

Dwg No. W-20

8/02
Concrete pad if outside of paved area (see detail)

2 Piece Valve Box

Ductile Iron Service Saddle FORD F202

2" Close Brass Nipple

2" Gate Valve FIP x FIP

2" MIP x CTS Brass Coupling FORD C 84-77

Quazite Meter Box Lid
Part No. PG2436WAR2
(4 1/2" x 7 1/2" Reader)

Coppersetter
FORD VBH77-12B-11-77
with 2" MIP x CTS Brass Coupling
(FORD C 84-77) on inlet

Strongwell/Quazite
Meter Box
Part No. PG2436BA30
(Open Bottom)

2" Brass Plug

Solid brick foundation
(Min of 8 required on each box)

Min 4" TDOT #8 Stone

2" Copper Service Pipe shall be placed under the bottom of the meter box between brick supports

**Meter Setting for 2" Service**
4 - METER SETTING

N.T.S.
8 - METER SETTING

N.T.S.

City of Bristol Tennessee
Standard Construction Detail