

STANDARD SPECIFICATIONS
FOR
CITY OF COOKEVILLE
WATERLINES

City of Cookeville, Tennessee
1860 South Jefferson Avenue
Cookeville, Tennessee 38506

Ronnie Kelly, Director
Ricky Shelton, Mayor
Mike Davidson, City Manager

CONSTRUCTION SPECIFICATIONS INDEX

1. WATER DISTRIBUTION LINES AND APPURTENANCES

<u>Section</u>	<u>Page</u>
1-01 SCOPE	TS-1
1-02 QUALITY ASSURANCE	TS-2
1-03 APPLICABLE DOCUMENTS AND SPECIFICATION REFERENCES	TS-2
1-04 MATERIAL HANDLING	TS-3
1-05 MATERIALS.....	TS-3
1-06 RESPONSIBILITY FOR MATERIAL FURNISHED BY THE CONTRACTOR	TS-10
1-07 ALIGNMENT AND GRADE	TS-10
1-08 EXCAVATION.....	TS-11
1-09 PIPE BEDDING	TS-14
1-10 WATER MAIN INSTALLATION	TS-14
1-11 BACKFILLING OF WATER MAINS AND APPURTENANCES.....	TS-17
1-12 MAGNETIC DETECTION TAPE AND WIRE	TS-19
1-13 SERVICE LINE INSTALLATION.....	TS-19
1-14 REMOVAL, RESTORATION, AND MAINTENANCE OF PROPERTY	TS-20
1-15 STREET AND DRIVEWAY REPLACEMENT	TS-21
1-16 HIGHWAY CROSSING.....	TS-25
1-17 STREAM CROSSING	TS-26
1-18 EROSION CONTROL.....	TS-26
1-19 TESTING	TS-29
1-20 STERILIZATION AND BACTERIOLOGICAL TESTING	TS-29
1-21 CLEAN-UP	TS-31

1. WATER DISTRIBUTION LINES AND APPURTENANCES

1-01 Section I: Scope

1. This item shall consist of furnishing all material and performing all work necessary for or incidental to completing and making ready for operation water lines, water service lines, and fire hydrant lines and appurtenances including testing, sterilization, clean-up and all other operations necessary to complete the work in accordance with the Contract Drawings and these Specifications. Sewer force mains will use these same specifications.
2. The Contract drawings indicate the extent and general arrangement of Water Systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted as soon as practicable for approval. No such departures shall be made without written approval.
3. The Drawings and these Specifications shall be considered as supplementary, one to the other, so that materials and labor indicated, called for, or implied by the one and not the other, shall be supplied and installed as though specifically called for on both. Should any discrepancy appear or any misunderstanding arise, the Engineer/Owner shall decide the true intent and his decision shall be binding.
4. A pre-construction conference is required for all projects. Prior to construction beginning, the Owner/Contractor shall submit the "Construction Start Notification" to the Division of Water Supply's Local Field Office.
5. On contracts made with the City, the "Owner" is the City. On such contracts the references to pay items apply.
6. On contracts between a private developer and a contractor, the "Owner" is generally the developer. The two parties are to reach their own agreement regarding pay items and what constitutes extra cost items. The City shall not be responsible for payment of any items on such contracts with developers.
7. A video shall be submitted for all contracts with the City. Before beginning the job, the Contractor shall make a video recording showing the status before any construction has begun. The video(s) shall be made, submitted and approved prior to the beginning of work. The video shall be submitted on a DVD.
8. As-builts shall be submitted to the owner upon completion of the project. As-builts must show accurate location, of all meters, valves, air release valves, fire hydrants, bends, and other appurtenances before project will be accepted by the city.

9. Caution shall be taken around existing utilities. The contractor is responsible for all costs incurred when utilities are disturbed during construction. All material, labor, and vehicle costs will be charged to the contractor from all departments within the city. It is the contractor's responsibility to contact utilities outside of the city when disturbed. Water services damaged during subdivision development will be replaced, not repaired.
10. Any structures or utilities that need to be moved or held during construction shall be the responsibility of the contractor. It is the responsibility of the contractor to contact the City of Cookeville Electric Department or UC EMC to maintain, hold, or move guy wires or utility poles. Any costs incurred are considered part of the project cost and are the responsibility of the contractor.
11. In Subdivision Development, property pins must be installed before water and sewer line installation can begin.
12. On projects where the City is not the owner the contractor shall be responsible for paying for bacteria testing. The City will collect the samples and do the analyses. The fee is \$60 up to 2,000 feet of water line and then \$60 for each additional 2,000 feet or portion thereof.
13. Contractor must install temporary fencing on a project site as needed when existing fencing is disturbed for farm animals or household pets. Property owners shall be contacted to ensure optimal placement of fencing.

1-02 Section II: Quality Assurance and Warranty:

Installation and materials shall conform to the construction standards of the local governing authority and to the Tennessee Department of Environment and Conservation.

The Contractor and/or Developer shall provide a one-year maintenance warranty on all water lines and related appurtenances.

1-03 Section III: Applicable Documents and Specification Reference

The acronyms and names of various organizations are used throughout this document. Publications by these organizations referenced in these specifications form a part of this specification and where referred to by basic designation only, are applicable to the extent indicated. The latest editions of the publications referenced shall apply to the work.

1. AASHTO: American Association of State Highway and Transportation Officials)
2. ASTM: American Society for Testing and Materials (ASTM)
3. The terms "State Specifications," as used herein, refer to the State of Tennessee Division of Highways, "Standard Specifications for Road and Bridge Construction" current at the date of this Specification. Reference to State Specifications is solely for the purpose of specifying quality of materials and/or methods of construction as therein set forth.
5. The term A.S.A. as used herein refers to the American Standards Association.
6. AWWA: American Water Works Association.

1-04 Section IV: Material Handling

1. Deliver materials to the job site and store in a safe, dry place with all labels intact and legible at time of installation.
2. All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor. Materials furnished by the Owner shall be picked up by the contractor at points designated and hauled to and distributed at the site.
3. Protection of materials for the project before, during, and after installation, and protection of installed work, and materials of all other trades shall be the responsibility of the contractor. In the event of damage, the contractor shall make all repairs and replacements necessary to the approval of the owner at no additional cost to the owner.
4. Ductile iron pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. In distribution of the material at the site of work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

1-05 Section V: Materials

1. GENERAL:
 - A. Materials, pipe and accessories shall be new and unused materials of the size and type shown on the Drawings and conforming to the requirements of the applicable article of this Section of the

Specifications. All brass fittings shall meet the new low lead requirements in accordance with Federal Law S.3874 and NSF-61, Annex G.

- B. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter before lowered into the trench, and shall be kept clean during laying operations. The pipe shall not be laid in water or when trench or weather conditions are unsuitable for work. When the work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other foreign substance can enter the line.
- C. Any section of pipe, or fitting, or accessory found to be defective, either before or after laying, shall be replaced with new material at no additional expense to the Owner.
- D. The nominal pipe size, type of plastic, ASTM designation, SDR, and name of manufacturer shall be clearly marked on each length of pipe. Brass fittings shall be labelled indicating they meet the low lead requirements.

2. Polyvinyl Chloride (PVC) Water Pipe:

- A. PVC pipe shall be Class 200 (SDR 21) unless SDR-17 is required on the plans. pressure rated valve, manufactured in accordance with the latest revisions of the following specifications:

ASTM-D2241

Department of Commerce PS 22-70 (SDR-PR)

National Sanitation Foundation Laboratories (NSF)

- B. Materials used to produce the pipe couplings and fittings shall conform to ASTM D 1784, Type 1, Grade 1, 2000 psi design stress. The pipe shall be designed to pass without failure of pressure of 600 psi for 90 seconds when tested in accordance with PS 22-70 as referenced to ASTM D1599. In addition, the pipe shall pass without failure for 1000 hours a pressure of not less than 340 psi when tested in accordance with ASTM 1598. Rubber gaskets shall conform to ASTM D1869. All necessary fittings and adapters shall be provided as necessary to connect to water system facilities.
- C. The PVC pipe must meet the requirements of Policy Statement from the Tennessee Department of Public Health dated July 6, 1971, and all subsequent statements relating to PVC pipe by the Tennessee Department of Environment and Conservation - Division of Water Supply.

3. Ductile Iron Water Pipe:

- A. Ductile iron pipe shall be Pressure Class 350 unless noted otherwise on the plans. The ductile iron pipe shall be designed in accordance with AWWA C151 method of design based on 21,000 psi bursting tensile strength and 45,000 psi modulus of rupture for a minimum of 150 psi water working pressure, laying conditions "Type 2" flat bottom trench, without blocks, tamped backfill, and under 3 feet of cover.
- B. The pipe interior shall be standard cement lined in accordance with ANSI/AWWA Standard C104/A21.4 and seal coated with an approved bituminous seal coat in accordance with AWWA Standard C-104 (ANSI Standard A 21.4), latest revision.
- C. Joints shall be "mechanical joint," or "push-on" type conforming to AWWA Standard C-111 (ANSI Standard A 21.11), latest revision. Push-on joints shall be "Super Bell-Tite joint as manufactured by Clow Corporation, "Tyton" as manufactured by U.S. Pipe and Foundry Company, "Fastite" as manufactured by American Cast Iron Pipe Company, or approved equal.
- D. Ductile Iron Fittings shall conform to AWWA Standard, C-153 for compact fittings, latest revision. Joints shall be mechanical joint or push-on, conforming to AWWA Standard C-111 (USA Standard A 21.11), latest revision. Fittings shall be rated for 250-psi water working pressure and shall be standard cement lined and seal coated in accordance with AWWA Standard C-104.

4. Polyethylene Pipe (HDPE):

Polyethylene pipe (HDPE) shall have a co-extruded blue cover or stripes designating use for potable water. Pipe shall be HDPE 3608, manufactured by an approved manufacturer. HDPE 3608 may also be used for casing pipe where designated. Pipe with extruded blue stripes shall have a minimum of three equally spaced stripes. Pipe shall have a heat indented print line containing the information required in ASTM D 3035. Sizes larger than 4 inch and larger shall be Ductile Iron Pipe Size (DIPS) in compliance with *AWWA C906* and *ASTM F 714*. Sizes 2 inch and 3 inch shall be Iron Pipe Size (IPS) in compliance with *AWWA C901* and *ASTM D 3035*. Pipe shall be SDR 11 unless shown otherwise on the plans. All pipe shall be in compliance with *NSF 61*. Color print lines are not an acceptable method for color marking of pipe. The transition of HDPE to PVC on new lines shall be with a Poly-Cam Series 732 for DIPS pipe and a Series 737 for IPS pipe or other approved fittings. See Service tubing specification below for HDPE service tubing.

5. Gate Valves:

Gate valves shall be of the resilient seat type, conforming to AWWA Standards, tested to 300 pounds hydraulic pressure, suitable for 150 pounds working pressure. Valve shall have mechanical joint ends (some applications for a 2" valve require threaded valves), and inside screw, and shall be equipped with a two (2) inch operating nut – open left. Mechanical joint valves shall be M & H 4067-01 valves or equal. Threaded valves shall be M & H 4067-07 or equal. Mueller, US Pipe, and American Darling brands of the equivalent valve are considered equal. Valves with the top of the valve more than 3' below ground will require a gate valve stem extension kit with a set screw and a centering plate.

6. Blow-Off:

The valve installed for a blow-off's shall meet the same requirements as the Gate Valves. Blow off hydrants shall be as on the detail sheet.

7. Tapping Sleeve and Valve:

Tapping saddle and valve shall consist of Ford style FTSC or Smith-Blair No. 622 epoxy coated tapping saddle with stainless steel bolts and an M & H 4751-01 resilient seat tapping valve or equal. Mueller, US Pipe, and American Darling brands of the equivalent valve are considered equal. For 2" taps use the threaded gate valve in the valve section and the iron pipe saddle in the service saddle section.

8. Valve Boxes:

Valve boxes shall be good quality cast iron and made in sections. Made in USA required. The lower section shall be a minimum of five (5) inches in diameter enlarged to fit around bonnet of the valve if a two (2) section box is furnished, or to fit a circular or oval base section if a three (3) section box is furnished. The upper section shall be arranged to slide or screw down over the adjoining section and shall be full diameter throughout. Valve boxes shall be provided with cast iron lids or covers. The cast iron cover shall be marked "Water". Total length of valve box shall be sufficient to permit the top of the box to be set flush with the established grade at the surface. Valve Boxes located outside of pavement shall have a 2' x 2' x 4" thick concrete collar around the box.

9. Air Release Valves

A. Air release valves for normal use in the system shall be A.R.I or APCO brand valves. Unless the plans and/or detail sheet specifies another size, a 1" valve shall be used such as the APCO #50, or an A.R.I. S-050. Sewer ARV's will be as shown on the plans.

- B. Air release valves shall be installed in valve basins detailed below.
10. Valve Basins:
- A. Sidewalls shall be precast concrete manhole section.
 - B. Valve basin frame and covers shall be of the type and weight shown on the plans or as specified by the Engineer. Castings shall conform to the specification for Gray Iron Castings, ASTM Designation A48, Class 20.
 - C. Valve basin steps shall be of cast iron to the design and section shown on the plans.
 - D. Pipe penetrations shall use rubber boots or Link Seals or a "dog house" cut out is acceptable.
11. Fire Hydrants:
- A. All fire hydrants furnished shall be of one brand, or make. US Pipe, M&H, Mueller, and American Darling are approved for hydrants with the 4 ½" valve opening and M & H 129T, and Mueller A-423 are approved for the 5 ¼" valve opening. Hydrants shall conform to AWWA Standard C-502, latest revision, and to the following:
 - B. Main Valve of the hydrant shall be compression type. Valve opening shall be 4½ inches unless plans or detail sheet require the use of 5 ¼ inch valve opening. As a general rule, mains larger than 8" will require 5 ¼" valve opening.
 - C. The Bonnet Section of all hydrants shall be designed so that the bearing surfaces and stem threads are sealed in an oil reservoir and automatically lubricated each time the hydrant is operated.
 - D. Breakable Safety Flange shall be provided for each hydrant furnished.
 - E. Footpiece or Elbow shall have standardized mechanical joint socket for 6-inch diameter inlet connection.
 - F. Bury Length shall be for 3 1/2 foot (min) bury with provision in the barrel sections for the addition of extension sections in multiples of six (6) inches.
 - G. Outlet Nozzles for hydrants shall consist of two 2 1/2 inch hose nozzle and one 4 1/2 inch pumper nozzle.
 - H. Unless otherwise specified for conformance with Owner's existing equipment, hose and pumper nozzle threading and operating nut shall conform to National (American) Standard. Hydrants shall open to the left (counter clock-wise).

- I. Unless otherwise specified for conformance with the paint color scheme in Owner's existing system, the portion of the hydrant above ground shall be coated with an epoxy coating meeting AWWA C550, and top coated with a polyurethane - hydrant shall be fire hydrant red in color.
 - J. The Contractor shall furnish, for Engineer approval, specifications and shop drawings of the hydrants proposed for installation in the system. Auxiliary valve and companion box shall be as herein before specified.
12. Casing Pipe for Highway and Road Crossings:
- A. Steel Casing Pipe: Steel casing pipe shall conform to AWWA Standard C-202, latest revision for Mill-Type Steel Water Pipe, Grade B, minimum wall thickness 1/4 inch, minimum yield strength 35,000 psi. If under a railroad, casing pipe larger than 12" up to 24" in diameter shall have a minimum wall thickness is 0.375" – casing larger than 24" in diameter shall meet the railroad specification. Welded joints shall be bituminous coated/field applied.
 - B. Plastic Casing Pipe: For water service lines plastic pipe will be used for casing where requested by the Engineer. 2" PVC casing shall be used for casing pipe for service line when service lines cross the road and they are installed by open cutting.
13. PVC and Ductile Iron Carrier Pipe:
- Ductile Iron pipe used in Steel Casing Pipe shall use field lock gaskets. PVC pipe in Steel Casing Pipe shall be SDR-21. Either pipe shall be supported by Advance Products & Systems Model SI epoxy coated casing spacers (centered and restrained), or approved equal.
14. Service Tubing:
- Tubing shall Endot EndoPoly Water Tubing, SDR 9, 250 psi, PE 7410, or approved equal. Tubing manufactured in accordance with ASTM 2737. Plastic inserts required.
15. Service Saddles:
- Smith-Blair Type 313 with cc threads or approved equal shall be used on Ductile Iron or Cast Iron Pipe.
On PVC pipe a Ford Style S70 with cc threads or approved equal shall be used.
For 2" taps use a Ford Style S71 or Smith-Blair Type 313 saddle with iron pipe treads.

16. Corporation Stops:

Ford Style F1000 or approved equal shall be used.

17. Meter Boxes:

Meter Boxes for 5/8" x 3/4" and 3/4" meters shall be Southeastern Distributors, Inc. (phone 1-800-869-6327) MB-1 box with a two-piece cast iron lid. Item No. 03.

Meter Boxes for 1" meters shall be Southeastern Distributors, Inc. (phone 1-800-869-6327) MB-2 box with a two (2) piece cast iron lid. Item No. 19.

Meter Boxes for 2" meters shall be Carson-Brooks 1730-18 meter boxes with a one piece plastic lid. When meters must be set in traffic areas the City will trade out a traffic type box for one of these polyethylene boxes.

18. Full Circle Repair Clamps:

For 2" and less water lines Smith-Blair style number 244, or approved equal, is to be used. For mains larger than 2" in size Smith-Blair style number 226, or approved equal, is to be used.

19. Water Meters:

Water meters 1" and smaller in size are to be furnished by the City.

20. Meter Coppersettters:

The following meter yokes with 1/4 turn full port ball valve with meter nut and lock wings - inlet and outlet connection for copper size tubing - or approved equals shall be used.

<u>Size</u>	<u>Ford Part Number</u>
2"	VBB-77-12-11-77
1"	VB-74-10W-44-44-Q
5/8" x 3/4"	VB-72-7W-44-44-Q

21. Concrete:

A. Class "A" concrete shall have the following characteristics and/or proportions of materials.

- (1) Minimum Cement Content:
6.0 bags (564 pounds) per yd.
- (2) Minimum 28-day Compressive Strength:
3500 psi avg. any three cylinders.
- (3) Anticipated 28-day Compressive Strength:
3700 psi or greater.

B. Class "C" concrete shall have the following characteristics and/or proportions of materials.

- (1) Minimum Cement Content:
5.0 bags (470 pounds) per yd".
- (2) Minimum 28-day Compressive Strength:
2500 psi avg. any three cylinders.

Compressive strength of concrete shall be determined by use of standard 6-inch diameter by 12-inch test cylinders in accordance with ASTM Designations C 39-80 and C 31-69 (1980), as amended to date.

22. Tests and Quality Certificates:

The Contractor shall be responsible for furnishing the Engineer with certified test certificates and manufacturers affidavits stating that all material furnished is in accordance with these Specifications before any such material is placed or stored at the project site.

1-06 Section VI: Responsibility for Material Furnished by the Contractor

1. The Contractor shall be responsible for all material furnished by him and shall replace at his own expense, all such materials found defective in manufacturer or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work.
2. The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipes, fittings and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.
3. Any material furnished by the Owner that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.

1-07 Section VII: Alignment and Grade

1. On subdivision projects, property pins must be installed before water construction can begin.

2. Benchmarks must be established on project site before construction can begin.
3. The water main shall be laid and maintained to the required lines and grades established by the Engineer, with fittings, valves, and hydrants at the required locations; spigots centered in bells; and all valves and hydrant stems plumb.
4. Whenever obstructions not shown on the Plans are encountered during the progress of the work and interfere to such an extent that an alteration in the Plan is required, the Engineer shall have the authority to change the Plans or order a deviation from the established line and grade or arrange with the Owners of the structures for the removal, relocation, or reconstruction of the obstructions. If the change in plans result in a change in the amount of work by the Contractor, such altered work shall be done on the basis of payment to the Contractor for extra work authorized and credit to the Owner for eliminated work.
5. The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures both known and unknown may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.
6. Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of existing underground structures, the Contractor shall make explorations and excavations for such purposes. If the Contractor is required to perform additional work in making the explorations and excavations, extra compensation will be allowed for such additional work, as approved by the Engineer.

1-08 Section VIII: Excavation

1. The excavations shall include the removal of quicksand, hard pan, boulders, drain tile, clay and roots, within the depth and width of trench necessary to the proper installation of the work.
2. The excavation shall be of sufficient width and carried to the depth required for the construction of the improvement. Bell holes of sufficient depth shall be provided across the bottom of the trench to accommodate the bell of the pipe, to provide sufficient room for joint making, and to insure uniform bearing for the pipe.
3. Where a firm foundation is not encountered at the bottom of the trench due to soft, spongy, or other unsuitable material, it shall be removed and replaced with sand, gravel, or crushed rock firmly compacted into place.

4. Where rock is encountered in the prosecution of the work, it shall be excavated to a depth of six (6) inches below the established grade of the bottom of the trench. The cut below grade shall be refilled with gravel, firmly compacted. Rock is defined herein as any natural boulder exceeding twelve (12) cubic feet in volume, or natural ledge rock or stone which cannot be broken and removed by a power shovel of one-half (1/2) cubic yard capacity.
5. Any excavation made below that necessary for the proper installation of the improvement shall be refilled with sand or fine gravel and thoroughly compacted.
6. Sheet piling and bracing shall be placed in the ditch, as may be necessary to protect workmen, adjacent structures, adjacent utilities, pavements, roadways, curbs, sidewalks, and for the safety and proper execution of the work. It is the contractor's sole responsibility to determine if it is required.
7. Sufficient pumping and/or well pointing equipment shall be provided to remove all water from the trenches and appurtenant excavation. No pipe shall be installed in or under water without the Engineer's approval.
8. The trench shall be dug so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of pipe laying as permitted by the Engineer. The trench shall be braced and drained so that the workmen may work therein safely and efficiently. It is essential that the discharge of the trench dewatering pumps be conducted to natural drainage channels, drains, or sewers.
9. The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and the backfill to be placed and compacted as specified. Trenches shall be of such extra width, when required, as will permit the convenience for placing of timber supports, sheet piling and bracing, and handling of specials.
10. All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural watercourses shall not be obstructed.
11. Hand methods for excavation shall be employed in locations shown on the drawings. In other locations, the Contractor may use trench-digging machinery or employ hand methods.

12. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the highway. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. The rules and regulations of the local authorities respecting safety provisions shall be observed.
13. The Contractor shall carry on the work in a manner which will cause the least interruption to traffic, and may close to through travel not more than two (2) consecutive blocks, including the cross street intersected. When traffic must cross open trenches, the Contractor shall provide suitable bridge at street intersections and driveways.
14. The Contractor shall post suitable signs necessary for proper maintenance of traffic. The Engineer may require additional signs if he deems they are necessary.
15. Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his expense and under the direction of the Contractor at his expense and may have been disturbed shall be restored upon completion of the work.
16. Trench shall be excavated to a depth sufficient to allow minimum cover of thirty-six (36) inches above the crown of the pipe. Also, the top of the main shall be at least thirty inches below the finished grade of the existing or proposed road.
17. Trees, shrubbery, fences, poles and all other property and surface structures shall be protected unless their removal is shown on the drawings or authorized by the Engineer. When it is necessary to cut root and tree branches, such cutting shall be done under the supervision and direction of the Engineer.
18. All excavated material not needed for backfilling purposes shall be disposed of in a manner satisfactory to the Owner.
19. In all areas along highways or roadways where the pipeline is being laid in the pavement or in the right-of-way of the road, excavation during each day shall be limited to the footage of pipe that can be laid and the trench to be backfilled so that minimal ditch is left open overnight in such areas. The rules and regulations of the Tennessee Department of Transportation and the City of Cookeville shall apply.

20. All excavation shall be accomplished in accordance with applicable safety laws and regulations; the Owner does not assume responsibility of any degree or sort for acts of the Contractor.
21. EXCAVATION NEAR SEWER LINES
 - A. The Contractor shall protect proposed water lines that cross existing sewer lines by providing 18-inch minimum separation between the bottom of the proposed water line and the top of the existing sewer line.
 - B. When water lines are being laid parallel to existing sewer lines, there should be a minimum of 10 feet horizontal separation or a minimum of 18 inches vertical separation as specified above and laid in separate trenches.
 - C. When the above conditions cannot be obtained, both the water and sewer lines shall be constructed of water pipe and be pressure tested to assure water tightness.

1-09 Section IX: Pipe Bedding

1. In general, the trench shall be opened below the bottom of the pipe and refilled with bedding material to a depth sufficient to provide a firm bed for the lower quadrant of the pipe at the proper line and grade.
2. Clear dry excavated earth, sand, or crushed stone may be used as bedding material.
3. Where 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 suitable bedding material.

1-10 Section X: Water Main Installation

1. Adequate provision shall be made for safely storing and protecting all water pipe and fittings prior to actual installation in the trench. Care shall be taken to prevent damage to the pipe castings, both inside and out. Provisions shall be made to keep the inside of the pipe clean throughout its storage period and to keep mud and/or other debris from being deposited therein. All Pipe shall be thoroughly cleaned on the inside before laying. Proper equipment shall be used for the safe handling, conveying and laying of the pipe. Each pipe or fitting shall be firmly supported throughout its entire length. The bottom of the trench shall be shaped to assist in providing the even bearing for the pipe. Bell holes of sufficient size and depth shall be provided at each joint to permit proper jointing.

2. Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe fittings, valves and hydrants shall be carefully lowered into the trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.
3. The pipe and fittings shall be inspected for defects and, while suspended above grade, be rung with a light hammer to detect cracks. All lumps, blisters, and excess coal tar coating shall be removed from the ends of each pipe, and the inside of the bell or the face of the joint shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
4. Joining of Push-On Joint Pipe:
 - A. Shall conform in general to AWWA Standard procedures.
 - B. The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket.
 - C. A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot end of the pipe or both. Gasket lubricant shall be as supplied by the pipe manufacturer and approved by the Engineer.
 - D. The spigot end of the pipe shall be entered into the socket with care used to keep the joint from contacting the ground. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack-type tool or other device approved by the Engineer.
 - E. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. Field cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured. Manufacturer's assembly instructions shall be followed.
5. Joining of Mechanical-Joint Pipe shall in general conform to AWWA Standard procedures. The last 8 inches outside of the spigot and inside of the bell mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter from the joint, and then painted with a soap solution made by dissolving one-half cup of granulated soap in 1 gallon of water. The cast-iron gland shall then be

slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with the thick edge toward the gland. The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell; care shall be taken to locate the gasket evenly around the entire joint. The cast-iron gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and the nuts screwed up tightly with the fingers. All nuts shall be tightened with a suitable (preferably torque-limiting) wrench. Nuts spaced 180° apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

6. Where indicated on the Plans, or directed by the Engineer, the Contract shall install plugs for anticipated future extensions by placing a branch fitting (Tee or Cross) in the line and plugging the unused branch or branches. In general, such plugs will be located at the street intersections where present plans provide lines running in only two or three directions from the intersection and where, in the opinion of the Engineer, a connection may be required for a future extension.
7. The Contractor shall furnish all labor and materials, including all necessary tools and equipment, and all other incidentals necessary for making connections between the new work and the existing main at the point indicated on the Plans or where directed by the Engineer.
8. During the construction and until jointing operations are complete, the open ends of all pipe shall be at all times protected and sealed with temporary watertight plugs.
9. Valve Basins:
 - A. Valve basins shall be constructed of the size and dimension, and at the locations shown on the plans. Full mortar joints shall be used. Interior joints shall be struck smooth. Precast concrete rings shall be laid with full mortar joints. Steps shall be placed as shown on the plans.
 - B. Bottom for valve basins shall be constructed of cast in place concrete or precast concrete sectional slabs on the Plans, a one-half (1/2) inch mortar seal shall be placed over bottom constructed of precast concrete sectional slabs.
 - C. The outside of the walls of the valve basins shall be plastered with a mortar coat one-half (1/2) inch thick, mortar to be of the same ingredients as specified for use in sidewall joints.

10. Anchorage:

- A. The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench with stone or precast concrete slabs, and it shall be tied to its valve with suitable metal tie rods or clamps, as shown or directed by the Engineer.
- B. All plugs, caps, tees and bends deflecting 22 1/2° or more shall, unless otherwise indicated, be anchored to prevent movement by providing suitable reaction backing or metal tie rods, or metal harness, as shown on the Plans or specified herein. Also, all caps installed shall use a Romac Grip Ring restraining coupling.
- C. All valves shall be restrained by rodding it to the main or by using restrained joint pipe or by using valve and hydrant tees.
- D. Concrete reaction backing shall be of a mix not leaner than one (1) cement, two and one-half (2 1/2) sand, five (5) stone, and having a compressive strength of not less than 3,000 psi at twenty-eight (28) days. Backing shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that shown or directed by the Engineer. The backing shall, unless otherwise shown or directed, be so placed that the pipe and fittings joints will be accessible for repair.
- E. Metal harnesses, tie rods or clamps of adequate strength to prevent movement shall be used instead of concrete backing on the valves for fire hydrants unless prior approval is given by the Engineer. Steel rods or clamps shall be galvanized or otherwise rustproof treated, or shall be painted as shown or directed by the engineer.

1-11 Section XI: Backfilling of Water Mains & Appurtenances

- 1. After the pipe has been embedded in accordance with the manufacturer's recommendation and inspected by the Engineer, backfilling shall be carefully placed for a depth of one (1) foot above the pipe. Material for this purpose shall be free from stones and shall contain no frozen materials. The remainder of the back fill shall be further compacted by hand or machine. No backfill material will be used that exceeds 6 inches in its greatest dimension in the first 4 feet above the pipe. No material shall exceed 12 inches in its greatest dimension in the remainder of the backfill. It shall be mounded and left at a height, over the trench, eight (8) inches higher than the original elevation of the ground in dirt backfill areas. A minimum cover of thirty-six (36) inches above the crown of pipe is required. Also the crown of the pipe shall be at least thirty (30) inches below the finished road grade.

2. When the type of backfill material is not indicated on the drawings or specified, the Contractor may backfill with the excavated material, provided that such material consists of loam clay, sand, gravel or other materials which, in the opinion of the Engineer, are suitable for backfilling. Where excavated material is indicated on the drawings or specified for backfill and there is a deficiency due to a rejection of part thereof, the Contractor shall furnish the required amount of sand, gravel or other approved material as an extra.
3. Backfilling shall not be done in freezing weather except by permission of the Engineer, and it shall not be made with frozen material. No fill shall be made where the material already in the trench is frozen.
4. All sand used for backfill shall be a natural bank sand, graded from fine to coarse, not lumpy or frozen, and free from slag, cinders, ashes, rubbish or other material which, in the opinion of the Engineer, is objectionable or deleterious. It shall not contain a total of more than ten (10) percent by weight of loam and clay, and all material must be capable of being passed through a three-quarter (3/4) inch sieve. Not more than five (5) percent shall remain on a No. 4 sieve.
5. Gravel used for backfill shall consist of natural bank gravel having durable particles graded from fine to coarse in a reasonably uniform combination with no boulders or stones larger than two (2) inches in size. It shall be free from slag, cinders, ashes, refuse or other deleterious or objectionable materials. It shall not contain excessive amounts of loam and clay, and shall not be lumpy or frozen. No more than fifteen (15) percent shall be finer than No. 200 sieve.
6. Screenings shall consist of the product obtained from crushing sound limestone or dolomite ledge rock and shall be free from shale, dust, excessive amounts of clay and other undesirable materials. All materials shall pass a one-half (1/2) inch sieve and no more than twenty-five (25) percent shall be finer than a No. 100 sieve.
7. Where sand or gravel backfill is not indicated on the drawings or specified herein, and in the opinion of the Engineer should be used in any part of the work, the Contractor shall furnish and backfill with sand or gravel as directed, as an extra.
8. Where the excavation is made through permanent pavements, curbs, driveways, or sidewalks, or where such structures are undercut by the excavation, the entire backfill to the subgrade of the structures shall be made with sand or gravel. Walks and driveways consisting of broken stone, gravel, slag or cinders shall not be considered as being of a permanent construction.

9. Gravel backfill shall be used around each service tap and under the first four feet of tubing from the corporation stop.

1-12 Section XII: Magnetic Detection Tape and Wire

1. Magnetic detection tape shall be placed approximately eighteen inches (18") above all main water lines and all service lines to the meter box in excavated trenches, and with the service line through bore holes. The tape shall be 2" wide and such that it can be located with a standard pipe locator and shall have stamped clearly upon it, "Water Line Buried Below."
1. Underground warning tape (magnetic detection tape is acceptable) shall be placed approximately eighteen inches (18") above all sewer force main. The tape shall be 2" wide and shall have stamped clearly upon it, "Serwer Line Buried Below."
2. The Contractor shall bury a #12 AWG solid copper tracer wire with 45-mil polyethylene coating in the ditch with the water line, water service line, and sewer force main. Blue coating shall be used for water and green for sewer. The wire shall also be installed with the plastic service lines. The detection wire shall be continuous and shall be connected to the valve boxes, hydrants, etc. The wire in the service line ditch shall be connected to the meter yoke and to the wire in the water main ditch. Contractor shall use King Wire Nut connectors with silicone to fit #8 gauge through #22 gauge wire (Direct Bury King 6 Blue).

1-13 Section XIII: Service Line Installation

1. Service line taps of shall be at least one-inch diameter on new installations. Water Line/Service Line replacement Projects may use different sizes (See Plans/Detail Sheet) Services on new installations requiring taps larger than one-inch lines shall be installed by installing a Tee unless stated different on the plans.
2. Between the main and the meter shall be a continuous piece of service line - no fittings may be used.
3. No service tap shall be located within four (4') of another service tap.
3. If the Contractor breaks a service line that he has installed, the service must be replaced from the main to the coppersetter without a coupling.
4. Service lines that cross the road, installed by open cutting, shall be installed in 2" SDR-21 casing pipe.

1-14 Section XIV: Removal, Restoration and Maintenance of Property

1. The contractor shall limit his work area to that provided by temporary and permanent easements and lands owned by the Owner unless he obtains written permission of the property owner (s) on which the Contractor desires to encroach. The contractor shall supply a copy of said permission to the Owner for its records.
2. Where any trees, shrubbery, fences, poles or other property and surface structures have been damaged, removed or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the Contract Documents, State Laws, Municipal Ordinances or the specific direction of the Engineer, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired at the expense of the Contractor. The Contractor shall (unless otherwise stipulated) replace or repair and restore said structures to a condition equal to that before the work began, furnishing all labor and materials incidental thereto.
3. The Contractor shall restore (unless otherwise stipulated) all sidewalks, curbing, gutters, shrubbery, fences, poles, sod or other property and surface structures removed or disturbed as part of the work to a condition equal to that before the work began, furnishing all labor and materials incidental thereto. No permanent pavement shall be restored unless and until, in the opinion of the Engineer, the condition of the backfill is such as to properly support the pavement.
4. All disturbed areas other than lawns (which shall be reseeded in approximately their pre-construction condition) shall be left smooth and thickly sown with a mixture of Blue Grass, Kentucky Fescue #31 and/or such other grasses as are specified by the Owner. When the final grading has been completed, the entire area to be seeded shall be fertilized with an approved commercial fertilizer at the rate of 10 lbs. per 1000 square feet. After the fertilizer has been distributed, the Contractor shall disc or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be sowed in two operations, broadcast either by hand or by approved sowing equipment. The applications shall be 30 pounds per acre for each operation. If the owner determines to use "hulled" or "unhulled" Bermuda, the application rate shall be 7 lbs. per acre. After the seed has been distributed, the Contractor shall then lightly cover the seed by use of a drag or other approved device. All seed shall be certified not more than three percent weed. The seeded area shall then be covered with straw at the rate of 1 1/2 tons per acre.
5. Any necessary reseeding or repairing shall be accomplished by the Contractor prior to final acceptance. If the construction work is brought to completion when, in the opinion of the Owner, 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 Owner.

6. All planting and seeding shall be watered thoroughly as soon as completed and shall be watered daily or more often, if necessary, until all growth is thoroughly established.
7. Seeding and landscaping is not a separate pay item. Replacement of sod disturbed by the Contractor's operation is not a pay item.
8. Mailboxes shall be placed back in their original location. For any reason the mailbox cannot be placed back into its original location, the inspector shall be notified. The inspector will determine the location of the mailbox. Mailboxes shall be installed 40" from the ground in which the post office vehicle will sit to the bottom of the mailbox. If the shoulder where the post office vehicle sits is disturbed during construction causing the post office to be unable to drive up to the mailbox, the contractor will be responsible for spreading gravel 4" thick to provide a large enough radius for the post office vehicle to drive to and from the mailbox.
9. Driveways shall be resealed by the contractor when damaged has occurred during construction. Contractor shall not use private driveways or property to park vehicles or store materials without written permission from the property owner(s).
10. Water line services disturbed by the contractor during construction of this project shall be replaced from the point of conflict to the meter box, not repaired.
11. The contractor is responsible for property pins disturbed during construction. Any pins removed during construction must be replaced at the contractor's expense including any survey of the property needed to install the pins in the proper location.

1-15 Section XV: Street and Driveway Replacement

1. REPLACING STREETS AND ROADWAYS:

A. General

The Contractor shall replace all streets, alleys and roadways, which may be removed, disturbed, or damaged in connection with his operation under the Contract. The Contractor shall reconstruct same to the original lines and grades and in such a manner as to leave all such surfaces in as good or better condition as that which existed prior to his operations. The reuse of materials removed in making excavations will be permitted in the manner described, provided said materials are capable of being compacted without settlement.

Gravel, crushed limestone, bituminous materials, or other materials used in the resurfacing of streets shall meet the current requirements of the Standard Specifications of the Tennessee Department of Transportation.

The Contractor shall patch the roadway within 15 days of backfilling the trench. Since asphalt plants regularly shut down during the winter months, the Contractor shall patch roadways with 4 INCHES OF Grade B Modified Binder as specified herein during the time of year which asphalt plants are open. During the time period that the asphalt plants are closed, the Contractor shall replace the roadway with Temporary Pavement Replacement as specified herein. The Contractor shall have 15 days from the date the asphalt plant re-opens to replace all temporary patches placed during times of plant shutdown with Grade B Modified Binder patches as specified herein. Temporary patches shall be replaced by digging out the temporary patch and replacing with 4 INCHES of binder as specified herein.

The Contractor shall submit the name and credentials of his paving subcontractor to the Engineer. No pavement shall be placed without prior approval of the paving subcontractor by the Engineer.

B. Temporary Pavement Replacement

If asphalt plants are closed for the season, the Contractor shall replace pavement with a temporary patch comprised of 2 inches of Bituminous Plant Mix Surface Course (Cold Mix) as specified in Section 410 of the TDOT Standard Specifications for Road and Bridge Construction. Temporary patches shall be placed a maximum of fifteen days from the time of initial construction. The Contractor shall maintain the ditch in the interim as specified in subparagraph 2 of this section.

C. Traffic-Bound Base Course

Replacement of streets after trenching shall be handled in the following manner:

After the backfill has been compacted to within about 3 inches of finished grade as specified hereinbefore, the Contractor shall place approximately 4 inches of crushed stone, Tennessee Department of Transportation Class "A", Grade "D", as a Traffic-Bound Base Course, at the proper elevation to allow for settlement, but not in such a way as to prevent traffic from using the street.

Where the entire ditch is to be backfilled with crushed stone, compacted Tennessee Department Size No. 67 may be used up to a point approximately 12 inches below finished grade and then

capped with Class "A", Grade "D" Traffic-Bound Base Course placed in 4-inch lifts compacted to 95 percent of its Standard Proctor Density.

Crushed stone added to ditches for maintenance after initial backfill will not be cause for additional payment.

The Contractor may leave replaced roadways in the condition described in this paragraph for a maximum of 15 days before final patch (if asphalt plant is open) or temporary patch (if asphalt plant is closed) is placed.

D. Subgrade for Final Resurfacing

The traffic-bound course described above will comprise of the base course of all types of resurfacing.

When, in the opinion of the Engineer, the trench has reached a condition of settlement satisfactory for final resurfacing the Contractor shall first strip the base course or add backfill with crushed stone the size specified above to obtain the proper subgrade elevation. The subgrade shall then be rolled with an approved type roller or tamped until thoroughly compacted and 8 inches thick. Any depression shall be filled with crushed stone or gravel—as specified above—and the process of rolling or tamping continued until the subgrade has a smooth and uniform surface.

E. Binder Course

Where required Grade "B" modified (B-M) binder as specified in the Tennessee Department of Transportation Specifications Section 307 shall be used as a base prior to application of the asphaltic concrete surface. Placement of binder shall be in 4-inch lifts well compacted with a heavy roller.

Prior to placement of the Binder, the subgrade or base shall be thoroughly cleaned and broomed and a prime coat of Grade RT-2 tar meeting the requirements of TDOT Specifications Subsection 904.04 or Grade AE-P emulsified asphalt meeting the requirements of TDOT Specification Subsection 904.03 shall be uniformly applied at the rate of 0.20 to 0.25 gallons per square yard.

Where the Binder will be left at the finished grade, the existing pavement will be neatly saw cut back approximately 1 foot outside the trench and the new pavement tied to the existing pavement.

F. Asphaltic Concrete Pavement (Hot Mix)

Where asphaltic concrete pavement is to be replaced, the subgrade shall be prepared as above specified, and this subgrade shall comprise the base course upon which the bituminous pavement shall be laid.

The existing pavement shall be neatly saw cut back approximately one (1) foot outside the trench and the new pavement tied into the existing. The subgrade or base shall be thoroughly cleaned and broomed, and a prime coat of medium tar shall be uniformly applied at the rate of 0.20 to 0.25 gallon per square yard. Where Portland Cement concrete subslab is required, the prime coat shall be applied to the concrete at a rate of 0.05 gallon per square yard. The prime coat shall be applied by a pressure distributor or other approved pressure spray method. When the prime coat has become tacky but not dry and hard, a bituminous surfacing consisting of asphaltic concrete shall be placed, spread, finished and compacted in accordance with the current standard Specifications of the Tennessee Department of Transportation, Section 104. Compacted thickness of asphaltic concrete pavement replacement shall be as directed or shown on the plans.

G. Untreated Surface

Where the existing surface is untreated crushed stone, the Contractor shall replace the surfacing that is disturbed or removed with crushed stone as above specified to at least the thickness of the existing surface.

2. BITUMINOUS SURFACING (Tar and Chip)

- A. Where bituminous surfacing is required, as shown on the Plans, or as directed by the Owner, the traffic-bound base shall comprise the subgrade upon which the bituminous surfacing shall be placed.
- B. After the subgrade or base has been prepared, thoroughly cleaned and broomed, a prime coat of Grade RT-2 tar shall be applied at the rate of 0.30 to 0.35 gallons per square yard.
- C. Where the prime coat has become tacky but not hard, cutback asphalt RC-800 shall be applied in two applications at the rate of 0.35 to 0.45 gallons per square yard for each application. The Contractor shall apply approximately 50 lbs. per square yard of crushed stone chips between the two applications of bituminous material and 35 to 40 lbs. of chips after the final application of bituminous material.

3. REMOVING AND REPLACING CONCRETE DRIVEWAYS, SIDEWALKS AND PAVED DITCHES
 - A. Whenever driveways are removed or disturbed in connection with the construction work, they shall be replaced to the original condition and grades in fully as good or better condition than which existed prior to the Contractor's operation.
 - B. After the sub-base has been brought to a satisfactory grade, a 3-inch layer of cinders or crushed stone shall be spread over it and thoroughly tamped. Immediately prior to pouring the concrete, the cinders or stone shall be thoroughly wetted, or the concrete shall be poured on a layer of heavy building paper.
 - C. The driveways shall consist of 6 inches of Class "A" concrete, struck off to accurately placed screeds and worked with a float until the mortar appears on top. After the surface has been thoroughly floated, it shall be brushed to leave marking of a uniform type similar to the existing driveway. All joints and edges shall be finished with an edging tool.
 - D. Other types of driveways, such as brick, stone asphaltic concrete, etc., shall be replaced with materials removed during the progress of the work, in equally as good condition as that found before the work began.

1-16 Section XVI: Highway Crossings

1. Where shown on the Plans or required for the successful completion of this project, highway crossings for the water lines are to be installed by boring and jacking. The following Tennessee Department of Transportation requirements apply: "Where open cutting is allowed, the following conditions shall be met: (a) all backfill material shall be compacted crushed stone, (b) one-half of the traveled portion of the paving must be open at all times." Crossings of City roads will be open cut with permission of the City of Cookeville Public Works Department. The Contractor shall be fully responsible for the successful operation without interruption of traffic and shall be held responsible for any settlement that occurs as a result of his work.
2. Casing pipe under highway roadways shall be installed to the limits shown on the approved Permit Drawings. Boring and jacking operations, when used, shall be performed in accordance with State Highway Specifications, exercising extreme caution to maintain a straight line through the roadbed. When drilled holes are not to grade and required clearance, holes shall be redrilled at no extra cost to the Owner.

3. Upon completion of installation of casings, the carrier pipe shall be installed in the casings in such a manner as to avoid any undue stress or damage to the pipe or its coating. The carrier pipe shall not be in a state of tension at any point within the casing.
4. PVC and Ductile Iron carrier pipe shall be supported within the casing by utilizing Advance Products & Systems Model SI epoxy coated casing spacers, or approved equal. Casing spacers shall be spaced at not more than 8' apart. The annulus space between the casing and carrier pipe shall be sealed at each end by installing Advanced Products & Systems end seals, or approved equal, in accordance with the instructions of the manufacturer of the seals.
5. For those sections of the "crossing where open trench construction is permitted, the backfill shall be placed in uniform loose layers not exceeding 6 inches in depth under and around the casing and not exceeding 8 inches over the casing. The successive layers of soil shall be placed and thoroughly compacted by mechanical tampers until the trench is filled and brought to the required elevation. All backfill shall be compacted to a density of 95% of the maximum density as determined by AASHTO Method T-99.

1-17 Section XVII: Stream Crossings

1. Water lines entering or crossing streams shall be constructed of ductile iron pipe with mechanical joints, concrete encased, or shall be so otherwise constructed as shown by the Engineer on the plans. The crossing shall be such that it will remain watertight and free from changes in alignment and grade.
2. The contractor shall not unnecessarily disturb or uproot trees and vegetation along the stream bank and in the vicinity of the stream, or dump soil and debris into streams and/or along the banks of streams. Contractor is required to comply with the requirements of the ARAP permit for utility line crossings as discussed in section 1-18 of these specifications.
3. Stream banks shall be sodded if due to erosion Contractor is unable to otherwise establish grass.
4. Where tree canopy has been removed, replacement trees shall be planted of natural species.

1-18 Section XVIII: Erosion Control

1. The City of Cookeville is very concerned that the contractor use proper

erosion control procedures. The contractor shall explicitly follow any direction from the owner or engineer as well as state regulations as to the placement of erosion control structures. The owner has the authority to stop construction if the proper erosion control procedures are not utilized.

2. Cleanup, grading, seeding, planting, and restoration of the work area shall be carried out as early as practical as the construction proceeds. ALL AREAS DISTURBED DURING CONSTRUCTION SHALL BE SEEDED TO RE-ESTABLISH VEGETATION WITHIN 30 DAYS OF DISTURBANCE. THE OWNER HAS THE AUTHORITY TO STOP WORK IF THIS PROTOCOL IS NOT FOLLOWED.
3. Temporary pollution control provisions and permanent erosion control features such as berms, slope drains, sediment basins, silt fences, and seeding and mulching shall be used as necessary to assure economical, effective, and continuous erosion control.
4. All temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.
5. All permanent erosion control features shall be incorporated into the project at the earliest practicable time. Temporary pollution control measures shall be used to correct conditions that develop during construction that require attention prior to installation of permanent pollution control features, or that are needed temporarily to control erosion that develops during normal construction practices.
6. Provisions shall be made to retard the rate of runoff from the construction site and control disposal of runoff, including pump discharges resulting from dewatering operations.
7. THE CONTRACTOR SHALL BE SOLELY AND STRICTLY LIABLE FOR ANY VIOLATIONS OF STATE OR FEDERAL WATER POLLUTION LAWS, REGULATIONS, OR STANDARDS CAUSED DURING CONSTRUCTION BY THE CONTRACTOR'S FORCES OR SUBCONTRACTORS AND ANY PENALTIES LEVIED BY ANY PARTY DUE TO SAID VIOLATIONS.
8. On projects that it is anticipated that 1 acre or more will be disturbed, the Engineer will submit on behalf of the Owner, a "Notice of Intent for General NPDES Permit to Discharge Storm Water Associated with Construction Activity" in accordance with Tennessee Department of Environment and Conservation Rule Chapter 1200-4-10. This submittal is required at least thirty (30) days prior to the date on which construction is scheduled to begin. The Contractor is required to sign the Notice of Intent provided by the Engineer prior to commencing construction activities

stating that he understands the conditions of the General Permit and accepts responsibility for compliance for his portion of the work.

As part of this permit, the Contractor is also required to develop a "Stormwater Control Plan" in accordance with the provisions of the Tennessee Department of Environment & Conservation Rule 1200-4-10-05 unless such plan is already prepared by the engineer and included in the construction plans.

9. Work under this contract is covered by the rules of the Department of the Army 404 nationwide permit #12 effective March 12, 2007. The Contractor shall be solely responsible for compliance with the requirements of this nationwide permit. .
10. Work under this contract is also covered by the rules of the Tennessee Department of Environment and Conservation, Water Quality Control Board, Division of Water Pollution Control, Chapter 1200-4-7 Aquatic Resources Alteration. Section 1200-4-7-08 "General permit for utility line crossings of streams" is specific to this contract. The Contractor shall be solely responsible for compliance with the requirements of this general permit for utility line crossings of streams and pollution laws and regulations applicable to construction of the work included in this contract.
11. Pollution and Erosion Control Methods

Temporary silt fences with baled hay or straw shall be placed on the natural ground, at the bottom of fill slopes, in ditches or other areas where siltation is a problem or where shown on the Plans or directed by the Engineer. Silt fences are constructed of wire mesh fence with a covering of filter cloth composed of burlap, plastic filter fabric or some other suitable material on the upper grade side of the fence and anchored into the soil.

Bales of hay or straw shall be either hay or straw containing five (5) cubic feet or more of material.

The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded, removed, etc. as directed by the Engineer. The silt fence becomes the property of the Contractor whenever the fence is removed.

All temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

12. A copy of the Notice of Intent, the Tennessee Construction Activity Storm

Water Permitting Checklist and the Contractor's Signature Form are included at the end of this document if it was determined that one was needed.

1-19 Section XIX: Testing

1. All water pipe appurtenances, after installation, shall be hydrostatically tested. Testing by air shall not be permitted.
2. All pipe shall be tested under a hydrostatic pressure equal to the larger of 150 psi or 1.5 times the pressure at which the line will normally operate. The time of the test shall be one hour. The test shall be in accordance with AWWA C600-87 with proper correction applied if the test gauge is not at the lowest point.
3. Leakage shall not exceed 10.0 gpd per mile of pipe per inch of diameter based on 20-foot lengths of pipe in accordance with AWWA C600-87 for different length pipe refer to AWWA 600-87 for the leakage allowance.
4. Re-excavation to repair leaks shall be borne by the Contractor and no additional compensation will be allowed.

1-20 Section XX: Disinfection and Bacteriological Testing

1. Disinfection:
 - A. The disinfection of the water mains, reservoir and all appurtenances shall be the responsibility of the Contractor and shall meet all requirements of the Tennessee Department of Environment and Conservation and/or any other appropriate agencies. Not required for sewer force main.
 - B. The mains shall be flushed as thoroughly as possible with water pressures and outlets available. This shall be done after the pressure tests have been made. If no hydrant or outlet is available at the end of the main, a tap shall be provided at the extremity large enough to develop a 2.5 fps velocity.
 - C. Before being placed in service, all new mains, reservoir and appurtenances shall be sterilized. All new and existing piping disturbed in any manner by the work shall be sterilized.
 - D. The disinfection of mains, valves, and other appurtenances shall be done by a chlorine and water mixture. This shall be applied by means of a chlorinating measuring device, with proper devices for regulating the rate of flow and providing an effective diffusion of

chlorine into the water within the piping. The point of chlorine application shall be at a corporation cock, provided for that purpose, at the beginning of the main extension. The source of water supply shall be controlled so as to flow slowly into the pipeline. The rate of chlorine application shall be in such proportion to the water entering the piping to produce a concentration of at least fifty (50) parts per million of chlorine in the mains.

- E. During the disinfecting operation, valves and hydrants shall be operated to permit the full effectiveness of the chlorine. Valves shall also be manipulated so that the strong chlorine solution in the mains being treated will not flow back into the line supplying the water, nor flow into a water supply line already in service.
- F. The heavily chlorinated water shall be retained in the mains for at least twenty-four (24) hours, after which it shall be flushed out to waste.

2. Bacteriological Testing:

A. Flushing and Sampling Mains:

After the heavily chlorinated water has been flushed out and replaced with acceptable quality water the main shall be flushed through the end-most hydrant so that a flushing velocity of at least two and five tenths (2.5) feet per second is obtained. Contractor shall keep a record of when and how much water is used for filling and flushing the line. If plans do not call for a hydrant at the end of the main being disinfected, the Contractor shall furnish a temporary tee and riser for this purpose. Sampling taps shall be installed by the Contractor for each twenty-five hundred (2,500) feet of main to be sterilized. After flushing as specified, the Contractor shall notify the City who will do any final flushing and collect the bacteria samples. The contractor is responsible to provide an acceptable area (erosion control concern) for any flushing by the City. If the samples fail the City may require the contractor to further disinfect and/or flush the lines before additional samples are collected. The contractor is responsible for all cost for the bacteriological testing as included in Section 1-01. The main shall not be placed in operation nor accepted by the Owners until satisfactory bacteriological tests results are obtained. Samples shall be collected after the main has set for 24 hours with a second sample taken 24 hours after the first sample. Alternatively, one sample can be taken after the main has set for 48 hours after flushing.

1-21 Section XXI: Clean Up

In areas where the water line has been backfilled, the Contractor shall clear the right-of-way and surrounding ground, and shall dispose of all waste materials and debris resulting from his operations. He shall fill and smooth over holes and ruts and shall repair all miscellaneous and unclassified ground damage done by him, and shall restore the ground to such stable and usable conditions as may reasonably be required, consistent with the condition of the ground prior to building of the pipeline.