# SECTION 02800
# WATER DISTRIBUTION SYSTEM

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. The Work to be performed under these specifications consists of furnishing all materials and performing all work necessary for or incidental to completing and making ready for the operation of the water distribution system as indicated on the Contract Drawings.

B. The Work shall also include the furnishing, transporting and stringing of pipe; furnishing, transporting, storage and protection of valves, meters, fittings and all other materials that may be required for construction of the facility; ditching, shoring, backfill, installation of pipe, valves, fire hydrants, fittings, other appurtenances, and operations necessary to complete the work in accordance with the requirements of these specifications.

### 1.02 COORDINATION WITH INTERESTED PARTIES

The Contractor shall duly notify and coordinate any work with interested parties such as the Mississippi Department of Transportation, the Mississippi State Department of Health and the governing water association. No work which affects these interested parties will commence until satisfactory coordination has been achieved.

### 1.03 SUBMITTALS

A. Shop Drawings:

1. Submit size, class and other details of the pipe to be used.

2. Submit information on typical joint and harnessing details.

B. Tests: Submit a description of the proposed testing methods, procedures, and apparatus. Submit copies of all test reports.

C. Record Drawings: During progress of the Work, keep an up to date set of drawings showing field modifications. Submit drawings at a scale satisfactory to the Engineer that show the actual in-place installation of all piping and appurtenances installed under this section. The drawings shall show all piping on the plans with all reference dimensions and elevations required for complete record drawings of the piping systems. The drawings shall be furnished no later than 30 days after Substantial Completions of the Work.

### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and handling of pipes, fittings and accessories shall be in complete compliance with the manufacturer's recommendations and instructions.

B. Handle all pipes, fittings and accessories carefully with approved handling devices. Do not drop or roll pipes off of trucks. Do not otherwise drop, roll or skid pipes. Materials cracked, gouged, chipped, dented or otherwise damaged will not be approved.

C. Pipes, fittings and accessories shall be unloaded opposite to or as close to the place where they are to be laid as is practicable to avoid unnecessary handling. Interiors shall be kept free from dirt and foreign matter.

## 1.05 CLEARANCE BETWEEN WATER AND SEWER LINES

A. Water mains shall be laid at least 10 feet horizontally from any sanitary sewer line or manhole.

B. Where this 10 feet horizontal separation cannot be maintained, the water line shall be ductile iron with water line joints located at least 10 feet from the sewer line or the water line shall be totally encased in concrete.

C. Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer (water over sewer). The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where this separation cannot be met the sewer line shall be constructed to the same specifications as the water line and be water until such a point where the separation can be met.

## 1.06 CONFLICTS WITH OTHERS UTILITIES

A. Where construction conflicts with underground utilities which are to remain in place, or indicated to be removed and/or relocated by the Contractor, the Contractor shall at his own expense, protect these facilities, restore the portions of those lines which are damaged or severed as a result of his operations, and remove and/or relocate existing facilities as indicated on the Contract Drawings.

B. Where existing lines in conflict are indicated to be removed by others, the Contractor shall cooperate with the Owner of these utilities to the end that these conflicts are removed prior to excavation for the waterlines.

## 1.07 RAILROAD AND HIGHWAY CROSSING

All work incidental to the construction of water lines under railroads and highways shall be done in strict compliance with the regulations prescribed by the owners of these properties and shall be done with extreme care to safeguard life and property. After the necessary permits and agreements for these crossings have been approved and executed. The Contractor shall confer with the representatives of the Railroad Company, the Mississippi Department of Transportation or the County owning these properties and arrange schedules, and the manner for constructing the work in accordance therewith.

## 1.08 MAINTENANCE

A. The Contractor shall be responsible for, without extra compensation, the maintenance of all water lines and structures, for the stability of all backfills and the finished grades above the water line and around the structures and for the repair, replacement, and restoration of all items which were damaged or removed during construction.

B. The Contractor shall be responsible for, without extra compensation, the restoration of all permanent surfaces and landscaped areas such as pavements, sidewalks, driveways, curbs, gutters, shrubbery, decorative plantings, fences, poles and other property and surface structures removed, disturbed and/or damaged during or as a result of construction operations to a condition which is equal in appearance and quality to the condition that existed before the work began.

C. The Contractor shall take such measures necessary to prevent, control and correct any dust nuisance or muddy conditions developing on roadways as a result of his operation. Direct payment for maintenance of the site shall not be provided as such but shall be

considered a subsidiary obligation of the Contractor.

### 1.09 TRAFFIC CONTROL

Traffic control shall be the responsibility of the Contractor and should be implemented in accordance with the Manual on Uniform Traffic Control Devices.

### 1.10 TEMPORARY SURFACES OVER TRENCHES

Whenever the water lines are constructed under traveled roadways, driveways, sidewalks or other traveled surfaces, a temporary surface shall be placed over the top of the trench as soon as possible after placement and compaction of the backfill has been satisfactorily completed. The temporary surface shall consist of a minimum of six inches (6") of clay gravel. The top of the temporary surface shall be smooth and meet the grade of the adjacent undisturbed surface. The temporary surface shall be maintained at the Contractor's expense until final restoration of the street surface is completed as specified.

### 1.11 WARRANTY

A. The contractor shall warranty all materials of construction and repair and all workmanship for a period of one year from the date of acceptance of final work.

B. Should defects of failures occur during the period of warranty, the contractor shall promptly take whatever steps are necessary to return the work to first class condition.

## PART 2 - MATERIALS & EQUIPMENT

### 2.01 GENERAL

A. The Contractor shall furnish all materials necessary for or incidental to constructing the water distribution system. All materials shall be new and of first quality with certified tests for all pipe and pipe fittings made at the manufacturer's plant to assure conformance with these technical specifications. Two (2) certified copies of each test result shall be furnished to the Engineer.

B. The kinds and classes of materials incorporated into the work shall be as indicated on the Contract Drawings or the Bid Form. The Contractor shall not construe or interpret the several kinds of materials described herein as being equal in their application.

### 2.02 WATER FOR CONSTRUCTION AND TESTING

A. The Contractor shall be responsible for all water needed in constructing the work, flushing the completed system, testing and other incidental needs. All water used shall be from an approved source free of pollution and shall be of a satisfactory bacteriological quality.

B. Water used in mixing concrete and mortar shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkalis, salts or organic matter.

### 2.03 DUCTILE CAST IRON PIPE AND FITTINGS

A. Ductile iron pipe shall be water pipe manufactured in accordance with AWWA C 151 (ANSI A21.51).

B. All fittings shall be ductile iron and shall conform to the latest edition of AWWA specifications for ductile iron fittings.

C. All ductile iron pipe and fittings shall be factory-coated on the outside with coal tar enamel conforming to the latest edition of AWWA C105 (ANSI A21.5) and lined inside with a minimum of 1/16 inch cement-mortar lining in accordance with the latest edition of AWWA C104 (ANSI A21.4).

D. All pipe and fittings shall be tested for minimum 150 PSI water working pressure, laying conditions Type 2, flat bottom trench without blocking, tamped, backfilled and under five (5) feet of cover.

E. All pipe and fittings shall be encased with an 8 mil thick loose polyethylene encasement in accordance with the latest edition of AWWA C-105 (ANSI A21.5).

F. Joints for ductile cast iron pipe shall be slip-on type unless otherwise specified. Slip-on joint shall conform to the latest edition of AWWA C 111 (ANSI A21.11) except that the joints shall be made with a special gasket seal Super-Bel Tite as manufactured by the Clow Corporation or approved equal. Lubricants shall be non-toxic, odorless, tasteless and shall not support bacteria and shall be specifically manufactured for the pipe utilized.

G. Mechanical joint pipes shall conform to the latest edition of AWWA C 111 (ANSI A21.11).

H. All joints for fittings, valves and specials shall be mechanical joints; Meg-a-lug or approved equal.

I. If flexible joint or river crossing pipe is required and/or indicated in the project plans or specifications the joint shall be designed for a maximum deflection of 15 degrees, and a maximum working pressure rating of 250 psi. The type shall be the USIFLEX joint as manufactured by U.S. Pipe or an approved equal.

## 2.04 POLYVINYL CHLORIDE (PVC) PIPE

A. All PVC pipe and fittings four (4) inches to twelve (12) inches in diameter shall conform to the latest edition of AWWA C-900 and shall be made from Class 12454-A or B materials per the latest edition of ASTM D-1784. Pipe shall be a minimum of SDR 18 unless otherwise specified, for a working pressure rating of 150 PSI. All pipes shall conform to the outside diameter (OD) dimensions of ductile iron pipe to facilitate use of DIP fittings, standard cast iron valves and specials. All joints shall be elastomeric sealed conforming to the latest edition of ASTM F-477.

B. All PVC pipe three (3) inches and smaller in diameter shall conform to the latest edition of ASTM D-2241 and shall be made from Type 1120 material. Pipe shall be a minimum of SDR 26 unless otherwise specified, for a working pressure of 150 PSI. All joints shall be solvent welded in accordance with the latest edition of ASTM D-2855 with the solvent cement conforming to the latest edition of ASTM D-2564.

C. All jointing shall be made in accordance with the manufacturer's recommendations.

D. All pipes shall bear the National Sanitation Foundation (NSF) seal of approval.

E. Fittings for PVC pipe shall be ductile iron as per section 2.03.

## 2.05 PIPE MARKING

A. Pipe materials are specified under 2.03 & 2.04 of this section.

B. Pipe Marking:

1. General:

   a. Each piece of pipe or fitting shall be clearly marked with a designation which shall conform to designations shown on the shop drawings.

   b. Class designation shall be cast or painted on each piece of pipe or fitting four inches in diameter or larger.

   c. Piping smaller than 4 inches in diameter shall be clearly marked by the manufacturer as to material, type and rating.

2. Tracer Wire

   a. Contractor shall place a continuous tracer wire 6" to 12" above the water line in the same trench.

   b. Tracer wire shall be 12-gauge solid copper with insulation rated for direct burial applications.

   c. Tracer wire shall be turned up at all valves and hydrants.

   d. Splices shall be turned up and protected in a water meter box installed directly over the water line and set flush with finished grade.

3. Magnetic Underground Warning Tape **(NOT REQUIRED)**

   a. Contractor shall place magnetic warning tape approximately 12 to 18 inches below grade in all pressure pipe trenches.

   b. Buried water piping warning tape:

      1) Message: "CAUTION-BURIED WATER LINE"
      2) Size and Color: 3 inches wide and blue background with black lettering

C. See Contract Drawings for required pipe material.

## 2.06 SERVICE PIPING

A. Service piping shall be as specified on the Bid Form and shall be designed for working pressure compatible with the water mains specified above:

1. Copper Service Line: Copper service line shall be seamless copper tubing suitable for underground water services. This material shall be supplied in conformance with ASTM Specification B-88-62 "Type K".

2. PVC Service Line: PVC service pipe shall be solvent weld in accordance with the National Sanitary Foundation (NSF), Class 200 pipe, for use with potable water.

3. Polybutylene Service Line: Polybutylene service pipe shall be PB 2110 and approved by the National Sanitary Foundation (NSF) for use with potable water.

## 2.07 VALVES AND VALVE BOXES

A. Butterfly Valves: All butterfly valves shall be designed for buried service and in accordance with AWWA C504. The valve shall be rubber seated and operate under a 100 psi working

pressure and a test pressure of 250 psi. All valves shall be as manufactured by the Henry Pratt Company or an approved equal.

B. Check Valves: Check valves shall be iron body, spring loaded, swing type with straight-away passage of full pipe area and renewable bronze seat ring with resilient faced disc. Valves shall be as manufactured by Mueller, American-Darling or approved equal.

C. Gate Valves: Gate valves shall be standard AWWA C-500, nonrising stem, iron body bronze mounted, double disc, parallel seat, and shall withstand a maximum working pressure of 200 psi and be tested to 400 psi. Valves shall open by turning counter clockwise, be equipped with "O" Ring Seals at the top of the stem, and a 2" operating nut. The valves shall be equipped with mechanical joint connections unless otherwise specified. Gate valves shall be Mueller, American-Darling or approved equal.

D. Pressure Relief Valves: Pressure relief valves shall be installed as shown on the plans or as directed by the Engineer, and shall be a Model 66-D, as manufactured by GA Industries or an approved equal.

E. Air Release Valves: Air release valves, shall be installed at high points on the lines as shown on the plans or as directed by the Engineer and shall be 1" Crispin Universal, with Protectop, or an approved equal.

F. Blow-Off Valves: Blow-off valves shall be placed on all dead end lines or as directed by the Engineer and shall employ an American made 1-1/2" AWWA approved bronze gate valve, pressure rated at 125 psi, a meter box, marker, and all fittings and piping as shown on the typical detail sheets.

G. Pressure Reducing Valves: Pressure reducing valves shall be installed as shown on the Contract Drawings or as directed by the Engineer and shall be:

1. Clayton Model 90, G.A. Industries Model No. 4500 D, adjustable within the range shown on the Contract Drawings or approved equal.

2. Individual service size valves shall be Model No. 43-D, complete with strainer, as manufactured by G.A. Industries or approved equal. The entire individual pressure reducing assembly will be installed in a separate meter box as shown on the typical detail sheet. In addition to the pressure reducer and strainer, the assembly shall also include a 3/4" union and a 3/4" AWWA approved gate valve as manufactured by Crane Valve Company (No. 410), or approved equal. The entire reducer assembly shall be installed as a unit in front of the meter assembly and set to discharge at 60 psi.

H. Valve Operating Wrench: Contractor shall supply two operating wrenches in lengths to be approved by the Engineer. Wrenches shall be No. 24610 as manufactured by Mueller Company, or approved equal.

I. Valve Boxes: Valve boxes shall be installed on valves 2" and larger. Boxes shall be cast iron with a 5-1/4" shaft adjustable to appropriate height to be flush with ground, and with the correct base for each size valve. The boxes shall be as manufactured by Harper, M&H or approved equal with a cast iron drop-in lid marked "water". If plastic boxes are specified they shall be Clow, Ametex or an approved equal with cast iron drop-in lid marked "water".

## 2.08 FIRE HYDRANTS

A. Fire hydrants shall be Mueller Model Centurion, American-Darling Model B-84-B or approved equal. Hydrants shall be of the compression type with a 5 1/4 inch valve opening.

All hydrants shall be nominal 6" size, 3-way construction with one 4-1/2" pumper nozzle and two 2-1/2" hose connections. Nozzle threads shall be National Standard unless otherwise specified. The depth of bury shall be 4 feet unless otherwise specified.

B. Hydrants shall be furnished with a sealed oil reservoir located in the bonnet so that all threaded and bearing surfaces are lubricated when the hydrant is operated. Hydrant shall be furnished with a breakable feature that will break cleanly on impact and shall consist of two part breakable flange with a breakable stem coupling.

C. Hydrants shall be wire brushed as needed and painted with one coat of primer and two coats of epoxy paint of the color specified by the Engineer.

## 2.09 WATER METERS AND METER BOXES

A. Water meters shall be magnetic-drive with hermetically sealed registers indicating gallons, 5/8" X 3/4" for residential service and 1" X 1-1/2" for commercial and heavy farm use. They shall be positive displacement meters as manufactured by Rockwell Manufacturing, Neptune Meter Company, Hershey Products, Inc. or an approved equal.

B. Meter boxes shall be cast iron, concrete or plastic and be approximately 12" X 18" X 12" deep. Prior approval by the Engineer will be required.

## 2.10 COPPER METER YOKES

Copper meter yokes shall be as manufactured by the Mueller Company or equal, with lock-wing stop.

## 2.11 CORPORATION STOPS

Corporation stops shall be as manufactured by the Mueller Company or equal.

## 2.12 BRANCH CONNECTION

Branch connections shall be as manufactured by Mueller Company or equal.

## 2.13 SERVICE CLAMPS

Service clamps shall be double strap design as manufactured by Mueller Corporation or approved equal. All service connection on PVC mains shall be equipped with service clamps unless otherwise noted.

## 2.14 SPECIALS

Specials shall be of the same material as the pipe material being used or as approved by the Engineer. The term specials shall include plugs, caps, and other items as needed. Specials shall conform to the applicable AWWA/ASTM/ANSI Standards and shall be designed for the working pressure of the water mains on which they are being installed.

## 2.15 OTHER MATERIAL

A. Concrete: Concrete shall be in accordance with Section 0300, Concrete, and shall develop a compressive strength of 3,000 pounds per square inch at twenty-eight (28) days.

B. Steel Casing: The steel casing pipe shall conform to ASTM designation A-53 and have an A.S.A. Standard thickness.

C. Native material excavated from the trench shall be used for bedding and backfill under normal circumstances where allowed by the ENGINEER.

D. Select bedding and backfill shall be provided where called for by the Plans and Specifications and in additional areas where requested by the CONTRACTOR and deemed appropriate by the ENGINEER. Select bedding may not be used as a means of avoiding trench dewatering. Select bedding and backfill shall meet the criteria of Table 2 of ASTM Standard D 2321.

## PART 3 – EXECUTION

### 3.01 GENERAL

A. The Contractor shall duly notify and coordinate all work with the governing water association as well as the local Health Department, Mississippi Department of Transportation and all other interest parties. No work which affects these interested parties will commence until satisfactory coordination has been achieved.

B. Any time that the interruption of water service in the existing system is necessary because of operations under this Contract, the Contractor shall notify the Owner at least 48 hours in advance. Interruptions of water service shall not extend over night or through the weekend unless approved by the Owner and the Engineer.

C. The work required shall consist of excavation and trenching for open cut construction, installation of pipe, fittings and appurtenances, backfilling, testing, repair and restoration of property, and final cleanup.

### 3.02 EXCAVATION

A. The Contractor shall perform all excavation of every description and of whatever substances encountered to the depth specified in the Contract Drawings or as directed by the Engineer. All trenches shall be excavated to a depth to maintain the following minimum cover over the installed pipe:

1. 36" for ordinary conditions

2. 42" for farm areas or under existing creeks or ditches

3. Trenching within highway and railway right-of-way will be in strict accordance with the permit on file with the Engineer.

B. The bottom of all trenches shall be carefully shaped, graded and aligned. Care shall be taken not to excavate below the depth specified; however, in the event this should occur, the bottom of the trench shall be filled back to grade with approved material and thoroughly compacted in a manner satisfactory to the Engineer.

C. The bed for each piece of pipe is to be shaped either by trimming the bottom of the trench or by placing excavated earth therein and tamping so that each piece of pipe will have uniform bearing and be in continuous contact with the supporting ground for its entire length. The trench shall be further excavated around each bell or hub, if necessary, so that it will entirely be clear of the ground and leave ample room for making up joints.

D. When rock is encountered, the Contractor shall excavate to a depth at least 4 inches below the required grade and a minimum clearance of 12 inches on each side of pipe and backfilled to grade with 4 inches of sand cushion.

E. Water will not be permitted in the trenches while the pipe is being laid. The Contractor shall not open up more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer.

F. A tolerance of six inches (6") from the established grade may be permitted, if approved by the Engineer, in order to prevent excessive breaks in alignment at the joints to such an extent that the joints cannot be properly made.

G. Should conflicts in grade occur with other utilities, the water line grade shall be changed to avoid the conflict in a manner acceptable to the Engineer.

H Excavated material from trench and structure excavation suitable for backfill shall be placed compactly on the sides of the excavation and kept up so as not to endanger the work and be of as little inconvenience as possible to the public travel and abutting property, and so that free access is provided at all times to fire hydrants and water valves in the vicinity of the work. Any material encountered in the excavation which, in the opinion of the Engineer, is of such unsuitable nature as to be incapable of proper consolidation or is otherwise unsuitable for use in the work, shall be removed and wasted as directed and not stockpiled along the side of the excavation.

I. The disposal of all surplus and unsuitable excavation shall be the responsibility of the contractor at his own expense. The surplus and unsuitable material not to be used in the construction of the project shall not be left on the right-of-way or easement of the project, or adjacent thereto.

**3.03 SHEETING, SHORING AND BRACING**

A. The Contractor shall furnish and place such sheeting and bracing as may be required to support the sides of the trench and to protect the workmen and pipe or adjacent structures from injury by the sloughing off or caving in of the trenches.

B. When using movable trench support, care shall be exercised not to disturb the pipe location, jointing or embedment.

C. Any voids left in the embedment material by support removal shall be carefully filled with granular material and adequately compacted.

D. The sheeting and bracing may be removed as the trench is backfilled, or may be left in place where necessary to prevent damage. In the event the sheeting or bracing is left in place, it shall not extend nearer than one foot (1') to the surface of the ground.

E. In no case will extra compensation be allowed for furnishing, placing or removing any sheeting and bracing, but the cost of this work shall be included in the unit price bid for installing the pipe.

**3.04 PIPE EMBEDMENT**

A. Native material excavated from the trench shall be used for bedding and backfill under normal circumstances where allowed by the ENGINEER.

B. Where required, select embedment material used around and under pipes is as specified in 2.15 of this section.

C. Select Embedment Installation:

1. Foundation: If required, as recommended for material class in Table 2 of ASTM D 2321

2. Bedding: As recommended for material class in Table 2 of ASTM D 2321

3. Haunching: As recommended for material class in Table 2 of ASTM D 2321

4. Initial Backfill: As recommended for material class in Table 2 of ASTM D 2321

C. No pipe shall be brought into position until the preceding length has been embedded and secured in its final position.

**3.04 PIPE LAYING**

A. Pipes, specials and fittings shall be carefully laid to the line and grade established on the Contract Drawings or as directed by the Engineer. All pipes shall be laid in compliance with the manufacturer's instructions, technical specifications and details on contract drawings and at such depths that a minimum cover is maintained as specified previously. Extra depth will not be measured unless noted on the Bid Form.

B. Install all pipes accurately to the line and grade shown unless otherwise approved by the Engineer. Remove and relay pipes that are not laid correctly.

C. Pipe laying will not be permitted when trench contains water.

E. Place bell and spigot so that bells face the direction of laying, unless otherwise approved by the Engineer.

F. Excavate around the joints in bedding and lay pipes so that only the barrel receives bearing pressure from the trench bottom.

G. Blocking is not allowed to bring pipe to grade.

H. Permissible deflections at joints shall not exceed the amount allowed by the manufacturer.

I. Take every precaution that no foreign material enters the piping prior to and during installation.

J. All pipes and fittings shall be carefully examined for cracks, damage or other defects while suspended above the trench before installation. Defective materials shall be immediately removed from site.

K. Interior of all pipes and fittings shall be inspected and all dirt, gravel, sand, debris or other foreign materials shall be completely removed from pipe interior before it is moved into the trench.

L. Bell and spigot mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is laid.

M. Thrust blocks shall be installed at all bends, and at all tees, caps and plugs. Thrust blocks will be of concrete as shown on the Contract Drawing Detail Sheets.

N. At the end of all lines (dead ends), the line shall be equipped with a reducer and 1-1/2" Blow-Off valve.

O. Every time that pipe laying is not actively in progress the open ends of pipe shall be closed by a watertight plug.

P. Field cutting pipe, where required, shall be made with a machine specially designed for cutting piping. Cuts shall be carefully done, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cut ends shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.

Q. Touch up protective coatings in a satisfactory manner prior to backfilling.

**3.05 MAKING JOINTS**

A. Joints shall be constructed in accordance with the recommendations of the manufacturer.

B. Clean completely all jointing surfaces and adjacent areas immediately before matting joint.

C. After gaskets are compressed and before pipe is brought fully home, each gasket shall be checked for proper position around full circumference of the joint.

**3.06 TRANSITION FROM ONE TYPE OF PIPE TO ANOTHER**

Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

**3.07 SETTING FITTINGS, VALVES, HYDRANTS AND SPECIALS**

A. All fittings, valves, valve boxes, hydrants and other appurtenances shall be set at the location indicated on the Contract drawings or as directed by the Engineer.

B. All valves, including by-pass valves, shall be provided with a valve box. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut with the cover flush with the pavement surface or such other level as directed.

C. Valve box slabs or marker posts shall be provided where indicated on the Contract Drawings or as directed by the Engineer as an absorbed cost to the Contractor.

D. Hydrants shall be located as shown on the Contract Drawings and in a manner that will provide complete accessibility and will prevent damage from vehicles. All hydrants shall stand plumb and shall have their pumper connections at right angles to the curb line. The Center of steamer nozzle shall be 18" above top of finished ground or top of curb where applicable. Where necessary, hydrant extensions shall be furnished at no additional cost to the Owner, to meet this requirement.

E. Each fire hydrant shall set truly vertical and securely braced with concrete or stone blocks until it is self-standing. It shall be set on a stone or concrete slab not less than four (4) inches thick and not less than one square foot of surface area placed on well compacted soil surrounded by a minimum of seven (7) cubic feet of sound broken stone or clean gravel to permit free draining of the hydrant. The gravel or stone shall reach from the bottom of the trench to at least six (6) inches above the waste opening of the hydrant.

F. All hydrants, valves and fittings shall be anchored with steel all-thread rods (3/4" minimum) as indicated on the Plans or with anchor couplings approved by the Engineer.

**3.08 SERVICE ASSEMBLES AND SERVICE LINE INSTALLATION**

A. Assemblies shall consist of a corporation stop, service clamp, curb stop and other appurtenances needed to complete the assembly in accordance with the Contract Drawings. They shall be installed in a good and workmanlike manner in the places designated on the Plans or as directed by the Engineer.

B. Meter boxes, meters and service line shall be as specified herein and will be measured and paid for separately as detailed herein.

C. Service lines to be marked as shown in the Contract Drawings.

**3.09 CONNECTION TO EXISTING MAINS**

A. Where indicated on the Contract drawings, cut-ins must be made by the Contractor in order to make connection to existing water mains. The Contractor shall furnish all labor and materials and service required for the excavating, cutting the existing mains, removal and relocation of sections of old pipe, de-watering the trench, connection main with the existing main and the setting of necessary fittings, specials and valves as shown on the Contract Drawings.

B. The Contractor shall provide temporary blocking and bracing properly placed to prevent movement or blowing off of any pipe, valves or fittings due to water pressure on the main. All connections shall be made in a most expeditious and workmanlike manner to cause the least inconvenience to water customers and to traffic, and shall be made at night unless otherwise approved by the Engineer.

**3.09 BACKFILLING TRENCHES**

A Backfilling material used around and under pipes is as specified in 2.15 of this section.

B. Backfilling shall be carefully performed and the original surface restored, to the full satisfaction of the Engineer. The trenches shall be backfilled with fine, loose earth, free form large clods, stones or rocks, frozen material or debris.

C. Proper compaction procedures should be exercised to provide the required soil densities. The backfill procedures shall be as follows:

1. Open areas or cross-country: Backfill material suitable for this method shall be machine-placed in successive layers and compacted until a density of at least the adjacent undisturbed ground is obtained. This operation will continue until all settlement has occurred and to the full satisfaction of the Engineer.

2. Across driveways, parking lots, paved areas, yards and within all road rights--of-way: The trenches shall be backfilled carefully and rammed until enough has been placed to provide a cover of not less than one foot (1') above the pipe. The remainder of the backfill material shall be placed in successive layers, not to exceed six inches (6"). Each lift shall be thoroughly compacted with mechanical tampers in paved area as well as road shoulder, so that at least 95% of the density determined by the Proctor Method, ASTM D-698, shall be obtained before the next lift is placed.

3. Backfill in unpaved areas, shall be made as above specified, except the backfill lifts above the pipes may be deposited in layers not to exceed 6 inches and thoroughly tamped until a density of at least that of the adjacent soil is obtained.

D. Each lift of the backfill material shall have the proper moisture content to permit

compaction to the required density.

E. Whenever the trenches have not been properly filled, or if settlement occurs they shall be refilled, smoothed off, and finally made to conform to the surface of the ground. Surplus material shall be disposed of as directed by the Engineer.

## 3.10 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown should be considered approximate.

2. Contractor is responsible for determining exact location of existing piping to which connections are to be made, or which may become disturbed during earth moving operations, or which may be affected by the work in anyway.

B. Work on Existing Pipelines:

1. Cut pipes as shown or required with machines specifically designed for this work.

2. Install temporary plugs to keep out all mud, dirt, water and debris.

3. Provide all necessary adapters, fittings, pipes and appurtenances required.

## 3.11 TESTING OF PIPING

A. General:

1. Contractor shall conduct high-pressure & leakage test for all filtered and potable water lines.

2. Notify Engineer 48 hours in advance of testing.

3. Contractor shall furnish all apparatus necessary to perform required tests.

4. Pipelines which fail to hold specified test pressure or which exceed the allowable leakage rate shall be repaired and retested.

5. Test pressures required are at the lowest elevation of the pipeline section being tested unless otherwise specified.

6. Unless otherwise approved, conduct all tests in the presence of the Engineer.

B. High Pressure & Leakage Test for Water Lines:

1. After the pipe has been laid and backfilled, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of 150 psi. The duration of each pressure test shall be at least 24 hours.

2. Each valved section of pipe shall be slowly filled with water and the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection, gauges and all necessary apparatus shall be furnished by the Contractor. The Contractor shall furnish all necessary assistance for conducting the tests.

3. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation stops at such points, so that the air can be expelled as the line is filled with water. After all air has been expelled, the corporation stops shall be closed and the test pressure applied.

4. All exposed pipes, fittings, valves, hydrants and joints shall be carefully examined during the test. Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material. The test shall be repeated until satisfactory to the Engineer.

5. A leakage test shall be conducted by the Contractor along with the pressure test. The duration of each leakage test shall be 6 hours. During the test, the main shall be subjected to a pressure of 150 psi unless shown to be different in piping schedule.

6. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereto to maintain the specified leakage test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.

7. No pipe installation will be accepted if the leakage is greater than that determined by the formula “L=ND/302”.

8. Where “L” is the allowable leakage in gallons per hour, “N” is the number of joints in the length of pipe line tested, and “D” is the nominal diameter of the pipe measured in inches.

9. Water which is introduced into the water line to determine leakage may be measured by pumping water from a vessel of known volume or by using a calibrated water meter. If a meter is used it must have the capability of accurately measuring the low flows which may be required to maintain the test pressure on the line. A displacement type meter with sweep hand dial is recommended. One complete revolution of the sweep hand should represent not more than ten gallons.

## 3.12 CLEANING AND DISINFECTION

A. All piping shall be thoroughly cleaned and flushed in a manner approved by the Engineer prior to placing in service. Piping 48 inches in diameter and larger shall be inspected from the inside and all debris, dirt and foreign matter removed.

B. Disinfection:

1. Disinfect potable all water piping on potable water lines prior to placing in service.

2. Completely clean interior of all piping and flush piping prior to disinfection with warm water at a minimum velocity of 2-1/2 feet per second.

3. Conform to procedures described in AWWA C 651 entitled “Disinfecting Water Mains” unless otherwise approved by the Engineer.

4. Water for flushing, testing and chlorination shall be furnished and paid for by the Contractor. Contractor shall provide all temporary piping, hose, valves,

appurtenances and services required.

5. Chlorine will be supplied by contractor.

6. Chlorine concentration in the water entering the piping shall be 50 parts per million and allowed to remain in the pipe line section for not less than 24 hours. The line will then be flushed thoroughly until a chlorine residual not exceeding 0.2 parts per million is obtained.

7. Bacteriological samples will be taken by a representative of the Mississippi Department of Health, the Engineer or a Certified Operator of the system and analyzed by the Mississippi State Department of Health. The samples shall be collected in bottles approved by the Mississippi Department of Health. If the submitted samples are not approved the Contractor (at no additional expense to the owner) is to disinfect the system in accordance with the requirements of the Mississippi State Department of Health until the system is free of contamination.

8. Complete disinfection shall be defined as total coliform absent and no confluent growth for samples on two consecutive days.

### 3.13 CLEAN-UP

A. In areas where the water mains have 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 holes and ruts and shall repair all miscellaneous and unclassified ground damage done by him and shall restore the ground to such a stable and suitable condition as may be reasonably required, consistent with the condition of the ground prior to construction.

B. Clean-up, including grading, disposal, dress work and other incidentals shall be completed by the Contractor at no additional cost to the Owner to the extent directed by the Engineer.

## PART 4 - COMPENSATION

### 4.01 GENERAL

Where items are not indicated separately on the proposal form, no separate payment shall be made for completion of work indicated on the Contract Drawings and in the Specifications; therefore, full compensation for these items shall be considered absorbed in the Contract Lump Sum.

### 4.02 MEASUREMENT AND PAYMENT

A. Measurement and Payment for the water system piping, including service piping, will be made at the Contract Unit Price per linear foot, which price shall constitute full compensation for furnishing, installing all pipe, joints, accessories, specials and all other materials not particularly specified for separate payment, for furnishing all labor, tools, equipment and incidentals and performing all work including excavation, dewatering, installation of pipe, backfill, testing, disinfection, clean-up and any other operations essential to completing the water system as specified herein and as shown on the PLANS.

B. Measurement and Payment for valves and fire hydrants will be made at the Contract Unit Price per each, which price shall constitute full compensation for furnishing all boxes, concrete blocking, fire hydrant assemblies, valves, gravel and miscellaneous materials, for furnishing all labor, tools,

equipment and incidentals and performing all operations essential in completing the installations of valves, boxes and fire hydrants in accordance with the SPECIFICATIONS and PLANS.

C. Measurement and Payment for Service Assemblies will be made at the Contract Unit Price per each, which price shall constitute full compensation for furnishing all taps, corporation stops, curb stops, meter boxes, service clamps, meters, gravel, concrete and miscellaneous material and for furnishing all labor, tools, equipment and incidentals and performing all operations essential to completing the installation in accordance with these SPECIFICATIONS and PLANS.

D. Measurement and Payment for connection to existing water mains will be made on a per each unit cost basis and shall constitute full compensation for furnishing all materials, bedding, labor, tools, equipment, and incidentals and performing all operations essential to installation of the fittings in accordance with these SPECIFICATIONS and PLANS.

E. Ductile iron fittings shall not be measured or paid for separately. Compensation for ductile iron fittings shall be absorbed into the price paid for water mains as indicated on the Proposal, which price shall constitute full compensation for furnishing all fittings, glands, bolts, bedding, concrete blocking, labor, tools, equipment and incidentals and performing all operations essential to installation of the fittings in accordance with these SPECIFICATIONS and PLANS. Payment for PVC fittings shall not be made separately but shall be absorbed in the unit price per foot for each size PVC water main installed.

F. Thrust blocking, select backfill and select bedding hauled in from off-site will not be measured, and payment shall be considered absorbed into related items.

**--END OF SECTION 02800--**