SECTION 02660

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

B. ANSI/AWS A5.8 - Brazing Filler Metal.

C. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

D. ANSI/AWWA C500 - Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.

E. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.

F. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.

G. ANSI/AWWA C515 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

H. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.

I. UL 246 - Hydrants for Fire - Protection Service.

1.2 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Submit manufacturer's product data and installation instructions for pipe and fittings, valves, hydrants, and accessories.

C. Shop Drawings: Submit shop drawings for system, showing pipe type, size, location, and elevations. Include details of underground structures, fittings, connections, anchors and thrust blocks.

D. Manufacturer's Certificate: Project Engineer shall certify that products meet or exceed specified requirements.

E. Manufacturer shall certify that pipe material shall meet or exceed applicable AWWA standards.

1.3 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01720.

B. Accurately record actual locations of piping mains, valves, connections, and invert elevations. Provide digital file with GPS coordinates for incorporation into City GIS system.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of water distribution system materials of types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.

B. Local Fire Department/Fire Marshall Regulations: Comply with governing regulations pertaining to hydrants, including hose unit threading and similar matching of connections. Comply with NFPA 291 for color coding related to hydrant flow capability.

C. Perform Work in accordance with municipality requirements.

D. Valves: Manufacturer's name and pressure rating marked on valve body; approved by FM, listed by UL.

E. Ductile Iron Pipe: Manufacturer's name, working pressure, DIPRA approval, and latest production code rated on pipe body.

F. Provide factory fabricated products to comply with governing regulations and AWWA standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Deliver and store valves in shipping containers with labeling in place. Ends of valves shall be plugged during shipping and storage.

PART 2 PRODUCTS

2.1 PIPE

A. Ductile Iron Pipe: ANSI/ A21.51/AWWA C151.
   1. Ductile iron pipe shall be ANSI Class 52 thickness unless otherwise indicated and shall be of the bell and spigot type.
   2. Fittings: ANSI/AWWA C110 or C153, ductile iron, mechanical joint type. No foreign made fittings are allowed.
   3. Joints: ANSI/AWWA C111, rubber gasket, push-on type:
      a) "Fastite" by American
      b) "Tyton" by US Pipe
      c) Substitutions: Under provisions of Section 01600.

B. Restrained Joint Pipe

   1. Where noted on the drawings for pipes 14-inch and smaller or where required by the WSD, restrained joint pipe shall be utilized by the use of gripper-style restraint gaskets. Gripper style restraint gaskets shall be Fast-Grip® by American Cast Iron Pipe Co., Field-Lok 350® by US Pipe Co., Sure Stop 350® by McWane Pipe Co., Talon™ RJ Gasket by Griffin Pipe Co. or approved equal.

   2. Restrained joint pipe is required for all pipes 16-inch and larger, and shall be American Flex-Ring®, US Pipe TR Flex® or McWane/Clow Super-Lock pipe.

   3. When restrained joint pipe is used, restrained joint push-on fittings may be used in lieu of mechanical joint fittings.

2.2 GATE VALVES – 2 INCH TO 3 INCH

A. Manufacturers:
   1. Mueller.
   2. M & H.
   3. Clow.
   4. American-Darling: Model AFC-250
   5. Substitutions: Under provisions of Section 01600.

B. Iron body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box and two valve keys.

2.3 GATE VALVES - 4 INCH TO 12 INCH

A. Manufacturers:
1. Mueller.
2. M & H.
3. Clow
4. American Flow Control
5. Substitutions: Under provisions of Section 01600.

B. ANSI/AWWA C515, Iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint ends, control rod, opening counter clockwise, extension box.

2.4 MECHANICAL JOINT TAPPING SLEEVE 4" – 24"

A. Manufacturers:
1. For Ductile Iron Pipe: Mueller H-615
2. For PVC: Ford FTSS or Romac SST.
3. Substitutions: Under provisions of Section 01600.

B. ANSI/NSF 61, Ductile Iron Body with ¾" NPT test plug, Outlet flange dimensions and drilling comply with ANSI B16.1, class 125 for ductile iron.

C. Body, straps and UNC threaded bolts of 304 Stainless steel with stainless steel flange. Flange to have ANSI 125# drilling. Stainless steel ¾" brass, no-lead test plug. Fully gasketed with EPDM gasket for 360^0 pipe coverage. Rated for 250 psi working pressure and meeting requirements of AWWA C223.

2.5 SWING CHECK VALVES - FROM 2 INCHES TO 24 INCHES

A. Manufacturers:
1. American (Series 52)
2. M&H
3. Clow
4. Substitutions: Under provisions of Section 01600.

B. ANSI/AWWA C508, iron body, bronze trim, 45-degree swing disc, renewable disc and seat, flanged ends; 150 psi capacity; removable cover for removal of internal parts without having to remove valve from line.

2.6 VALVE BOXES

A. Valve Box: Adjustable valve boxes with cover.

1. 2 to 24 Inch Diameter Valve: Concrete valve box, rectangular product with cast iron frame and cover, cover marked “WATER”.
   (a) Concrete Products of Nashville, Inc.
   (b) Substitutions: Under provisions of Section 01600.

2. Refer to Standard Details for Valve Boxes.

2.7 VACUUM-RELEASE OR AIR-RELEASE VALVES

A. Vacuum-Release or Air-Release Valves: Minimum 2 inch inlet diameter, fitted with proper size orifices; NSF 61 Reinforced Nylon body and cover; and NSF 61 foamed polypropylene float; suitable for use in lines having a maximum water pressure of 250 psi. Provide all valves with matching size ball or gate valve for isolation. Vacuum-release or air-release valves 3 inch and larger shall have flanged connections. Refer to Standard Details for enclosure requirements.
   1. ARI D-040 TP 02 or approved equivalent.

2.8 HYDRANTS

A. Manufacturers:
   1. Model "Super Centurion 250 A-423" Mueller, American Darling B-84-B-5, or M & H MVO 129 3-Way.

B. General: Provide fire hydrants with threaded male nozzle conforming to "American National Standard Fire Hose Connection Screw Threads" unless other hose connection required by local fire authorities.

C. Provide dry-barrel fire hydrants (base valve type) complying with UL 246 and AWWA C502, inside dimension of 5 1/4 inches minimum, with minimum 5 inches diameter valve seat opening; minimum net water area of barrel not less than 190 percent of valve opening; 6 inch mechanical joint inlet connection with accessories, gland bolts, and gaskets; all bronze working parts.

D. Requirements
   1. Working pressure, 250 psi and 500 psi hydrostatic pressure.
   2. Valve opening direction, counterclockwise, indicated by arrow and word "Open" cast on dome; 5-inch size minimum.
   3. Nozzles, one 4-1/2" pumper connection and two (2) 2.5” hose outlets with caps and chains. Nozzle cap nuts to match operating stem nuts.

(a) Operating stem nuts, 1-1/2" pentagon.

4. Bury Depth 3'-6"

E. Finish: Prior to any hydrant being accepted into service, said hydrant shall be flow tested per AWWA Standard M-17. Results of the test shall be provided to the City, including static, residual, flow, and time of test. Hydrant bonnet shall be color coded based on accepted flow testing results, including primer (2-3 mils DFT) and two coats of enamel (4-6 mils DFT) color coded as follows:

NFPA CLASS		
AA	Blue	>1500 gpm
A	Green	1000-1499 gpm
B	Orange	500-999 gpm
C	Red	0-499 gpm

E. Bonnets of all hydrants shall have a primer coating from factory. Barrels of fire hydrants in public installations shall be red in color. Barrels of fire hydrants in private installations shall be yellow in color.

2.12 BEDDING MATERIALS

A. Aggregate Fill: As specified in Section 02225.

B. Earth Fill: As specified in Section 02225.

C. Concrete: As specified in Section 03001.

D. Lean Concrete: As specified in Section 02225.

2.13 ACCESSORIES

A. Anchorages: Provide anchorages for tees, plugs, caps, bends and hydrants.

1. Clamps, Straps and Washers: Steel, ASTM A506. Rods: Steel, ASTM A575. Rod Couplings: Malleable iron, ASTM A197. Bolts: ASTM A307. Cast Iron Washers: ASTM A126, Class A.

B. Thrust Blocks:

1. 4,000 psi concrete, ASTM C94 ready-mixed concrete, 400 pounds of cement per cubic yard; water reducing admixture ASTM C494, Type A.

C. Mechanical Joint Restraint:

1. MEGALUG^{R} Series 1100 or approved equal when approved by the WSD and designed and installed per MEGALUG^{R} specifications.

D. Saddles: Factory-fabricated products to comply with governing regulations; bronze.
   1. Vega Manufacturing Company "H-13431," Mueller or Ford Equal.
   2. Substitutions: Under provisions of Section 01600.

E. Flanged Mechanical Joint Coupling Adapter with Joint Restraint:
   1. Smith-Blair Model 911 & 920
   2. Substitutions: Under provisions of Section 01600.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions.

B. Verify that building service connection and municipal utility water main size, location and inverts are as indicated.

3.2 PREPARATION

A. Remove scale and dirt, on inside and outside, before assembly.

B. Prepare pipe connections to equipment with flanges or unions.

C. Cover pipe ends during storage.

3.3 BEDDING AND BACKFILL

A. Begin backfilling after the line construction is completed and then inspected and approved by the WSD. In an earth trench, on each side of the line, from the bottom of barrel of pipe to 12 inches above the top of the pipe, the backfill material shall be select backfill consisting of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or other objectionable materials and that has a size of no more than 2 inches. Place this backfill simultaneously on either side of the pipe in even layers that, before compaction, are no more than 6” deep. Thoroughly and completely tamp each layer into place before placing additional layers.

B. In a rock trench, backfill shall be No. 67 crushed stone to a point 12 inches above the top of pipe.

C. In all paved areas or roadways, all backfill for shall be No. 67 crushed stone

up to subgrade level.

D. If pipe is installed in a rock trench or paved area, install a 6 inch bedding of No. 67 crushed stone below the pipe.

E. From 1' above the pipe upward (if outside paved area or roadway) the backfill material may contain broken stones that make up approximately 3/4 of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep. Tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

F. If earth material for backfill is, in the opinion of the WSD, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material the WSD considers too wet or otherwise unsuitable.

G. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials.

H. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill per the requirements of City of Brentwood Public Works Department. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the WSD.

I. Wherever pipes have diameter of 15 inches or less, do not use power operated tampers to tamp that portion of backfill around the pipe within 1 foot above the pipe.

J. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being place. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary.

K. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the Owner's requiring that the

Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

3.4 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with WSD and TDEC requirements.

B. Install pipe to indicated elevation to within tolerance of 5/8 inches.

C. Install ductile iron piping and fittings in accordance with ANSI/AWWA C600.

D. Route pipe in straight line.

E. Install pipe in trench with 6-inch minimum clearance from edge of trench to outside diameter of pipe bell.

F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

G. Install test taps at appropriate intervals to permit disinfection of water system performed under Section 02675.

H. Slope water pipe and position drain at low points.

I. Form and place concrete for thrust blocks at each elbow or change of direction of pipe or provide restrained joint pipe as required. Design calculations for restrained joint pipe shall be as follows:
   1. Soil Type = GC or other as suited to the site condition
   2. Safety Factor = 2.0
   3. Depth of Bury = 30 inches
   4. Test Pressure = 200 psi

J. All valves, hydrants and fittings shall include mechanical joint restraint devices.

K. Establish elevations of buried piping to ensure not less than 2'-6" of cover.

L. Shape bed of each piece of pipe so that each individual piece of pipe will have a uniform bearing. Lay pipe in a straight line and grade without kinks or sags. Lay pipe in a workmanlike manner.

M. Before each piece of pipe is lowered into trench, swab pipe thoroughly to insure its being clean. Lower each piece of pipe separately unless special

permission is given otherwise by the project Engineer and approved by the WSD. Prevent damage to pipe coating.

N. Do not lay pipe or castings which are known to be defective. If defective pipe or special casting is discovered after it has been laid in line, remove and replace it with a satisfactory section of pipe or special casting. In case a length of pipe is cut to fit in a line, cut it as to leave a smooth end at right angles to longitudinal axis of pipe. When Contractor is not actually laying pipe, plug pipe.

O. After installation, apply a full coat of asphalt or other acceptable corrosion-retarding material to unprotected surfaces of rods and clamps.

P. Ductile-Iron Pipe: Install in accordance with recommended procedures of Ductile Iron Pipe Research Association.

Q. At taps on existing PVC pipe, install a saddle for service connections. No saddle required for taps on existing ductile iron pipe.

R. Joint Adapters: Make joints between cast iron pipe and other types of pipe with standard manufactured ductile iron, mechanical joint fittings.

S. If indicated on Drawings, place pipe under roads by boring in accordance with requirements of the authority having jurisdiction and Section 02229.

T. Make creek crossings with ductile iron pipe regardless of type pipe used elsewhere and per the State of Tennessee.

U. Where water lines cross ditches or culverts, place line under invert of same at such a depth as to provide adequate cover. Line shall begin to slope on either side of ditch or culvert at a sufficient distance to hold a uniform gradient in line without sags or short breaks.

V. Water mains in cul-de-sacs shall extend straight through the cul-de-sac and terminate beyond curb line and include an approved hydrant.

W. In cases where gas, sewer, or other pipe is encountered, make appropriate adjustment utilizing fittings as needed. Consult with the WSD before installing fittings.

X. For detection purposes, a 10-gauge solid strand copper, blue clad tracing wire (shielded) shall be installed with the plastic water main pipe. Connections between wires shall be soldered or connected with wire nut fasteners and wrapped and sealed to be watertight. For access purposes, tracing wire shall be terminated at all valve boxes, combination air valve assemblies, etc.

Y. Magnetic detectable conductor, metallic tape clear plastic covering, imprinted with "CAUTION BURIED WATER LINE" in large letters shall be installed 18 inches above all water pipe.

Z. Backfill trench in accordance with Paragraph 3.3, this Section.

3.5 SEPARATION OF WATER MAINS AND SEWERS

A. Parallel: Under normal conditions, water mains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer, or sewer manhole, whenever possible; the distance shall be measured edge-to-edge.

a. When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer provided that the bottom of the water main is at least 18 inches above the top of the sewer.

b. When local conditions prevent a horizontal separation of 10 feet and the required vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.

B. Crossings: Under normal conditions when laying water mains over sewer pipe, provide a separation of at least 18 inches between bottom of water main and top of sewer.

1. Unusual Conditions: When local conditions prevent desired vertical separation as described above, protect water mains passing under sewers by providing:

a) A vertical separation of at last 18 inches between bottom of sewer and top of water main;

b) Adequate structural support for sewers to prevent excessive deflection of joints and settling on and breaking water mains;

c) Length of water pipe shall be centered at point of crossing so that joints will be equidistant and as far as possible from sewer and capped with concrete per the direction of the WSD.

C. No water pipe shall pass through or come into contact with part of a sewer or sewer manhole.

3.6 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing in accordance with manufacturer's instructions.

B. Center and plumb valve box over valve. Set box cover flush with finished grade. Lid shall be oriented so that lettering is perpendicular to main line.

C. All valves, hydrants and fittings shall include mechanical joint restraint devices.

D. Tapping sleeves shall be separately pressure tested before connection to the new water line. The WSD must witness the tapping saddle pressure test. The tapping sleeves must be rated for the anticipated working pressure. Care must be used to assure that all bolts are equally tightened. The tapping valve is to be solidly supported with brick or block and carefully bedded to prevent shifting due to settling back fill.

E. Install hydrants in accordance with AWWA M17, the WSD and Brentwood Fire Department requirements. Set hydrants plumb and locate pumper nozzle perpendicular to and facing roadway.

F. Set hydrants to grade and so that the 4-1/2-inch connection will be a minimum of 18 inches from bottom of nozzle to the ground, and turned so as to be unobstructed by poles or other objects.

G. Locate control valve immediately adjacent to the hydrant.

H. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

I. Paint hydrants in accordance with City of Brentwood color code system and NFPA 291 as specified within this Section.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with AWWA C651, latest revision and State of Tennessee, Water Resources Division disinfection criteria.

3.8 SERVICE CONNECTIONS

A. Refer to other applicable Sections for requirements of service connections.

3.9 INSPECTION

A. Interior Inspection: Inspect pipe to determine whether line displacement or other damage has occurred.

1. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects to satisfaction of the WSD.

3.10 CLEANING

A. Cleaning Pipe: Clear interior of pipe of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.

1. In large, accessible pipe, brushes and brooms may be used for cleaning.

B. Place plugs in end of uncompleted pipe at end of day or whenever work stops and remove all debris and trash from trench.

3.11 FIELD QUALITY CONTROL

A. Field testing for piping and valves will be performed under provisions of Section 01410.

B. Perform operational testing of hydrants and valves by opening and closing under water pressure to insure proper operation.

C. Inspect each joint thoroughly and make joints watertight before backfilling about joint. Furnish equipment and material for testing. Include hydrants and service lines to meter in test(s).

D. Test pipe under 200 pounds pressure for a minimum of 2 hours. This may be done from valve to valve or by plugging open end of pipe. Tests cannot be performed against water valves already in operation. Isolate lines to be tested from existing water lines in service. All tests shall be conducted in presence of WSD representative. Test each valve section separately unless otherwise approved by the WSD.

E. If pressure test reveals a drop in pressure, Contractor shall then conduct a leakage test. Leakage is defined as quantity of water to be supplied into newly laid pipe, or valve section thereof, necessary to maintain specified leakage test pressure after pipe has been filled with water and air expelled. Furnish pump, pipe, connections, gauges, and measuring devices and other necessary apparatus. Furnish necessary assistance to conduct test. Test each valve section separately unless otherwise approved by the WSD.

1. Should any test of pipe laid disclose leakage greater than that specified the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified

allowance. All visible leaks are to be repaired regardless of amount of leakage.

2. Allowable Leakage: No pipe installation will be accepted if the leakage is greater than that determined by the following formula per AWWA C600:

   a. Ductile Iron Pipe: $L = \frac{SD\sqrt{P}}{148{,}000}$

   Where: L = allowable leakage, in gallons per day.
   S = length of pipe tested, in feet.
   D = nominal diameter of the pipe, in inches.
   P = average test pressure during the leakage tests, in pounds per square inch (gauge).

3. Duration of each leakage test shall be two (2) hours.

F. Do not connect to municipal system until testing and disinfection of lines have been completed and permission granted by the WSD.

END OF SECTION 02660 - WATER DISTRIBUTION SYSTEM