SECTION 33 10 00
WATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION:

Underground water distribution system complete, ready for operation, including all appurtenant structures, and connections to both new building service lines and to existing water supply.

1.2 RELATED WORK:

A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.

B. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 11, EARTH MOVING (Short Form).

C. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.

D. Protection of materials and equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

E. Section 22 11 00, Facility Water Distribution

1.3 DEFINITIONS:

A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout building areas and other areas of water use, including hydrants, valves, and other appurtenances used to supply water for domestic and fire-fighting/fire protection purposes.

B. Water Service Line: Pipe line connecting building piping to water distribution lines.

1.4 QUALITY ASSURANCE:

A. Products Criteria:

1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.

2. Nameplate: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Comply with all rules and regulations of Federal, State, and Local Health Department having jurisdiction over the design, construction, and operation of potable water systems.

C. All material surfaces in contact with potable water shall comply with NSF 61.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers' Literature and Data (Submit all items as one package): shall be provided to COR for approval.

1. Piping.
2. Valves.
3. Meter.
4. Corporation and curb stops.
5. Curb stop boxes.
6. Disinfection products.
7. Backflow Preventer.

C. Testing Certifications:

1. Certification of Backflow Devices.
2. Hydrostatic Testing.
3. Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.

1.6 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI/ASME):

B16.1-98.....Cast Iron Pipe Flanges and Flanged Fittings
B16.18.....Cast Bronze Solder Joint Pressure Fittings
B16.26-88.....Cast Copper Alloy Fittings for Flared Copper Tubes
B40.100-98.....Pressure Gauges and Gauge Attachments

C. American Society for Testing and Materials (ASTM):

A123-97.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A148M-03.....Standard Specifications for Steel Castings
A242-00.....Standard Specifications for High Strength Low Alloy Structural Steel AASHTO No. M161
A307-02.....Standard Specifications for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
A536-04.....Standard Specifications for Ductile Iron Castings
B61-02.....Steam or Valve Bronze Castings
B62-02.....Composition Bronze or Ounce Metal Castings
B88-02.....Seamless Copper Water Tube

B828.....Standard Practice: Soldering and Brazing Copper Tube and fittings

C32-04.....Sewer and Manhole Brick (Made from Clay or Shale)

C139-03.....Concrete Masonry Units for Construction of Catch Basins and Manholes

D1784-03.....Standard Specifications for Rigid PVC Compounds and CPVC Compounds

D1869-00.....Standard Specifications for Rubber Rings for Asbestos Cement Pipe

D2464-99.....Standard Specifications for Threaded PVC Pipe Fittings, Schedule 80

D2467-02.....Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

D3139-98.....Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

F477-02e1.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe

C32-04.....Standard Specifications for Sewer Manhole Brick

D. American Water Works Association (AWWA):

B300-04.....Hypochlorites

B301-04.....Liquid Chlorine

C104-04.....Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water

C105-99.....Polyethylene Encasement for Gray and Ductile C.I. Piping for Water and Other Liquids

C110-03.....Ductile-Iron and Gray-Iron Fittings, 80 mm (3 Inches) Through 1200 mm (48 Inches) for Water and Other Liquids

C111-01.....Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

C115-99.....Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges

C150-02.....American National Standard for Thickness Design of Ductile Iron Pipe

C151-96.....Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

C153-00.....Ductile-Iron Compact Fittings, 80 mm (3 inches) Through 300 mm (12 Inches) for Water and Other Liquids
C500-02.....Gate Valves for Water and Sewerage Systems
C502a-95.....Dry-Barrel Fire Hydrants
C503-97.....Wet-Barrel Fire Hydrants
C508-01.....Swing Check Valves for Waterworks Service, 2 Inches (50 mm) Through 24 Inches (600mm) NPS
C509-01.....Resilient Seated Gate Valve for Water and Sewage System
C510-97.....Double Check Valve Back-Flow Prevention Assembly
C511-97.....Reduced Pressure Principle Back-Flow Prevention Assembly
C550-01.....Protective Epoxy Interior Coatings for Valves and Hydrants
C600-01.....Installation for Ductile-Iron Water Mains and Their Appurtenances
C605-94.....Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
C651-92.....Disinfecting Water Mains
C800-01.....Underground Service Line Valves and Fittings
C900-97.....Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Thru 12 Inches, for Water
C905-97.....Polyvinyl Chloride (PVC) Pressure Pipe 14 Inches Thru 36 Inches

E. National Fire Protection Association (NFPA):
24-95.....Installation of Private Fire Service Mains and Their Appurtenances
291-01.....Fire Flow Testing and Marking of Hydrants
1141-98.....Fire Protection in Planned Building Groups

F. NSF International:
14-03.....Plastics Piping Components and Related Materials
61-02.....Drinking Water System Components-Health Effects (Sections 1-9)

G. American Welding Society (AWS):
A5.8-04.....Brazing Filler Metal

H. Foundation for Cross-Connection Control and Hydraulic Research-2005

I. Copper Development Association’s Copper Tube Handbook-2005

PART 2 - PRODUCTS

2.1 COPPER PIPE AND TUBING:

Copper Piping: ASTM B88, Type K, or Type L with flared fittings in accordance with AWWA C800, with sweat cast brass fittings per ANSI B16.18. Use brazing alloy, AWS A5.8, Classification BCuP.

2.2 VALVES:

A. Asbestos packing is not allowed.

B. Corporation stops and saddles shall conform to AWWA C800.

C. Curb Stop: Smaller than 75 mm (3 inches). Waterworks standard for Type "K" copper, single piece cast bronze body with tee top operated plug sealed with O-ring gaskets, 1375 kPa (200 pound) WOG per AWWA C800.

2.3 CURB STOP BOX:

Cast iron extension box with screw or slide type adjustment and flared base. Box shall be adapted, without full extension, to depth of cover required over pipe at stop location. Cast the word "WATER" in cover and set cover flush with finished grade. Curb stop shut-off rod shall extend 600 mm (2 feet) above top of deepest stop box.

2.4 PIPE SLEEVES:

Ductile iron or zinc coated steel.

2.5 BACKFLOW PREVENTER:

A. Potable Water: Reduced Pressure Principle Type AWWA C511, except pressure drop at rated flow shall not exceed 100 kPa (15 psi).

B. Backflow preventer shall be 3/4" Watts Series 009 RPZ or approved equal.

C. Backflow preventers shall be approved by the Foundation for Cross-Connection Control and Hydraulic Research per current edition of the Manual of Cross-Connection Control.

D. Backflow preventer shall not be located in any area containing fumes that are toxic, poisonous or corrosive.

E. Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection.

F. Backflow preventer shall be accessed and have clearance for the required testing, maintenance and repair. Access and clearance shall require a minimum of one (1) foot (305 mm) between the lowest portion of the assembly and grade, floor or platform. Installations elevated more than five (5) feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

2.6 METER:

A. Water meter shall be 3/4" Badger Model M25 or approved equal.

2.7 POTABLE WATER:

Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act.

2.8 DISINFECTION CHLORINE:

A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.

B. Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.

C. Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight.

2.9 WARNING TAPE

Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type, blue with black letters, and imprinted with “CAUTION BURIED WATER LINE BELOW”.

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES:

Install water service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps.

3.2 REGRADING:

Raise or lower existing valve and curb stop boxes to finish grade in areas being graded.

3.3 PIPE LAYING, GENERAL:

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the COR.

B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

C. All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.

D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.
E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
G. Hold pipe securely in place while joint is being made.
H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
J. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. See section 3.7 “PIPE SUPPORTS”.
K. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
L. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.
M. Warning tape shall be continuously placed 300 mm (12 inches) above buried water pipes.

3.4 COPPER PIPE:

Copper piping shall be installed in accordance with the Copper Development Association’s Copper Tube Handbook and manufacturer’s recommendations. Copper piping shall be bedded in 150 mm (6 inches) of sand and then back filled as specified in Section 31 20 00, EARTH MOVING.

3.5 PIPE SUPPORTS:

A. Supports:
1. All piping shall be properly and adequately supported. Hangers, supports, base elbows and tees, and concrete piers and pads shall be provided as indicated on the drawings. If the method of support is not indicated on the drawings, exposed piping shall be supported by hangers wherever the structure is suitable and adequate to carry the superimposed load. Supports shall be placed approximately 2.4 m (8 feet) on centers and at each fitting.
2. Hangers shall be heavy malleable iron of the adjustable swivel type, split ring type, or the adjustable-swivel, pipe-roll type for

horizontal piping and adjustable, wrought iron, clamp type for vertical piping. Flat steel strap or chain hangers are not acceptable unless indicated on the drawings.

3. Hangers shall be attached to the structure, where possible, by beam clamps and approved concrete inserts set in the forms before concrete is poured. Where this method is impractical, anchor bolts with expanding lead shields, rawl drives, or malleable iron expansion shields will be permitted.
4. Where hangers cannot be used, the Contractor shall provide pipe saddle supports with pipe column and floor flange.

3.6 PIPE SEPARATION:

A. Horizontal Separation-Water Mains and Sewers:

1. Water mains shall be located at least 3 m (10 feet) horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.
2. Water mains may be located closer than 3 m (10 feet) to a sewer line when:
   a. Local conditions prevent a lateral separation of 3 m (10 feet); and
   b. The water main invert is at least 450 mm (18 inches) above the crown of the gravity sewer; and
   c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.
3. When it is impossible to meet (1) or (2) above, both the water main and drain or sewer shall be constructed of mechanical joint ductile iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section. The drain or sewer shall be pressure tested to the maximum expected surcharge head before back filling.

B. Vertical Separation-Water Mains and Sewers:

1. A water main shall be separated from a sewer so that its invert is a minimum of 600 mm (24 inches) above the crown of the drain or gravity sewer whenever water mains cross storm sewers, gravity sanitary sewers or gravity sewer service connections. For pressure sewers (forcemain) the water main shall maintain 1200 mm (48 inches) separation above the crown of the pressure (force) main. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed. A

length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.

2. In no case shall pressure (force) sanitary main cross above, or within 600 mm (24 inches) of water lines.
3. The sewer shall be cased within a HDPE butt fused pipe when:
   a. It is impossible to obtain the proper vertical separations described in (1) above for gravity systems; or
   b. The water main passes under a gravity sewer or drain.
4. A vertical separation of 450 mm (18 inches) between the invert of the gravity sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the gravity sewer or drain lines to prevent settling and breaking the water main.
5. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 3 m (10 feet).
6. For additional pressure sewer (forecmain) requirement refer to Section 33 30 00.

3.7 SETTING OF VALVES AND BOXES:

A. Clean valve and curb stops interior before installation.
B. Set valve and curb stop box cover flush with finished grade.
C. Valves shall be installed plumb and level and in accordance with manufacturer’s recommendations.

3.8 PIPE SLEEVES:

Install where water lines pass through retaining walls, building foundations and floors. Seal with modular mechanical type link seal. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

3.9 FLUSHING AND DISINFECTING:

A. Flush and disinfect new water lines in accordance with AWWA C651.
B. Initial flushing shall obtain a minimum velocity in the main of 0.75 m/sec (2.5 feet per second) at 40 PSI residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

Pipe Diameter		Flow Required to Produce 2.5 ft/sec(approx.) Velocity in Main		Number of Hydrant Outlets			
				Size of Tap. in. (mm)			
				1(25)	1 ½(38)	2(51)	2 1/2-in (64 mm)
In	(mm)	gpm	(L/sec)	Number of taps on pipe			
4	(100)	100	(6.3)	1	--	--	1

6	(150)	200	(12.6)	--	1	--	1
8	(200)	400	(25.2)	--	2	1	1
10	(250)	600	(37.9)	--	3	2	1
12	(300)	900	(56.8)	--	--	3	2
16	(400)	1,600	(100.9)	--	--	4	2

The backflow preventers shall not be in place during the flushing.

C. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.

D. The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.

E. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the Health Department of the State. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.

F. Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.

G. Before backflow preventers are installed, all upstream piping shall be thoroughly flushed.

3.10 HYDROSTATIC TESTING:

A. Hydrostatic testing of the system shall occur prior to disinfecting the system.

B. After new system is installed, except for connections to existing system and building, backfill at least 300 mm (12 inches) above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.

C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.

D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.

E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.

F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 1375 kPa (200 psi). Leakage shall not exceed the following requirements.

1. Copper Tubing: No leaks.

3.11 BACKFLOW PREVENTOR TESTING:

A. All backflow preventers shall be tested and certified for proper operation prior to being placed in operation.

B. Original copies of the certification shall be submitted to the COR.

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