SECTION 33 10 00
WATER UTILITIES

SPEC WRITER NOTES:
1. Use this section only for NCA projects.
2. Delete between //----// if not applicable to project. Also delete any other items not applicable to project in the section and renumber the paragraphs.
3. References to pressure in this section are gage pressure unless otherwise noted.
4. Sites for national cemeteries may have full, limited or no access to existing potable water supply sources from existing government operated campus type water systems, or from connection to municipal water systems. Adjust this specification section according to the conditions applicable for the potable water supply for the specific project site.
5. Fire protection for NCA cemetery facilities may be provided from the same potable water supply sources as that for the buildings, or from onsite ponds, or from the irrigation system which may only be available for the portion of the year when the irrigation system is operational. Modify this specification section accordingly, based upon the conditions applicable for the specific project site.

PART 1 - GENERAL

SPEC WRITER NOTES: Retain applicable following Description paragraph 1.1. Use first paragraph, if both potable water and fire protection water are to be provided from the same water supply source. Use second paragraph if the fire hydrant assemblies are to be provided from the irrigation water supply source due to limited potable water supply from wells, as an example.

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 potable water supply.

SPEC WRITER NOTES:
Add or delete paragraphs that are applicable to the potable water utilities for the project.

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

SPEC WRITER NOTES:
Coordinate the work for the Water Utilities to insure connection is made between the water utility and the building where applicable, at 1500 mm (5 feet) outside of the building.

//D. Building Plumbing starting 1500 mm (5 feet) outside of the building: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.//

//E. Flower Watering Spigot Assemblies: Section 32 30 00, SITE FURNISHINGS.

1.3 DEFINITIONS

SPEC WRITER NOTES: Modify the definitions to reflect the site specific conditions regarding which type of services are to be provided from the potable water supply source.

A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout the site, as applicable, and in the building areas that provides water from the potable water supply source for the project, including //hydrants, valves, and other appurtenances used to supply water for domestic //and fire-fighting/fire protection //purposes only when required due to Life Safety issues.
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.

SPEC WRITER NOTES: Edit, delete and or modify Paragraphs B and C, as required, to reflect the conditions for providing a potable water supply source for the project site. Delete as required and re-number accordingly.
B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Water lines and the extension, and/or modifications to Public Utility systems. //

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

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

SPEC WRITERS NOTES:
Review and edit the following submittal listing, as applicable, for the specific conditions of the project site. Fire Hydrant Assemblies are included in this section for submittal, even though they may be installed and connected to the irrigation system at the project site. If the project site is an existing facility with potable water and fire protection uses from the same system, then the fire hydrants are typically included in the NCA water utilities.

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

SPEC WRITER NOTES:
1. Modify the following to clearly indicate the requirement for submittal as one package. Indicate that the submittal must identify what items are included and that all required items are being submitted at once as specified. Otherwise, the submittal will be returned un-reviewed.
2. Modify the list in the following paragraph to include those items relevant for this specific project. Add any items that may be missing and delete those not being utilized and re-number.

B. Manufacturers' Literature and Data (Submit all items as one package):
(Ductile Iron Pipe and Polyvinyl Chloride (PVC) shall be in accordance with AWWA C600 and C605 respectively.)
1. Piping.
2. Fittings
4. Valves.
5. Fire hydrants.
6. Meter.
7. Vaults, frames and covers.
8. Steps.
9. Backflow Preventer
11. Valve boxes.
13. Curb stop boxes.
15. Disinfection products.
16. Warning Tape
17. Link/sleeve seals.

SPEC WRITER NOTES:
Modify the following paragraph to indicate all of the testing certifications that will be required for this work. Clarify whether the Contractor is required to submit the procedures to be followed, timing for the work in the project and who will be performing the certifications and what will be certified. Clarify how much of the above is required during the submittal process for this section and whether it is required as part of the all inclusive submittal.

C. Testing Certifications:
3. Certification of Disinfection, including free chlorine residuals, and bacteriological examinations.

1.6 APPLICABLE PUBLICATIONS

SPEC WRITER NOTES:
1. Confirm the applicability of the references listed in this paragraph for the specific project being designed. Delete publications that are not applicable for this project.
2. Check the dates for the indicated standards and make sure they are current at the time of A/E submission of this specification section.
3. Coordinate these references within the remaining body of the specifications. Insure that they are clearly referenced in the specifications text as to how they are applicable for this project. General reference to these standard specifications by only inclusion in this paragraph does not make them applicable to this project.
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):
   B16.1-2005..............Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
   B16.18-2001.............Cast Copper Alloy Solder Joint Pressure Fittings
   B16.26-2006.............Cast Copper Alloy Fittings for Flared Copper Tubes
   B40.100-2005............Pressure Gauges and Gauge Attachments

C. American Society of Mechanical Engineers (ASME):
   B18.5.2.1M - 2006 Metric Round Head Short Square Neck Bolts
   B18.5.2.2M - 1982 Metric Round Head Square Neck Bolts
   B18.2.2 - 1987 Square and Hex Nuts

D. American Society for Testing and Materials (ASTM):
   A123/A123M-08.............Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   A148M/A148M-08............Standard Specifications for Steel Castings
   A242/A242M-04e1..........Standard Specifications for High Strength Low Alloy Structural Steel AASHTO No. M161
   A307/A307-07b..........Standard Specifications for Carbon Steel Bolts and Studs, 415 MPa (60,000 psi) Tensile Strength
   B42-02e1.................Standard Specification for Seamless Copper Pipe, Standard Sizes
   B61-08....................Standard Specifications for Steam or Valve Bronze Castings
   B62-02....................Standard Specifications for Composition Bronze or Ounce Metal Castings
   B88-03....................Standard Specifications for Seamless Copper Water Tube
   B117-07a..................Standard Practice for Operating Salt Spray (Fog) Apparatus
B-633-07.............Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
B828-02.............Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
C32-05.............Sewer and Manhole Brick (Made from Clay or Shale)
C94/C94M-09.........Standard Specification for Ready-Mixed Concrete
C139-05.............Concrete Masonry Units for Construction of Catch Basins and Manholes
C443-05a.............Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
D1784-08.............Standard Specifications for Rigid PVC Compounds and CPVC Compounds
D1785-06.............Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
D1869-95(2005)e1.....Standard Specifications for Rubber Rings for Asbestos Cement Pipe
D2000-08.............Standard Classification System for Rubber Products in Automotive Applications
D2241-05.............Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
D2464-06.............Standard Specifications for Threaded PVC Pipe Fittings, Schedule 80
D2466-06.............Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
D2467-06.............Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
D3139-98(2005)........Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
D4101-08.............Standard Specification for Polypropylene Injection and Extrusion Materials
F441/F441M-02(2008).....Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
F477-08.................Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F1674-05................Standard Test Method for Joint Restraint Products for Use With PVC Pipe

E. American Water Works Association (AWWA):
B300-04.................Hypochlorites
B301-04.................Liquid Chlorine
C104/A21.4-08..........Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
C105/A21.5-05..........Polyethylene Encasement for Gray and Ductile C.I. Piping for Water and Other Liquids
C110/A21.10-08.........Ductile-Iron and Gray-Iron Fittings, 80 mm Through 1200 mm (3 Inches Through 48 Inches) for Water and Other Liquids
C111/A21.11-07.........Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
C115/A21.15-05.........Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
C150/A21.50-08.........American National Standard for Thickness Design of Ductile Iron Pipe
C151/A21.51-02.........Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
C153/A21.53-06.........Ductile-Iron Compact Fittings, 80 mm Through 300 mm (3 inches Through 12 inches) for Water and Other Liquids
C200-05.................Steel Water Pipe - 150 mm (6 in.) and Larger
C203-02.................Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
C205-07.................Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 100 mm (4 in.) and Larger - Shop Applied
C206-03.................Field Welding of Steel Water Pipe
C207-07................Standard for Steel Pipe Flanges for Waterworks Service-Sizes 100 mm Through 3600 mm (4 in. through 144 in.)
C208-07................Standard for Dimensions for Fabricated Steel Water Pipe Fittings
C209-06................Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fitting for Steel Water Pipe
C210-07................Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
C500-02................Metal-Seated Gate Valves for Water Supply Service
C502-05................Dry-Barrel Fire Hydrants
C503-05................Wet-Barrel Fire Hydrants
C504-06................Standard for Rubber-Seated Butterfly Valves
C508-01................Swing-Check Valves for Waterworks Service, 50 mm thru 600 mm (2 inches through 24 inches) NPS
C509-01................Resilient Seated Gate Valve for Water Supply Service
C510-07................Double Check Valve Back-Flow Prevention Assembly
C511-07................Reduced Pressure Principle Back-Flow Prevention Assembly
C550-05................Standard for Protective Interior Coatings for Valves and Hydrants
C600-05................Installation of Ductile-Iron Water Mains and Their Appurtenances
C605-05................Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
C651-05................Standard for Disinfecting Water Mains
C700-02................Standard for Cold-Water Meters - Displacement Type, Bronze Main Case
C701-07................Standard for Cold-Water Meters - Turbine Type for Customer Service
C702-01................Cold-Water Meters - Compound Type
C706-96(R05)...........Direct-Reading, Remote-Registration Systems for Cold-Water Meters
C707-05................Encoder-Type Remote-Registration Systems for Cold-Water Meters
C800-05................Underground Service Line Valves and Fittings
PART 2 - PRODUCTS

SPEC WRITER NOTES: Make material requirements agree with applicable requirements specified in the referenced Applicable Publications. Update and
2.1 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe, direct buried:
   1. Provide ductile iron pipe conforming to the requirements of AWWA C151, Pressure Class 350 for Pipe 100 mm through 300 mm (4 inches through 12 inches) in diameter with double thickness cement mortar lining interior, and interior asphaltic seal coat and exterior asphaltic coating, in accordance with AWWA and ANSI Standards.
      SPEC WRITER NOTES: Modify the following paragraph and clarify which conditions are applicable for the project. If restrained joint pipe is required, modify to provide information describing the approved restrained joints.

   2. Below Grade: Supply pipe in lengths not in excess of a nominal 6 m (20 feet) with rubber ring type push-on joints, mechanical joint or approved restrained joint. Provide mechanical and restrained joint pipe with sufficient quantities of accessories as required for each joint.
      SPEC WRITER NOTES: Modify or delete the following, based upon the determination of soil characteristics as indicated in SPEC WRITER NOTES for Paragraph 3.4.

   3. When a polyethylene encasement over pipe, fittings, and valves is a requirement as indicated on the drawings, the material, installation and workmanship shall conform to applicable sections of AWWA C105. Make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfill following installation without delay to avoid exposure to sunlight.

B. Ductile Iron Pipe Above Grade or in Below Ground Concrete Pits:
   1. Flanged ductile iron pipe, AWWA C115, with factory applied screwed long hub flanges except as otherwise specified hereinafter. //Provide flange joint pipe where shown on the drawings.// Face and drill flanges after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and flush with end of pipe, ANSI B16.1, 850 kPa (125 psi) or 1725 kPa (250 psi) standard, for the purpose intended.
   2. Wall Sleeve Castings: Size and types shown on the drawings and as herein specified in the paragraph on Link/Sleeve Seals.
   3. Pipe Thickness Class: Minimum of Class 53 as defined in AWWA C150 for all sizes of flanged pipe.
4. Rubber Ring Gaskets: Full face type, AWWA C111, 2 mm (1/16 inch) rubber ring gaskets and of approved composition suitable for the required service.

5. Pipe and fittings exposed to view in the finished work are to be painted in accordance with Section 09 91 00, PAINTING. Pipe shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of the pipe manufacturer standard color of rust inhibitive primer or equal. Finished paint color shall

SPEC WRITER NOTES:
Modify as required to identify what the paint color shall be, based upon the location for the pipe.

a. be as selected for the location.

SPEC WRITER NOTES:
Modify the following and identify where the two identified types of bolt assemblies are to be used. Connections that will periodically be opened for maintenance, should use the stainless steel.


C. All Pipe Fittings: Ductile iron with a minimum pressure rating of 2400 kPa (350 psi). Fittings shall meet the requirements of ANSI and AWWA specifications as applicable. Rubber gasket joints shall conform to AWWA C111 for mechanical and push-on type joints. Ball joints shall conform to AWWA C151 with a separately cast ductile iron bell conforming to ASTM A148. Flanged fittings shall conform to AWWA C115 and be furnished flat faced and drilled to 850 kPa (125 psi) or 1725 kPa (250 psi) template in accordance with ANSI B16.1 with full faced gaskets.

D. Provide cement mortar lining and bituminous seal coat on the inside of the pipe and fittings in accordance with AWWA C104. Provide standard asphaltic coating on the exterior.

E. Provide a factory hydrostatic test of not less than 3.5 MPa (500 psi) for all pipe in accordance with AWWA C151.

2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. Class-Rated Polyvinyl Chloride (PVC) Pipe: Pipe and accessories shall bear the NSF mark indicating pipe size, manufacturer’s name, AWWA and/or ASTM Specification number, working pressure and production code.

1. PVC pipe and accessories 100 mm to 350 mm (4 inches–14 inches) in diameter, AWWA C900 “Polyvinyl Chloride (PVC) Pressure Pipe”, Class
200, DR 14, cast iron outside diameters, unless otherwise shown or specified.

2. PVC Pipe and Accessories Smaller than 100 mm (4 inches): Schedule 80, meeting the requirements of ASTM D-1785, Type 1, Grade 1. All exposed piping shall be CPVC meeting requirements of ASTM F441.

B. Joints:

1. Pipe 75 mm (3 inches) and Greater in Diameter: Push-on type with factory installed solid cross section elastomeric ring meeting the requirements of ASTM F-477.

2. Pipe Less Than 75 mm (3 inches) in Diameter: Threaded (ASTM D-2464) or solvent welded (ASTM 2467). Use Teflon tape or liquid Teflon thread lubricant approved for use on plastic on all threaded joints.

C. Fittings:

1. Class-Rated Pipe 75 mm (3 inches) in Diameter and Greater: Ductile iron with mechanical joints conforming to the requirements of AWWA C153. Mechanical joint fittings shall include retainer glands, unless otherwise noted.

2. For Schedule 80 Pipe less than 75 mm (3 inches) in Diameter: Threaded or solvent weld. Threaded PVC fittings shall conform to ASTM D2464. CPVC fittings shall conform to ASTM F437 for threaded fittings and ASTM F439 for solvent weld fittings.

2.3 MECHANICAL JOINT RETAINER GLANDS

A. Restraint devices for mechanical joint fittings and appurtenances conforming to either ANSI/WWAWA C111/A21.11 or ANSI/WWAWA C153/A21.53, shall conform to the following:

1. Restraint devices for nominal pipe sizes 75 mm (3 inch) through 900 mm (36 inch) shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/WWAWA C110/A21.10.

2. The devices shall have a working pressure rating equal to that of the pipe on which it is used. Ratings are for water pressure and must include a minimum safety factor of 2:1 in all sizes.

3. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN.

4. An identification number consisting of year, day, plant and shift (YYDDD) (plant designation) (Shift number), shall be cast into each gland body. All physical and chemical test results shall be recorded.
such that they can be accessed via the identification number on the casting. All components shall be manufactured in the United States.

5. Mechanical Joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.

6. MJ restraints shall be listed by Underwriters Laboratories, and approved by Factory Mutual in the 75 mm (3 inch) through 300 mm (12 inch) sizes.

7. All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.

### 2.4 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. Fittings for compression-type joint, ASME B16.26, flared tube type.

*SPEC WRITER NOTESS:*
Modify and/or delete the following paragraphs based upon the valve types applicable for the project.

### 2.5 VALVES

A. Gate:

1. Unless otherwise specified, valves shall conform to AWWA C509 with mechanical-joint ends. Valves 75 mm (3 inches) and larger shall be resilient seated, ductile iron body, bronze mounted inclined seats, non-rising stem type, turning counter-clockwise to open, with a minimum 1375 kPa (200 pound) WOG. The resilient seat shall be fastened to the gate with stainless steel fasteners or vulcanizing methods. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550. Stuffing boxes shall have O-ring stem seals. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. Asbestos packing is not allowed.

2. Operator:
   a. Underground: Except for use with post indicators, furnish valves with 50 mm (2 inch) nut for socket wrench operation.
   b. Above Ground and in Pits: Hand wheels.
3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed.

B. Check Valve: Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 2 inches and larger shall be [outside lever and spring] [outside lever and weight] [_____] type.

1. Smaller than 100 mm (4 inches): Bronze body and bonnet, ASTM B61 or B62, 1375 kPa (200 pound) WOG.

2. 100 mm (4 inches) and Larger: Iron body, bronze trim, swing type, vertical or horizontal installation, flange connection, 1375 kPa (200 pound) WOG. Check valves for fire lines shall conform to AWWA C508 and shall be epoxy coated and lined per AWWA C550.

C. Corporation stops and saddles - Ground key type; bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.

D. Curb or Service Stops - Ground key, round way, inverted key type; made of bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow. 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.

D. Vacuum and Air Relief Valves - Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float. Valves shall be rated for the same operating pressure as the pipeline.

E. Pressure Reducing Valves - Pressure reducing valves shall maintain a constant downstream pressure regardless of fluctuations in demand. Valves shall be suitable for [_____] psi operating pressure on the inlet
side, with outlet pressure set for [_____] psi. The valves shall be of the hydraulically-operated, pilot controlled, globe or angle type, and may be actuated either by diaphragm or piston. The pilot control shall be the diaphragm-operated, adjustable, spring-loaded type, designed to permit flow when controlling pressure exceeds the spring setting. Ends shall be [threaded] [flanged]. Valve bodies shall be bronze, cast iron or cast steel with bronze trim. Valve stem shall be stainless steel. Valve discs and diaphragms shall be synthetic rubber. Valve seats shall be bronze. Pilot controls shall be bronze with stainless steel working parts.

SPEC WRITER NOTES:
The following two spec paragraphs shall be modified or deleted, as applicable based upon the project conditions. The final water utility pipe installation shall be locatable by the NCA staff with appropriate locating equipment, and the warning detection tape shall be present when excavating down on top of the water utility pipeline or appurtenances.

2.6 TRACER WIRE FOR NONMETALLIC PIPING
Provide bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe.

2.7 WARNING TAPE
Standard, 4-Mil polyethylene 75 mm (3 inch) wide tape, // detectable // non-detectable // type, blue with black letters, and imprinted with “CAUTION BURIED WATER LINE BELOW”.

SPEC WRITER NOTES: Modify or delete the following paragraph according to the project conditions. For existing NCA facilities, the Spec Writer shall determine if the NCA has suitable equipment for the purposes of utility location, and if not, or if the equipment doesn’t perform the required location capabilities, revise this paragraph and those in Part 3 to require that the Contractor provide appropriate location equipment.

//2.8 LOCATOR EQUIPMENT
Contractor shall provide location equipment (device and appurtenances) suitable for locating tracer wire and/or detectable warning tape placed above water utility lines at the actual depths for this project. The locator device shall be capable of locating the detectable warning tape from above the tape, without making physical contact with the detectable warning tape. Before acceptance, the equipment, shall be demonstrated.
at various locations and conditions for the project to confirm the functionality for its intended purpose. The intended purpose of the locating equipment is to allow the NCA staff to field locate the water utility lines for the project where the line locations are designated by placement of detectable warning tape above the lines, or by placement of tracer wire on the pipes.//

2.9 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.

2.10 VALVE BOX

SPEC WRITER NOTES:
Indicate how many "T" handles are to be provided by the Contractor, it is recommended that a minimum of two be provided.

Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover. Provide [ ] "T" handle socket wrenches of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box. The least diameter of the shaft of the box shall be 133 mm (5 1/4 inches). Cast-iron box shall have a heavy coat of bituminous paint. Valve box and cover shall be installed where indicated on the drawings to be utilized as access points for the tracer wire or detectable warning tape.

2.11 POST INDICATOR VALVE

A. Valve: Valve shall conform to the specifications listed in Section 2.4 for gate valves. The Post Indicator shall conform to NFPA 24, and shall be fully compatible with the valve and all the supervisory switches.

2.12 FIRE HYDRANTS

A. Size of main valve opening of each hydrant shall be 125 mm (5 inches), minimum. Hose thread, size of fire apparatus connection, and shape, size and direction of rotation of operating head of hydrant shall be identical with // present local fire department and/or water department standards // those in use at the facility//.

B. Hydrant shall be type AWWA C502, heavy construction, of proper length to connect pipe without extra fittings, and shall be the traffic type with
safety flange on barrel and safety couplings on the valve stem with the following features:

1. Interior removable without digging up hydrant; can be packed under pressure; 150 mm (6 inch) bell connection; one steamer nozzle and two hose nozzles with nozzle caps securely chained to barrel; suitable drainage device; single rubber or leather-faced valve in base; nozzles, stuffing boxes, wedge nuts, seat rings, clamp plates, etc. Threaded joints or spindles shall be bronze. Upper and lower barrels shall be of equal diameters. Upper barrel shall be of sufficient length to permit setting hydrant with barrel flange not more than 50 mm (2 inches) above finished grade. All fire hydrants shall have 150 mm (6 inch) bottom connection.

2. Provide fire hydrants with a finish paint identical to the existing fire hydrants. If there are no existing hydrants, contact the nearest fire department responder (fire department) for appropriate color.

SPEC WRITER NOTES:
Indicate how many operating wrenches are to be provided by Contractor. It is recommended that 2 be the minimum number.

C. Provide _____ wrenches with handles not less than 350 mm (14 inches) long.

2.13 TAPPING SLEEVES

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, stainless steel or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 1034 kPa [(150)] psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pre-torqued to 68 joules (50 foot-pounds).

SPEC WRITER NOTES:
Modify the following to make pipe sleeves under roadways to be in compliance with the local State Department of Transportation standards, or for a selected local town, or specify on the
drawings the size, material, thickness, length, etc.

2.14 PIPE SLEEVES

Ductile iron or zinc coated steel.

2.15 SLEEVE-TYPE MECHANICAL COUPLINGS

A. Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. [For [ductile iron] [and] [PVC plastic] pipe, the middle ring shall be of cast-iron [or steel; and the follower rings shall be of malleable or ductile iron].] [For steel piping, the middle ring shall be of steel and the follower rings shall be of steel or malleable iron.] [Cast iron, ASTM A 48/A 48M not less than Class 25.] Malleable and ductile iron shall, conform to ASTM A 47/A 47M and ASTM A 536, respectively. [Steel shall have a strength not less than that of the pipe.] Gaskets shall be designed for resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Bolts shall be track-head type, ASTM A 307, Grade A, with nuts, ASTM A 563, Grade A; or round-head square-neck type bolts, ASME B18.5.2.1M and ASME B18.5.2.2M with hex nuts, ASME B18.2.2. Bolts shall be 16mm (5/8 inch) in diameter; minimum number of bolts for each coupling shall be [_____] [for [_____] mm (inch) pipe [, [_____] for [_____] mm (inch) pipe,] [and] [_____] for [_____] mm (inch) pipe]. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Mechanically coupled joints using a sleeve-type mechanical coupling shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Mechanical couplings shall provide a tight flexible joint under all reasonable conditions, such as pipe movements caused by expansion, contraction, slight setting or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Couplings shall be of strength not less than the adjoining pipeline.

2.16 BACKFLOW PREVENTER
A. Potable Water and Irrigation Water Service: Reduced Pressure Principle
   Type AWWA C511, except pressure drop at rated flow shall not exceed 100
   kPa (15 psi). Gate valves installed on the assembly shall be resilient
   seated valve conforming to AWWA C509.
C. In cold climate areas, backflow assemblies and devices shall be
   protected from freezing by a method acceptable to local jurisdiction.
D. 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.
E. Backflow preventer shall not be located in any area containing fumes
   that are toxic, poisonous or corrosive.
F. Direct connections between potable water piping and sewer connected
   wastes shall not exist under any condition with or without backflow
   protection.
G. Backflow preventer shall be accessed and have clearance for the required
   testing, maintenance and repair. Access and clearance shall require a
   minimum of 300 mm (one foot) between the lowest portion of the assembly
   and grade, floor or platform. Installations elevated more than 1500 mm
   (5 feet) above the floor or grade shall be provided with a permanent
   platform capable of supporting a tester or maintenance person.

   SPEC WRITER NOTES: Retain applicable
   following Water Meter paragraph and modify
   to include the name of the Water Service
   Utility, and the flow rate parameters for
   sizing the flow meter, as applicable:

   //2.17 WATER METER

   SPEC WRITER NOTES: Modify the following
   and provide flow rate information for
   sizing the meter. Select the appropriate
   paragraph 1 and modify as required.

A. Furnished and set by Contractor for use by Owner. Meter shall be a:
   //1. Turbine type Meters
   Shall conform to AWWA C701 [Class I] [Class II]. The main casing
   shall be bronze with stainless steel external fasteners. Registers
   shall be straight-reading type, shall be permanently sealed and shall
   read in [liters] [cubic meters] [(U.S. gallons)] [(cubic feet)].
   Connections shall be suitable to the type of pipe and conditions
   encountered. Register type shall be a direct reading remote register
   designed in accordance with AWWA C706. Meters shall comply with the
   accuracy and capacity requirements of AWWA C701.
   //1. Displacement Type Meters
Shall conform to AWWA C700. Registers shall be straight-reading and shall read in [liters] [cubic meters] [(U.S. gallon)] [(cubic feet)]. Meters in sizes 13 mm through 25mm (1/2" through 1") [shall] [shall not] be frost-protection design. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be [a direct reading remote register designed in accordance with AWWA C706] [or] [an encoder type remote register designed in accordance with AWWA C707]. Meters shall comply with the accuracy and capacity requirements of AWWA C700. //

//1. Compound Type Meters
Shall conform to AWWA C702 and [shall] [shall not] be furnished with strainers. The main casing shall be [bronze] [cast iron protected by corrosion resistant coating] with stainless steel external fasteners. The main casing shall be tapped for field testing purposes. Registers shall be straight-reading type, shall be [permanently sealed] [open] and shall read in [liters] [cubic meters] [(U.S. gallons)] [(cubic feet)]. The meter [shall] [shall not] be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be [a direct reading remote register designed in accordance with AWWA C706] [or] [an encoder type remote register designed in accordance with AWWA C707]. Meters shall comply with the accuracy and capacity requirements of AWWA C702. //

//2.17 WATER METER
Furnished and set by Water Service Utility. //

//2.17 WATER METER
Furnished by Water Service Utility and installed by Contractor. //

//2.17 WATER METER
Furnish and install meter approved by Water Service Utility. Forward approval. //

SPEC WRITER NOTES: Modify the paragraph for vaults to include compliance with the local water purveyor’s standards, if applicable. Whenever possible, install meters and backflow devices inside of buildings. Next choice for backflow devices is in above ground locations, especially where weather conditions allow.

2.18 VAULTS (BACKFLOW PREVENTER OR METER)
A Large meters and/or backflow preventer assemblies to be installed underground shall be installed in precast reinforced concrete vaults manufactured in accordance with Section 03 40 00.00 10 PLANT-PRECAST
CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION. Large meters and/or backflow preventer assemblies shall be installed in reinforced concrete vaults in accordance with the details shown on the drawings.

SPEC WRITER NOTES: Modify the cover assemblies for large meter and/or backflow preventer assemblies in underground vaults, when applicable, to require suitable hatches for access to the vault rather than manholes, whenever possible.

2.19 CAST IRON FRAME AND COVER, STEPS, ETC.
Frames and covers - shall be cast iron or ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 180 Kg (400 lbs.). The word "Water" shall be stamped or cast into covers so that it is plainly visible.
Manhole Steps - Plastic or rubber coated, pressure-molded to the steel. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

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

2.21 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 5g tablets, and shall contain 65 percent chlorine by weight.

2.22 LINK/SLEEVE SEALS
A. Manufacturers shall submit detailed drawings of their proposed equipment and suitable evidence of a minimum of 25 years of experience in producing modular seal assemblies meeting these specifications, for pipe penetrations.
B. The modular seal assemblies shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per the manufacturer’s recommendations and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for
positive field inspection. Each link shall have a permanent identification of the size and manufacturer’s name molded into it.

1. For Standard Service Applications:
   EPDM = ASTM D2000 M3 BA510, Color = Black
2. For Hydrocarbon Service Applications
   Nitrile = ASTM D2000 M1BF510, Color = Green
3. For High Temperature of Fire Seal Applications
   Silicone = ASTM D2000 M1GE505, Color = Gray
4. References shall always be made to the latest published seal selection guide for the service intended, from the manufacturer.

C. The modular seal hardware for fastening the links shall be sized according to the latest modular seal technical data of the manufacturer. Bolts, flange hex nuts shall be:

SPEC WRITER NOTES:
SPEC WRITER shall generally select the first “Paragraph a.” for conditions where the presence of groundwater on the outside of the penetration is not anticipated, and should select the second “Paragraph a.” for conditions where groundwater, or other standing water, is anticipated on the outside of the penetration. The second “Paragraph a.” should be selected for any other conditions where the designer has concerns of long term corrosion of the fastners.

a. Mild Steel with a 415 MPa (60,000 psi) minimum tensile strength and 2-part Zinc Dichromate coating per ASTM B633 and Organic Coating, tested in accordance with ASTM B117 to pass a 1,470 hour salt spray test.

a. 316 Stainless Steel per ASTM F593, with a 585 MPa (85,000 psi) average tensile strength

D. Quality Assurance – Manufacturer’s modular seal components and systems shall be domestically manufactured at a plant with a current ISO-9002 registration. Copy of the ISO-9002 registrations shall be provided with the submittal for these items.

SPEC WRITER NOTES:
Determine the appropriate Wall Opening (i.e. steel sleeve, Thermoplastic (HDPE) sleeve, cored hole or formed hole.) The wall opening size and/or type shall be selected according to recommendations found in the most recent modular seal catalog of the manufacturer. For openings that require water stops use the following:
E. Water Stop Wall Sleeve – Unless otherwise shown or specified, install molded non-metallic high density polyethylene sleeves which shall have integrally formed hollow water stop sized having a minimum of four inches larger than the outside diameter of the sleeve itself and allowing ½ movement between wall forms to resist pour forces. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve itself and installed at each end of the sleeve so as to prevent deformation during the initial concrete pour, and to facilitate attaching the sleeve to the wall forms. End caps shall remain in place to protect the opening from residual debris and rodent entry prior to pipe insertion. The above described wall sleeve shall be manufactured by the same company as the modular seal assembly. 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 or any other applicable water system facilities 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 recommended by the manufacturer to maintain the product performance as if it were undamaged.

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 installed on underground pipe shall be anchored. See Section 3.8 “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.

SPEC WRITER NOTES: Coorinate and modify this paragraph with the other paragraphs where warning tape, identification wire and Locator Equipment are described.

M. Warning tape shall be continuously placed 300 mm (12 inches) below finish grade above buried water pipes, or at bottom of subbase where roadways exist, whichever is deeper with overall depth not exceeding 24 inches. Detectable warning tape shall be locatable by the NCA staff from the finish grade above the pipe, utilizing existing locating equipment, or the approved locator equipment provided by the Contractor to the Owner (NCA Staff) as specified in Paragraph 2.8.

3.4 DUCTILE IRON PIPE

SPEC WRITER NOTES: Modify the following paragraph based upon testing of the soils. If soils are determined to be corrosive when tested in accordance with Appendix A of ANSI/AWWA C105/A21.5, then it is recommended that polyethylene encasement in accordance with the AWWA C105 standard be installed for corrosion protection. Adjust the following paragraph accordingly.

A. Installing Pipe: Lay pipe in accordance with AWWA C600 //with polyethylene encasement, if required, in accordance with AWWA C105//.

WATER UTILITIES
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Provide a firm even bearing throughout the length of the pipe by tamping selected material at the sides of the pipe up to the spring line.

B. All pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.

SPEC WRITER NOTES:
Modify the following paragraph to select the allowable procedure(s) for cutting the pipe in the field.

C. When cutting pipe is required, the cutting shall be done by

//machine,//an appropriate industry standard method// leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged//or perform cutting following manufacturer’s recommendations for field cutting of pipe//.

D. Jointing Ductile-Iron Pipe:

1. Push-on joints shall be made in strict accordance with the manufacturer’s instruction. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is joined, and pushed home following industry standard procedures or manufacturer’s approved means.

2. Mechanical Joints at Valves, Fittings: Install in strict accordance with AWWA C111. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gaskets with soapy water before tightening the bolts. Bolts shall be tightened to the specified torque. For new construction, all mechanical joints at valves and fittings shall be secured with an approved mechanical joint retainer glands suitable for the pipe.

3. Ball Joints: Install in strict accordance with the manufacturer’s instructions. Where ball joint assemblies occur at the face of structures, the socket end shall be at the structure and ball end assembled to the socket.

4. Flanged joints shall be in accordance with AWWA C115. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

3.5 PVC PIPEA.

A. PVC piping shall be installed in strict accordance with the manufacturer’s instructions and AWWA 605. Place selected material and
thoroughly compacted to one foot above the top of the pipe and thereafter back filled as specified in Section 31 20 00, EARTH MOVING.

SPEC WRITER NOTES: Modify or delete the following paragraph for the project conditions and coordinate with the other paragraphs for tracer wire, warning tape, and locator equipment in this section.

B. Copper Tracer Wire: Copper tracer wire consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.

SPEC WRITER NOTES: Modify the following according to the project conditions and coordinate with the other paragraphs regarding identification wire, warning tape and locator equipment in this section.

3.6 TRACER SYSTEM INSTALLATION

A. Install with all buried water main piping.
B. Begin and terminate system at all connections to existing mains.
C. Install wire continuously along the lower quadrant of the pipe. Do not install wire along the bottom of the pipe. Attach wire to the pipe at the midpoint of each pipe length; use 2-inch wide, 10 mil thickness polyethylene pressure sensitive tape.
D. Install splices only as authorized by the Jurisdictional Engineer. Allow the Jurisdictional Engineer to inspect all below-grade splices of tracer wire prior to backfill.
E. Install ground rods adjacent to connections to existing piping and at locations shown on plans specified in the contract documents or as directed by the Jurisdictional Engineer.
F. Bring two wires to the surface at each hydrant designated location within a valve box and cover and terminate with an accessible tracer wire termination.
G. Final inspection of the tracer system will be conducted at the completion of the project and prior to acceptance by the owner. Verify the electrical continuity of the system. Repair any discontinuities.

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3.7 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.

3.8 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.

3.9 RESTRAINED JOINTS

A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained “locked-type” joints and the joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 1375 kPa (200 psi). The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.

B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be as shown on the drawings.
C. Restrained joint assemblies with ductile iron mechanical joint pipe shall be as specified herein in Paragraph 2.3 or approved equal.

D. Thrust blocks shall be required, unless otherwise noted.

E. Where ductile iron pipe manufactured with restrained joints is utilized, all restrained joints shall be fully extended and engaged prior to back filling the trench and pressurizing the pipe.

F. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with the specified Mechanical Joint Restrainer Gland, or approved equal.

3.10 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);
      b. The water main invert is at least 450 mm (18 inches) above the crown of the 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 450 mm (18 inches) above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. 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. Both the water main and sewer shall be constructed of slip-on or mechanical joint ductile iron pipe or PVC pipe equivalent to water main standards of construction when:
   a. It is impossible to obtain the proper vertical separations described in (1) above; or
   b. The water main passes under a sewer or drain.
3. A vertical separation of 450 mm (18 inches) between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.
4. 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).

3.11 SETTING OF VALVES AND BOXES
   A. Provide a surface concrete pad 450 by 450 by 150 mm (18 by 18 by 6 inches) to protect valve box when valve is not located below pavement.
   B. Clean valve and curb stops interior before installation.
   C. Set valve and curb stop box cover flush with finished grade.
   D. Set curb stop box and cover for access to identification wire and/or detectable warning tape with a 300 by 300 by 75 mm (12 by 12 by 3 inches) at approximately the depth of the warning tape and bring the tape and/or identification wire into the box and coil extra length sufficient to allow the tape or wire to be uncoiled and extended 1500 mm (5 feet) above finish grade at the location.
   E. Valves shall be installed plumb and level and in accordance with manufacturer’s recommendations.

3.12 SETTING OF FIRE HYDRANTS
   A. Set center of each hydrant not less than 600 mm (2 feet) nor more than 1800 mm (6 feet) back of edge of road or face of curb. Fire apparatus connection shall face road with center of nozzle 450 mm (18 inches) above finished grade. Set barrel flange not more than 50 mm (2 inches) above finished grade.
   B. Set each hydrant on a slab of stone or concrete not less than 100 mm (4 inches) thick and 375 mm (15 inches) square. The service line to the hydrant, between the tee and the shoe of the hydrant, shall be fully restrained.
   C. Set bases in not less than 0.4 cubic meter (1/2 cubic yard) of crushed rock or gravel placed entirely below hydrant drainage device.
   D. Clean interiors of hydrants of all foreign matter before installation.

3.13 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.

SPEC WRITER NOTES: Edit the following section to conform with governing Health Department/Department of Environment Quality Regulations.

3.14 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 275kPa (40 psi) residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line.

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Flow Required to Produce 76 cm/sec (2.5 ft/sec) (approx.) Velocity in Main</th>
<th>Number of Hydrant Outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of Tap. mm (in.)</td>
<td>25 (1)</td>
<td>38 (1 1/2)</td>
</tr>
<tr>
<td>mm (In)</td>
<td>L/sec (gpm)</td>
<td>Number of Taps on Pipe</td>
</tr>
<tr>
<td>100 (4)</td>
<td>6.3 (100)</td>
<td>1 -- -- 1</td>
</tr>
<tr>
<td>150 (6)</td>
<td>12.6 (200)</td>
<td>-- 1 -- 1</td>
</tr>
<tr>
<td>200 (8)</td>
<td>25.2 (400)</td>
<td>-- 2 1 1</td>
</tr>
<tr>
<td>250 (10)</td>
<td>37.9 (600)</td>
<td>-- 3 2 1</td>
</tr>
<tr>
<td>300 (12)</td>
<td>56.8 (900)</td>
<td>-- -- 3 2</td>
</tr>
<tr>
<td>400 (16)</td>
<td>100.9 (1600)</td>
<td>-- -- 4 2</td>
</tr>
</tbody>
</table>

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 / Department of Environmental Quality / 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.

3.15 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.

SPEC WRITER NOTES: Modify the pressure and leakage test pressure readings, as applicable to meet or exceed the requirements of the local water purveyor, or use 1.5 times the operating pressure for the water main, whichever is larger, and if no other information is available, use the value in the paragraph.
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. Polyvinyl Chloride (PVC) AWWA C605.Provide to Resident Engineer office.

3.16 BACKFLOW PREVENTOR TESTING
A. All backflow preventers shall be installed, tested and certified for proper operation, prior to being placed in operation.
B. Original copies of the certification shall be submitted to the Resident Engineer.