

SPECIAL PROVISION

WATER MAIN INSTALLATION

Description

1.1 General Description of Work. The purpose of this work is to install _____ (X-inch "type") water line that will connect to the existing _____ (X-inch "type") water line. The CONTRACTOR is responsible for furnishing, installing and removing temporary water systems and furnished and installing the new water mains and appurtenances in accordance with the water main plans and as specified herein or as ordered by the ENGINEER.

1.1.1 _____ ("CONTRACTOR'S NAME") or its Designated Agent, hereinafter called CONTRACTOR, together with the ENGINEER and the OWNER, will inspect, accept and/or reject work related to the water main herein specified.

1.1.2 The CONTRACTOR shall furnish all materials, labor, tools and equipment, and perform all operations, testing, and incidentals necessary for a complete operating water main installation, as outlined herein and on the plans and setting up and maintaining a temporary water system to maintain water service at all times, except for authorized shutdowns approved by the North Conway Water Precinct.

1.2 Sequence/Maintenance of Service. The CONTRACTOR is responsible for maintaining continuous water service to affected customers via a temporary water system, except when construction requires an interruption of water service. A service interruption may last for a maximum of six hours. The CONTRACTOR must obtain written approval from the OWNER prior to interruption of water service to affected water users. The OWNER requires that a written notice be sent to all water customers 48 hours in advance of the scheduled shutdown. The OWNER will provide written notification, but it is the CONTRACTOR's responsibility to establish and address needs and coordinate with the ENGINEER and the OWNER.

1.3 Reference Drawings and Information. The OWNER does not guarantee the accuracy or completeness of existing conditions shown on the project construction plans for this water main work. Sufficient investigations shall be made by the CONTRACTOR so that the CONTRACTOR is knowledgeable of existing conditions prior to tendering a bid.

Materials

2.1 The CONTRACTOR shall provide the following material for the installation of the water mains, services, and appurtenances.

2.1.1 Common Backfill. Common backfill shall be granular material, consisting of hard sand and gravel so graded that, of the material passing the No. 4 (4.75 mm) sieve, not more than 35 percent shall pass the No. 200 (0.075 mm) sieve. Common backfill shall be free of organic matter, trash, roots or other deleterious material and shall contain no stone measuring greater in any dimension than two-thirds of the loose lift thickness or 8 inches (200 mm), whichever is smaller. Common backfill shall be capable of forming a firm, stable base when spread and compacted in accordance with this specification. In addition, common backfill shall be non-plastic (plasticity index zero, defined as liquid limit minus plastic limit). Common backfill may be obtained from either on-site excavations or off-site sources. Any materials excavated from the trench not conforming to this specification shall be disposed of as specified and replaced with approved material, as required, at no additional cost to the OWNER.

2.1.2 Sand Bedding and Blanket. Sand bedding and blanket material required for installation of the water mains, services, and appurtenances shall meet the following gradation requirements, 100 percent passing the ½-inch (12.5 mm) sieve and, of the material passing the #4 (4.75 mm) sieve, no more than twelve percent shall pass the #200 (0.075 mm) sieve.

2.1.3 Gravel Fill. Gravel fill shall consist of hard, durable gravel free from trash, organic matter, clay, surface coatings, and other deleterious materials. Gravel fill shall have a maximum stone size of two-thirds of the loose lift
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thickness or 6 inches, whichever is smaller. That portion passing the 4-inch (100 mm) sieve shall meet the following gradation requirements, as determined by ASTM C 136 and ASTM C 117:

<u>Sieve Size</u>	<u>Percent Passing</u>
6-inch (150 mm)	100
No. 4 (4.75 mm)	25-70
No. 200 (0.075 mm) *	0-12

* Based on fraction passing the No. 4 (4.75 mm) sieve.

2.1.3.1 When approved by the OWNER, gravel fill used for pipe bedding shall have a maximum stone size of 1 ½-inches (37.5 mm).

2.1.4 Crushed Gravel. Crushed gravel shall consist of hard durable sand and gravel, free from trash, organic matter, clay, surface coatings, and other deleterious materials. Crushed gravel material shall meet the following gradation requirements, as determined by ASTM C 136 and ASTM C 117:

<u>Sieve Size</u>	<u>Percent Passing</u>
3-inch (75 mm)	100
2-inch (50 mm)	95-100
1-inch (25 mm)	55-85
No. 4 (4.75 mm)	27-52
No. 200 (0.075 mm)*	0-12

* Based on fraction passing the No. 4 (4.75 mm) sieve.

2.2 Water Mains and Appurtenances. All products and materials shall conform to the latest appropriate section of the American Water Work Association (AWWA) and the American National Standards Institute (ANSI) standards and as otherwise specified hereinafter.

2.2.1 Ductile Iron Water Main Pipe.

2.2.1.1 Class 54 push-on type ductile iron water pipe - Water pipe for temporary and permanent systems shall be ductile iron complying with ANSI A21.51 and AWWA C 151, Class 54. Pipe shall be double cement-lined 1/8" (3 mm) thick and seal coated inside and out in accordance with ANSI A21.4 and AWWA C 104. Pipe shall be polyethylene wrapped according to ANSI A21.5/AWWA C105 standards. Joints shall be Tyton rubber gasket, push-on type in accordance with ANSI A21.11 and AWWA C 111. Only use a lubricant that is specified by the pipe manufacturer. Pipe shall be manufactured in United States or Canada.

2.2.1.2 Mechanical Joint Ductile Iron Pipe for use on bridge crossings shall conform to ANSI A21.51/AWWA C 151 Class 54. Mechanical joint fittings shall be ductile iron conforming to ANSI A21.10/AWWA C 110. Pipe and fitting joint shall meet ANSI A21.11/AWWA C 111 standards and shall include plain rubber gaskets. Pipe and fittings shall be double cement lined and seal coated inside and outside in accordance with ANSI A21.4/AWWA C 104. All pipe and fittings shall be furnished with ductile iron retainer glands. Pipe shall be manufactured in United States or Canada.

2.2.1.3 All push on joint connections before and after all fittings and valves shall be made with a "Field Loc" Gasket.

2.2.2 Brass Wedges. Two (2) brass wedges shall be installed in all push-on type joints to provide electrical conductivity between pipe lengths.

2.2.3 Ductile Iron Fittings. Ductile iron fittings shall be a mechanical joint type with a 350 psi (2.40 Mpa) pressure rating in accordance with ANSI A21.10 and AWWA C 110. Fittings shall be fusion-bonded epoxy coated inside and out in accordance with ANSI A21.416 and AWWA C 116. Fitting shall be Tyler or approved equal. See paragraph 2.3 for thrust restraint.

2.2.4 Mechanical Joint Restraining Devices. Mechanical joint restraining devices shall be used with all mechanical joints. Glands shall be manufactured of ductile iron conforming to ASTM A 536. The ring shall be grade 65-45-12 ductile iron in accordance with ASTM A 536. M.J. restraining devices shall be "Grip-Ring" as manufactured by Romac or approved equal.

2.2.5 Couplings. Couplings shall be mechanical joint ductile iron solid sleeve type meeting the requirements stated above for ductile iron fittings.

2.2.6 Gate Valves. Gate valves shall be in accordance with AWWA C 509. Gate valves shall be a resilient-wedge type with a non-rising bronze stem, 2-inch (50 mm) AWWA operating nut and fusion bonded epoxy coated both inside and out. Gate valves shall have mechanical joints as specified above. The valves shall be American Flow Control - 2500 or approved equal. Valves shall open left.

2.2.7 Butterfly Valves. Butterfly valves shall be in accordance with AWWA C 504. Butterfly valves shall be used for size 18-inch (450 mm) and above. The valves shall be Henry Pratt Co. 'Groundhog', Dresser 450BF, or Allis-Chambers 'Steamseal'.

2.2.8 Valve Boxes. Valve boxes shall be heavy pattern cast iron, two-piece, slip type, 5-inch (125 mm) shaft, with extension pieces sufficient to allow proper cover. The upper section of the box shall be a top-flange type to prevent settlement. The lower section shall be a belled type to enclose the operating nut of the valve. The cover shall be cast iron with the word "WATER" plainly cast thereon. Valve boxes shall be BUFFALO, TYLER, or approved equal.

2.2.9 Hydrants and Appurtenances.

2.2.9.1 Hydrants shall be in accordance with AWWA C 502, and all addenda thereto. Hydrants shall be equipped with 5¼-inch (135 mm) main valves, as sized by seat ring internal opening, plugged drain holes, 6-inch pipe connection, one 4½-inch (115 mm) National Standard pumper connection and two 2½-inch (65 mm) hose connections. Each hydrant shall be equipped with a gate valve on the branch line connected directly to an anchor tee for new construction, or tapping sleeve, for an existing main on the main line as specified herein. Hydrants shall include breakaway flange. Hydrant drain hole shall be open except for cases where drain plug is located below seasonal high water table. Minimum burial depth shall be 6 feet.

2.2.9.2 Hydrants shall open left.

2.2.9.3 For purposes of standardization, hydrants shall be Waterous Pacer or Kennedy K81. Hydrants shall have been manufactured no earlier than one year prior to installation. Hydrants shall be thoroughly cleaned and given two shop coats of paint in accordance with AWWA Specification C 502. Paint color shall be red.

2.2.9.4 If the paint coating on any hydrant is damaged during shipping or installation, the CONTRACTOR shall touch-up paint the hydrants in accordance with AWWA Specification C 502.

2.2.10 Corporation Stops. Corporation stops shall be ball valve type with a PTFE coated brass ball, CC (AWWA tapered) threads, double O-ring seal, blow-out proof stem design, and compression-type outlet connection with a grip joint. Corporation stops shall be Ford or approved equal and meet or exceed AWWA C800. All service brass must meet or exceed current "Lead Free" standards.

2.2.11 Service Saddles. Service saddles shall be required for corporation stops in accordance with paragraph 3.7 herein. Service saddles shall be double strap type with 360-degree contact on the main. The body

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shall be constructed of nylon-coated ductile iron and the straps shall be stainless steel. Service saddles shall be Ford or approved equal and meet or exceed AWWA C800. All service brass must meet or exceed current "Lead Free" standards.

2.2.12 Service Pipes. Service pipes for house services and chlorine injection points shall be Type "K" copper tubing conforming to ASTM B 88 or DR9 copper tube size polyethylene pipe conforming to AWWA C901 with a minimum working pressure of 250 psi. Pipe color shall be blue. The name of trademark of the manufacturer and type shall be stamped at intervals along the pipe.

2.2.12.1 Connections for polyethylene pipe shall be compression type fittings with stainless steel stiffener inserts.

2.2.12.2 Metallic detectable warning tape shall be buried 12 to 24 inches below grade for the entire length of polyethylene service pipe.

2.2.13 Curb Stops. Curb stops shall be ball valve type with a PTFE coated brass ball, CC (AWWA tapered) threads, double O-ring seal, blow-out proof stem design, and compression-type outlet connection with a grip joint. Curb stops shall be Ford or approved equal and meet or exceed AWWA C800. Only seasonal services (cemeteries, shallow-bury irrigation, etc) shall be allowed to have a drain port. All other curb stops shall not have a drain port. All service brass must meet or exceed current "Lead Free" standards.

2.2.14 Curb Boxes. Curb boxes shall be adjustable in lengths consistent with pipe depths. Curb boxes shall be ERIE style with a ½-inch by 36-inch (12.5 mm x 900 mm) stainless steel rod and plug type cover and meet or exceed AWWA C800.

2.2.15 Service Pipe Couplings. Services pipe couplings shall be made of brass. Both ends of the coupling shall be compression type with a grip joint. Couplings shall be Ford or approved equal and meet or exceed AWWA C800. Service pipe couplings are not permitted within the public right of way under any circumstances. Service pipe couplings may be allowed by written permission of the Superintendent on private property after the curb stop on a case-by-case basis. All service brass must meet or exceed current "Lead Free" standards.

2.2.16 Temporary Water Main and Fittings. Temporary water main and fittings shall be ductile iron as specified in paragraph 2.2.1.1 above or butt-fused HDPE.

2.2.17 Temporary Service Pipe and Fittings. Temporary service pipe and fittings shall be as specified in paragraphs 2.2.10, 2.2.11, 2.2.12, 2.2.13, and 2.2.14, or butt-fused HDPE with MJ adaptors for fittings and valves.

2.3 Thrust Blocks. Concrete for thrust restraint shall be Class B in accordance with Section 520.

2.4 Insulation. Trench insulation shall be rigid extruded polystyrene 8 feet long, 2 feet wide and 4 inches thick (2.45 m long, 0.6 m wide, 50 mm thick,) having an R-value of 10 and conforming to ASTM C 578, Type VII, and shall be STYROFOAM HI-60 as manufactured by Dow Corning Chemical Co. or approved equal.

2.5 Casing Pipes. Casing pipe for highway crossing shall be steel and shall be in accordance with AP1 STD.5L, Grade B, X-42, ASTM A 139.

2.5.1 Casing Pipes:

Description	150 mm (6 inches) Carrier Pipe
Nominal Casing Size	24 inches (600 mm)
Outside Diameter	24 inches (600 mm)
Wall Thickness (min)	0.375 inches (9.52 mm)
Weight per Foot (min)	94.62 #/ft (141 kg/m)
Yield Strength (min)	35,000 psi (241 Mpa)
Type of Joint	Butt Welded
Type of Coating	None

2.5.2 Tolerance. Out-of-round tolerance shall not exceed ½ inches (12.5 mm).

2.5.3 Pipe Spacers. Pipe spacers shall be a two-piece 14-gauge (1.90 mm) T-304 stainless steel assembly with stainless steel bolts. Assembly shall be the restrained positioning type. The runners shall be an ultra-high molecular weight polymer with a maximum coefficient of friction 0.12. The assembly shell liner shall be 0.090 inches (2.3 mm) ribbed PVC with 85-90 durometer. Spacer assembly shall be as manufactured by Cascade Waterworks MFG. Co. or approved equal.

2.5.4 Carrier Pipes. Carrier pipes shall be mechanical joint ductile iron per paragraph 2.2.2.

2.5.5 Bulkhead Materials. Bulkhead materials shall be one of the following: (see plan for type).

2.5.5.1 Brick and Mortar. Brick for bulkheads shall be sound, uniformly burned and shall comply with ASTM C 32, Grade SA. Mortar shall consist of one (1) part cement, one-quarter (¼) part lime, and two (2) parts sand. Sand shall comply with ASTM C 144; lime shall comply with ASTM C 207, Type S; cement shall comply with ASTM C 150, Type II.

2.5.5.2 Rubber Seal. Rubber shall have one adhesive side for initial attachment to the pipe. Bonding agent shall seal the two ends of the rubber. Three-quarter-inch stainless steel bands shall secure the rubber seal to the casing and carrier pipes. Rubber seal shall be Model CCES as manufactured by Cascade Waterworks MFG or approved equal.

Construction Requirements

3.1 General. The CONTRACTOR shall furnish all water main pipe, fittings, services and related material and appurtenances, labor, tools and equipment, granular material, and concrete; and perform all operations and incidentals necessary for complete excavation, installation, backfill, and testing as outlined herein and on the plans; and maintain service at all times.

3.1.1 The CONTRACTOR shall be responsible for the layout of the work. The temporary and permanent water mains, service connections and appurtenances shall be built at the locations indicated on the plan to facilitate reconstructing other facilities within this area of the project.

3.1.2 The CONTRACTOR shall be responsible to field locate all existing water services for the purpose of connecting them to the proposed mains. This may involve exploratory test pits of which payment will be made under Item 206.19.

3.1.3 Location of new water services for all lots throughout the project area as part of the new water line will be as determined by the OWNER.

3.1.4 Consequential damages resulting from the CONTRACTOR not locating the facilities as shown on the plan are the responsibility of the CONTRACTOR.

3.1.5 The CONTRACTOR, at the completion of each part of the work, shall furnish the as-built locations of the water main and appurtenances. The as-built locations shall be to an accuracy of plus or minus 0.10 feet (0.03 m) in plan and elevation.

3.1.6 Any deviations from the locations shown on the plans require the OWNER's and the ENGINEER's approval. Any discrepancies with locations shown on the plans will be brought to the ENGINEER's attention and subsequently resolved between the OWNER, the ENGINEER, and the CONTRACTOR.

3.2 Temporary Water System.

3.2.1 Notice. CONTRACTOR shall provide a 48 hour written notice to all water users regarding any disruption in service related to the installation and removal of by-pass and temporary service piping.

3.2.2 Main and Service Locations and Size.

3.2.2.1 The temporary main shall be installed as shown on the Drawings.

3.2.2.2 Services to be connected to the temporary main shall be identified by the CONTRACTOR.

3.2.3 Installation:

3.2.3.1 New temporary services shall be connected to existing service piping and installed in accordance with these specifications. Materials shall be as specified herein and shall include piping, saddles, corporation stops, copper tubing, and compression couplings.

3.2.3.2 The temporary system shall be pressure and leakage tested and disinfected in accordance with applicable AWWA specifications.

3.3 Trench Excavation.

3.3.1 General. Excavation, dewatering, sheeting, and bracing shall be carried out in such a manner as to eliminate any possibility of undermining or disturbing the foundations of any existing structure, utilities or any work previously completed under this contract.

3.3.2 On paved surfaces that will not be resurfaced under this contract, the CONTRACTOR shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are so shaped as to cut or otherwise damage such surfaces during excavation or other phases of the Work.

3.3.3 All lawns, paved surfaces, roadways, and structures which have been damaged or disturbed by the CONTRACTOR's operations outside of the project work areas shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations or as specified on the drawings.

3.3.4 The CONTRACTOR shall provide trench shoring and dewatering, if necessary, to provide a stable and dry trench at all times. The pipe trench must be dewatered to 1-foot 6 inches (0.5 m) below the invert of the new water main pipe. Trench width shall be 2 feet (0.6 m) plus the diameter of the pipe. Cover on pipe shall be a minimum of 5 feet 6 inches (1.7 m). Trench depth shall extend to 6 inches (150 mm) below the invert of the main.

3.3.5 As the excavation approaches pipes, conduits, or other underground structures, digging by conventional trenching machine methods shall be discontinued. Only manual methods of excavating shall be employed around buried utilities.

3.3.6 Prior to doing any work outside the right-of-way line on private property for connection of water services, the CONTRACTOR shall advise the property owner of the work and/or disturbance of the person's property that will be done, and the restoration thereof.

3.3.7 The CONTRACTOR shall maintain utilities, utility services and sewers encountered in the excavation, and repair or replace them to their owner's satisfaction and be responsible for consequential damages thereof.

3.3.8 The CONTRACTOR shall not be compensated for any additional work involved if a utility line, sewer or underground structure is in the trench line above or below the water main, except for common structure excavation if required.

3.3.9 Excavations shall be kept dry until the pipes and appurtenances to be built therein have been completed to such extent that they will not be damaged.

3.3.9.1 Provide, operate and maintain any dewatering system required to lower and control groundwater levels and groundwater hydrostatic pressure during the construction of the Work as required by this Section and the Contract Documents. The CONTRACTOR shall assume full responsibility and expense for the adequacy of the dewatering system with no additional time for the performance.

3.3.9.2 The dewatering system shall be capable of developing an excavated subgrade relieved of any hydrostatic pressure that could cause a decrease in the stability of the excavated subgrade and which will provide the necessary groundwater control for the proper performance required for completion of the Work.

3.3.9.3 Dispose of subsurface water collected in a manner that conforms to all applicable local and state ordinances, statutes and laws.

3.3.9.4 Maintain continual and complete effectiveness of the dewatering system operation to provide a firm, stable, excavated subgrade at all times as required for proper performance of the Work.

3.3.9.5 Provide dewatering necessary to maintain the groundwater table 18 inches (450 mm) below the base of the proposed structure and/or pipe at all times.

3.3.9.6 Erosion Control. Provide adequate protection from erosion from any of the dewatering operations utilized during the course of the construction. Any damage, disruption or interference to newly constructed work or existing properties, buildings, structures, utilities and/or other work resulting directly or indirectly from dewatering operations conducted under this Contract shall be remedied by the CONTRACTOR, at no cost to the OWNER.

3.3.9.7 Treatment of Dewatering Operations Discharges. Provide such additional treatment devices as may be required to meet the provisions of the Contract. This may include the construction of sumps and/or settling basins, stone rip-rap, silt fences or other requirements. The treatment devices shall be later removed and/or filled in with acceptable backfill material, and restored to original conditions once they are no longer needed, at no additional cost to the OWNER.

3.3.10 Over-Excavation. If, in the opinion of the ENGINEER together with the OWNER, the material at or below the depth of the trench is unsuitable for foundation, it shall be removed to such depths as directed by the OWNER and ENGINEER and shall be replaced with Granular Backfill (Sand), conforming to 209.2.1.1 and placed as provided in 209.3.

3.3.11 If the bottom of the excavation is deeper than the depth shown on the drawings, by error of the CONTRACTOR, the condition shall be corrected by refilling to the proper grade with compacted Granular Backfill (sand), conforming to 209.2.1.1. All costs shall be borne by the CONTRACTOR.

3.3.12 Rock and Boulder Excavation. Rock, boulder, and ledge excavation shall be in accordance with "Section 206, Structure Excavation for Pipes and Other Minor Structures."

3.3.13 Excess and Unsuitable Excavation. Excess excavation that will not be used for backfill and unsuitable excavation shall be removed from the site and disposed of by the CONTRACTOR in accordance with local, state or federal regulations.

3.4 Trench Backfill.

3.4.1 General. After the pipe has been placed, inspection by the OWNER and ENGINEER is required prior to backfill.

3.4.2 Bedding. Bedding shall meet the requirements of 2.1.2 and shall extend the full width of the trench from 6 inches (150 mm) below the pipe, to the spring line of the pipe. Compact the bedding material to 95 percent modified proctor (in accordance with ASTM D 157 and ASTM D 2922) prior to the placement of the blanket material.

3.4.2.1 Bedding for overexcavated trenches shall follow the requirements of 3.4.2.

3.4.2.2 Recesses shall be provided in the bedding at pipe bells after compaction and prior to laying the length of pipe to allow the full length of pipe to rest on compacted and/or native, undisturbed soil.

3.4.3 Blanket. Blanket material shall meet the requirements of 2.1.2 and shall be placed from the spring line of the pipe to a minimum of 12 inches (300 mm) above the pipe crown. The trench shall be backfilled by placing and compacting the sand in lifts of 6 inches (150 mm) or less. The blanket shall be carried up evenly on both sides of the pipe, so as not to disturb the pipe. Compact the blanket material to 95 percent modified proctor (in accordance with ASTM D 157 and ASTM D 2922) with approved hand-operated devices.

3.4.4 Backfill. Backfill material from 12 inches (300 mm) above the pipe to the underside of the pavement select material profile, or to the underside of loam and grassed areas, shall be backfilled with common backfill described herein and as approved by the ENGINEER.

3.4.4.1 Backfill shall be placed and compacted in layers of 6 inches (150 mm) or less. Compact the backfill material to 95 percent modified proctor (in accordance with ASTM D 157 and ASTM D 2922). Compaction shall be by hand-operated compactors or other approved method.

3.4.4.2 Jetting and bucket compaction are not acceptable means of compaction.

3.4.4.3 Trench areas improperly backfilled or having excessive settlement, as determined by the ENGINEER, shall be reopened to the required grade, backfilled using proper techniques, and repaved as necessary. The CONTRACTOR shall receive no additional compensation for the repair of trenches constructed under this Contract.

3.4.5 Temporary Trench Pavement Patch. All pavement patching of water main-related trenches shall be in accordance with Section 401.3. The water main trench pavement edges shall be wheel cut prior to patching.

3.5 Pipe Installation.

3.5.1 There shall be no physical connection between a public or private potable water supply system and a sewer, or sewer appurtenance which would permit the passage of any sewage or polluted water into the potable supply. No water pipe shall pass through or come in contact with any part of a sewer manhole. Locate the new water main with a 10-foot (3 m) horizontal separation between it and the existing or proposed sewer main.

3.5.2 A deviation from the separation requirements of 3.5.1 above shall be allowed where necessary to avoid conflict with subsurface structures, utility chambers, and building foundations, provided that the sewer is constructed as follows:

3.5.2.1 Sewer pipe shall be Class 52 ductile iron.

3.5.2.2 Joints shall be pressure tested with zero leakage at 25 psi (172 kPa) for gravity sewers, and at 1 ½ time working pressure for force mains.

3.5.3 Whenever sewers must cross water mains, the sewer shall be constructed as follows:

3.5.3.1 Sewer pipe joints shall be located at least 9 feet (2.7 m) horizontally from the water main.

3.5.3.2 Sewer pipe joints shall be pressure tested with zero leakage at 25 psi (172 kPa) for gravity sewers, and at 1 ½ working pressure for force mains.

3.5.3.3 Vertical separation of the sewer and water main shall be not less than 18 inches (450 mm).

3.5.4 Piping in place shall be subject to inspection and approval of the ENGINEER together with the OWNER.

3.5.5 Pipe and accessories shall be kept in a sound, undamaged condition. They shall, at all times, be handled with care and shall not be dropped, dumped or bumped against any other object. Damaged material shall be replaced at no cost to the OWNER, at any time during the construction that the damage is identified or occurs.

3.5.6 Pipe shall be stored off the ground.

3.5.7 Buried Pipe Installation. Installation of all buried piping shall be in accordance with AWWA Standard for the installation of ductile iron water mains and their appurtenances, AWWA C 600. Minimum pipe cover shall be no less than 6 feet.

3.5.8 Pipe and fittings shall be thoroughly cleaned before they are placed. All lumps, blisters, and excess coal tar coating shall be removed from the spigot and from the interior of the bell, and these surfaces shall be wire-brushed, wiped clean and dry, and be free from oil and grease before the pipe is laid.

3.5.9 The interior of pipe, fittings, and valves shall be kept clean and free of foreign material or soils at all times during storage and installation or the material may be rejected by the OWNER and ENGINEER.

3.5.10 All pipes and appurtenances laid in open trench excavation shall be bedded and uniformly supported over their full-length on bedding of the types specified herein and shown on the drawings. All work shall be performed in a dry trench.

3.5.11 At all times when pipe laying is not actually in progress, the open ends of pipe in the trench shall be closed by temporary water-tight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed.

3.5.12 Pipe and fittings shall be laid accurately to the line and grades. Care shall be taken to provide a firm bearing for the pipe along its entire length. Pipes shall not be laid in water, nor shall water be allowed to flow through them.

3.5.13 Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, the amount of deflection allowed shall not exceed that required for making a satisfactory joint and shall be subject to the approval of the OWNER and ENGINEER.

3.5.14 For mechanical joints, the spigot shall be centrally located in the bell, and adequate anchorage shall be provided at abrupt changes in direction and at dead-ends. All surfaces in contact with the rubber gaskets shall be brushed thoroughly with a wire brush immediately prior to assembly. The clean surfaces shall then be brushed with manufacturer's recommended lubricant prior to slipping the gasket over the spigot and into the bell. Lubricant shall also be brushed over the gasket prior to installation for the purpose of removing loose dirt and lubricating the gasket, as it is forced into its retaining space. The CONTRACTOR shall use wrenches as recommended by the manufacturer. When tightening bolts, it is essential that the gland be drawn toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket.

3.5.15 For push-on joints, all foreign matter in the gasket seat in the socket shall be removed and the gasket wiped clean and flexed before placing in its seat. A thin film of lubricant shall be applied to the inside surface of the gasket. The plain end of the next pipe, after wiping clean, shall be aligned and carefully entered into the socket until it just makes contact with the gasket. The joint assembly shall be completed by forcing the end of the pipe past the gasket until it makes contact with the bottom of the socket. The final joint assembly of pipe 8 inches (200 mm) and smaller shall be accomplished by pushing against the face of bell of the entering pipe with a crow-bar or other tool. For larger pipe, the assembly shall be made with a jack and suitable slings.

3.5.16 When a pipe is cut in the field, the cut end shall be tapered back approximately $\frac{1}{8}$ inches (3 mm) at an angle of 30 degrees with the centerline of the pipe with a coarse file or grinder to remove any rough edges which might injure the gasket.

3.5.17 The CONTRACTOR shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the drawings or as directed by the OWNER and ENGINEER.

3.5.18 Bends, tees, and other fittings in pipelines buried in the ground shall be backed up with thrust restraint Class B concrete, $\frac{1}{2}$ cubic yard ($\frac{1}{2}$ cubic meter) minimum, against undisturbed earth (bearing area as shown in the drawings). If the soil does not provide firm support, then bridle rods, clamps, etc. shall be provided to brace the fittings properly. All accessories shall be seal-coated thoroughly and heavily with an approved material per AWWA C 104 after assembly and shall be subsidiary to the ductile iron fitting unit price.

3.5.19 As shown in the drawings and as directed by the ENGINEER, insulation shall be installed over water mains having less than 5-foot, 6-inch (1.7 m) cover. Limits of insulation shall be as shown in the drawings or as directed by the ENGINEER.

3.6 Casing Installation.

3.6.1 Casing pipe shall be installed by open-cut with bedding and cover material as shown in the drawings.

3.6.2 Casing pipe ends shall be beveled with a single V-groove for field welding. Pipe joints shall be butt welded and shall be a full penetration on the outside circumference of the pipe. The single V-groove butt weld shall conform to the latest AWS Welding Code. All joints of the casing pipe shall be butt-welded by a welder certified by the State of New Hampshire for the specific application.

3.7 Carrier Pipe Installation.

3.7.1 After casing pipe has been installed and cleaned of dirt and debris, pipe spacers shall be attached to carrier pipe as shown on the Drawings. As carrier pipe is jointed, it shall be pushed into position inside the casing pipe.

3.7.2 After the carrier pipe has been tested for leakage, bulkheads shall be constructed at each end of the casing pipe. On brick bulkheads, a "one brick" opening shall be left in the bulkhead at the top of the casing pipe at each end and covered with polyethylene to prevent entry of backfilling materials. The portion of the carrier pipe passing through the brick bulkhead shall be wrapped with three (3) layers of fifteen-pound (6.8 kg) asphalt-impregnated felt before the bulkhead is constructed.

3.8 Valve Installation. Valves and boxes shall be set with the stem vertical and box vertically centered over operating nut. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve. The gate box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade.

3.9 Hydrants. Hydrants shall be set at the locations shown and bedded on a firm foundation. Each hydrant shall be set in true vertical alignment and properly braced.

3.9.1 Hydrants shall be mechanically restrained by either GripRing or Megalug type joint restraint systems. Hydrant branch valve shall be connected directly to the water main by an anchor tee for new construction, or tapping sleeve, for existing mains.

3.9.2 Height adjustments shall be made to the hydrants so that the bottom flange of the hydrant is 3 inches (75 mm) above finish grade. Height adjustments shall be made with extension as manufactured by the hydrant supplied. All hydrant extension shall be considered subsidiary to the hydrant bid item.

3.9.3 Wherever a hydrant is set in soil that is pervious, a drainage pit 2 feet (600 mm) in diameter and 1-foot (300 mm) deep shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand, under and around the elbow of the hydrant and to a level of 6 inches (150 mm) above the waste opening. Compaction shall be in accordance with 304.3.7.

3.9.4 Wherever a hydrant is set in clay or other impervious soil, a drainage pit 2 feet (600 mm) in diameter and 3 feet (900 mm) deep shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand, under and around the elbow of the hydrant and to a level of 6 inches (150 mm) above the waste opening. Drainage pits shall not be connected to a sewer. Compaction shall be in accordance with 304.3.7.

3.9.5 Hydrants shall be set on a concrete base or other materials approved by the ENGINEER and shall be well braced and anchored by depositing concrete behind the hydrants on undisturbed earth at the end of the trench, or by wedging granite block in place of concrete.

3.9.6 Height adjustments for hydrants shall be made with appropriate extensions as approved by the Agency.

3.9.7 When hydrants are to be removed the existing isolation valve shall be removed and hydrant piping shall be cut and capped a maximum of 12 inches (300 mm) from the water main tee with a 1/3 cubic yard (0.25 m³) concrete thrust block poured against the cap.

3.9.8 The water main may be shut off for a maximum of four (4) hours beginning after 9:00 a.m. for the removal of hydrants or installation of the tap or tee. Coordinate the shut off with the utility.

3.9.9 No hydrant shall be backfilled until directed by the ENGINEER.

3.10 Service Installation. Install corporation stops on the new water main. The tapping machine shall be rigidly fastened to the pipe halfway between the horizontal and vertical position. The length of travel of the tap should be established so that when the stop is inserted and tightened with a 14-inch (350 mm) wrench, not more than one to three threads shall be exposed on the outside. When a wet tapping machine is used, the corporation stop shall be inserted with the machine while it is in place. Stops shall be tightened only sufficiently to give water-tightness, and care must be constantly exercised not to over-tighten them.

3.10.1 Service saddles shall be required as indicated by the following chart:

<u>Pipe Size</u>	<u>Saddle Requirements for Class 54 D.I. Pipe</u>
6-inch (150 mm)	Taps \geq ¾-inch (19 mm)
8-inch (200 mm)	Taps \geq ¾-inch (19 mm)
12-inch (300 mm)	Taps > 1-inch (25 mm)

3.10.2 Install a single length of copper or polyethylene tubing, from the corporation stop to the curb stop, in a trench with a depth of at least 6 feet (1.8 m). Service pipe between the corporation stop to the curb stop shall be free of couplings. Care shall be exercised in the placing and laying of copper or polyethylene tubing to be sure that the pipe does not have kinks. Place at least 6 inches of sand adjacent to and below the tubing and 12 inches (300 mm) above the tubing.

3.10.3 Install curb stops and curb boxes at the approximate property line, or as indicated on the drawings, and connect with new copper or polyethylene tubing coming from the new main. Place a concrete block or flat

stone beneath curb stop. Install curb box vertically centered over the operating key, with the elevation of the top adjusted to conform to the finished grade. Prior to backfilling, the CONTRACTOR shall ensure corporation stops are in the open position and curb stops are fully shut. Adequately support the box during backfilling to maintain vertical alignment. Care must be taken to ensure that the curb box does not rest on the curb stop.

3.10.4 Make connections of new copper or polyethylene services to existing services as directed by the ENGINEER. The connection shall be made using suitable couplings.

3.11 Inspection. Each section of the installed water main will be visually inspected by the OWNER and ENGINEER. The pipe shall be true to both line and grade, shall contain no broken pipe, shall show no leaks, and shall contain no debris or other deposits of which shall in any way reduce the full cross-sectional area of the pipe.

3.11.1 Any section of water pipe which does not comply with these inspection criteria, as determined by the OWNER and ENGINEER, shall be promptly corrected, replaced or repaired by the CONTRACTOR at no cost to the OWNER. Such methods as are employed for the correction shall be approved by the OWNER.

3.12 Pressure and Leakage Testing. The CONTRACTOR shall furnish all necessary equipment and labor for, and perform, pressure testing and leakage tests on the pipeline in accordance with AWWA C 600 Specifications.

3.12.1 The CONTRACTOR shall make any taps and furnish all necessary caps, plugs, etc., as required in conjunction with testing, and also furnish a test pump, gauges, and any other equipment required in conjunction with carrying out the hydrostatic tests. The CONTRACTOR shall at all times protect the new water mains and the existing water mains against the entrance of polluting material.

3.12.2 Testing Requirements:

1. Test duration: Two (2) hours, minimum.
2. Test pressure: 150 percent of maximum operating pressure as determined by the ENGINEER, or 200 psi, whichever is higher.
3. Allowable pressure loss: Pressure shall not vary more than 5 psi (34 kPa) for the duration of the pressure test.
5. Allowable leakage: Allowable leakage shall be determined by the following formula:

ENGLISH	METRIC
$L = \frac{(S)(D)(P)^{0.5}}{133,200}$	$L = \frac{(S)(D)(P)^{0.5}}{715,317}$
$L = \text{Allowable Leakage (gallons per hour)}$	$L = \text{Allowable Leakage (gallons per hour)}$
$S = \text{Length of Pipe Tested (feet)}$	$S = \text{Length of Pipe Tested (meters)}$
$D = \text{Nominal Pipe Diameter (inches)}$	$D = \text{Nominal Pipe Diameter (mm)}$
$P = \text{Average Test Pressure (psig)}$	$P = \text{Average Test Pressure (kPa)}$

6. Acceptance of installation shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified, the CONTRACTOR shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowance.
7. All visible leaks are to be repaired regardless of the amount of leakage.
8. The leakage test shall be constructed concurrently with the pressure test.
9. When hydrants are located in the test section, the tests shall be made against the closed hydrants.

3.13 Disinfection. Before being placed in service, all new and temporary water pipelines shall be chlorinated by the CONTRACTOR in accordance with the requirements of AWWA C 651. The procedure shall be discussed with the OWNER and ENGINEER prior to proceeding with the work.

3.13.1 The location of the chlorination and sampling points will be determined by the OWNER and ENGINEER in the field. Taps for chlorination and sampling shall be uncovered and backfilled by the CONTRACTOR, as required. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end, while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline for a minimum of 24 hours.

3.13.2 Following the chlorination period, all treated water shall be flushed from the lines at their extremities, and replaced with water from the distribution system. Bacteriological sampling and analysis of the replacement water shall then be made after the replacement water has occupied the chlorinated pipeline for a minimum of 16 hours. A bacteriological analysis shall be completed by a state-certified laboratory in full accordance with AWWA C 651. The CONTRACTOR will be required to re-chlorinate at no cost to the OWNER if the test fails to achieve satisfactory results. The line shall not be placed in service until the requirements of the New Hampshire Department of Environmental Services (NHDES), Water Supply Engineering Bureau are met.

3.13.3 Special disinfection procedures, such as soaking or swabbing approved by the ENGINEER, shall be used in connections to existing mains and where the method outlined above is not practical.

3.14 Spare Parts. The CONTRACTOR will be required to have on-site, at all times, the following spare parts:

11 ¼ degree bends	2 for each size pipe
22 ½ degree bends	2 for each size pipe
45-degree bends	2 for each size pipe
Solid sleeve couplings	2 for each size pipe
SDR 35 PVC pipe	2 lengths of 6-inch (150 mm) and 8-inch (200 mm)
Dresser couplings (for temporary use only) HYMAX couplings may be used with approval from Superintendent	2 for each size pipe
Retainer glands	2 for each size pipe

Method of Measurement

4.1 Pipe of the kind, type, and size specified (including temporary water system and service tubing) will be measured by the linear foot (linear meter) to the nearest 0.1 foot (meter) of furnished and installed and operational water main. Measurements will be taken along the centerline of the pipe, end to end, with no deductions for any valves and fittings.

4.2 Water main bridge crossing, including pipe of the kind, type and size specified, shall be measured to the nearest one-tenth of a foot (meter) on a linear meter basis from the back wall of abutment A to the back wall of abutment B. Measurements will be taken along the centerline of the pipe, end to end, with no deductions for any valves and fittings.

4.3 Water main casing pipe, including carrier pipe of the kind, type, and size specified, will be measured by the linear foot (linear meter) to the nearest 0.1 foot (meter).

4.4 Valves, fittings, chlorine injection taps, corporation stops, and curb stops will be measured by each for the number of units furnished and installed.

4.5 Hydrants including valve, pipe fittings and any other incidental work, including excavation and backfill, will be measured by the number of units furnished and installed.

4.6 Water main insulation will be measured by the square yard (square meter) to the nearest 0.1 of a square yard (square meter) of the area covered.

4.7 The ENGINEER must be involved in and approve of the measurement of any pay item.

Basis of Payment

5.1 The accepted quantity of ductile iron and copper pipe will be paid for at the contract unit price per linear foot (linear meter) of the kind, type, and size specified complete in place, with the following stipulations:

5.1.1 Common structure excavation required for the removal of unsuitable material below the typical trench section will be paid for as provided in 206.

5.1.2 All rock structure excavation, any common structure excavation exploratory and any common structure excavation below the depth specified in 206.4.1.1 shall be paid as provided in 206.

5.1.3 Granular Backfill (Sand), to replace material excavated under 5.1.1 only, will be paid as provided in 209.

5.2 The accepted quantity of water main casing pipe, including carrier pipe, will be paid at the contract price per linear foot (linear meter) complete in place as shown on the plan and specified herein, and shall include furnishing and installing casing pipe, assembly of casing pipe, excavation, bedding, blanket, backfill, furnishing and installing carrier pipe, pipe spacers, bulkheads and appurtenances, and all other work required for or incidental to the completion of this item, except as noted below.

5.3 The accepted quantity of water main bridge crossing, including pipe, shall be paid at the contract price per linear foot (meter) complete in place as shown on the plans and specified herein, and shall include furnishing and installing pipe, insulation, hangers, insulation protection shield, rollers and fittings, expansion joints and all other work required for or incidental to the completion of this item.

5.4 The accepted quantity of valves, fittings, chlorine injection taps, corporation stops, and curb stops will be paid for at the contract unit price of each of the kind, type, and size specified completely in place.

5.5 The accepted quantity of hydrants will be paid for at the contract unit price for each complete in place.

5.6 Excavation, bedding, sheeting and shoring, dewatering, concrete thrust blocks, thrust restraining systems, restoration of existing service connections, MJ glands, valve boxes, pressure testing, disinfection, flushing, maintaining water service, abandonment of existing water pipe, removing and stacking existing hydrants, couplings, connections to existing water mains, backfill, temporary trench pavement repair, removal and decommissioning of temporary water system, restoration of property, utilities, loam and seed, as-built drawings, and any other work necessary or required for a complete operational water main relocation shall be subsidiary to the pipe, valves, fittings, chlorine injection taps, corporation stops, service pipe, curb stops and hydrants.

5.7 The accepted quantity of water main insulation, including excavation and backfill, will be paid for at the Contract unit price per square yard (square meter), complete in place.

Pay items and units (ENGLISH):

611.05206	6-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL. 52	LF
611.05208	8-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05210	10-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05212	12-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05214	14-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05216	16-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05220	20-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05306	6-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL. 53	LF
611.05308	8-INCH CEMENT LINED DUCTILE IRON WATER PIPE, CL 53	LF
611.22206	6-INCH CEMENT LINED CAST IRON WATER PIPE, CL. 22	LF
611.22208	8-INCH CEMENT LINED CAST IRON WATER PIPE, CL. 22	LF
611.22210	10-INCH CEMENT LINED CAST IRON WATER PIPE, CL. 22	LF
611.22212	12-INCH CEMENT LINED CAST IRON WATER PIPE, CL. 22	LF
611.22310	10-INCH CEMENT LINED CAST IRON WATER PIPE, CL. 23	LF
611.31007	¾ INCH GALVANIZED STEEL WATER PIPE	LF
611.31015	1½ INCH GALVANIZED STEEL WATER PIPE	LF
611.3102	2-INCH GALVANIZED STEEL WATER PIPE	LF
611.3104	4-INCH GALVANIZED STEEL WATER PIPE	LF
611.3106	6-INCH GALVANIZED STEEL WATER PIPE	LF
611.3202	2-INCH CEMENT LINED STEEL WATER PIPE	LF
611.35224	24-INCH CASING PIPE WITH 6" DIA. CL 52 D.I. M.J. CARRIER PIPE	LF
611.50003	¾ INCH SERVICE CONNECTION	LF
611.5001	1-INCH SERVICE CONNECTION	LF
611.50015	1½ INCH SERVICE CONNECTION	LF
611.5002	2-INCH SERVICE CONNECTION	LF
611.50107	¾ INCH COPPER WATER PIPE	LF
611.5011	1-INCH COPPER WATER PIPE	EA
611.51007	¾ INCH CORPORATION STOP	EA
611.52007	¾ INCH CURB STOP	LF
611.6001	1-INCH PLASTIC WATER PIPE	LF
611.60015	1½ INCH PLASTIC WATER PIPE	LF
611.6002	2-INCH PLASTIC WATER PIPE	LF
611.6106	6-INCH PLASTIC PRESSURE WATER PIPE	LF
611.6903	LAYING 3-INCH PVC PLASTIC WATER PIPE	EA
611.70006	6-INCH FITTING	EA
611.70008	8-INCH FITTING	EA
611.70010	10-INCH FITTING	EA
611.70012	12-INCH FITTING	EA
611.70014	14-INCH FITTING	EA
611.71006	6-INCH GATE VALVE	EA
611.71008	8-INCH GATE VALVE	EA
611.71010	10-INCH GATE VALVE	EA
611.71012	12-INCH GATE VALVE	EA
611.71014	14-INCH GATE VALVE	EA
611.72010	10-INCH BUTTERFLY VALVE	EA
611.74	CHLORINE INJECTION TAP	EA
611.81	Hydrants	EA
611.811	Adjusting/Relocating Hydrants	EA
611.812	Installing Dry Hydrant System	U
611.813	Relocating Dry Hydrant System	U

611.814	Removing Hydrant	U
611.9	Water Regulator Chamber Iron Water Pipe	U
611.90001	Adjusting Water Gates And Shutoffs Set By Others	EA
611.91	Removing & Relaying Water Pipe	LF
611.951	Water Main Insulation	SF
611.99	Temporary Water & Appurtenances	LF

Pay items and units (METRIC):

611.05215	150 MM Cement Lined Ductile Iron Water Pipe, Cl. 52	LM
611.05220	200 MM Cement Lined Ductile Iron Water Pipe, Cl. 52	LM
611.05225	250 MM Cement Lined Ductile Iron Water Pipe, Cl. 52	LM
611.05230	300 MM Cement Lined Ductile Iron Water Pipe, Cl. 52	LM
611.05235	350 MM Cement Lined Ductile Iron Water Pipe, Cl. 52	LM
611.05238	375 MM Cement Lined Ductile Iron Water Pipe, Cl. 52	LM
611.05250	500 MM Cement Lined Ductile Iron Water Pipe, Cl. 52	LM
611.05315	150 MM Cement Lined Ductile Iron Water Pipe, Cl. 53	LM
611.05320	200 MM Cement Lined Ductile Iron Water Pipe, Cl. 53	LM
611.22215	150 MM Cement Lined Cast Iron Water Pipe, Cl. 22	LM
611.22220	200 MM Cement Lined Cast Iron Water Pipe, Cl. 22	LM
611.22225	250 MM Cement Lined Cast Iron Water Pipe, Cl. 22	LM
611.22230	300 MM Cement Lined Cast Iron Water Pipe, Cl. 22	LM
611.22325	250 MM Cement Lined Cast Iron Water Pipe, Class 23	LM
611.3102	20 MM Galvanized Steel Water Pipe	LM
611.3104	40 MM Galvanized Steel Water Pipe	LM
611.3105	50 MM Galvanized Steel Water Pipe	LM
611.3110	100 MM Galvanized Steel Water Pipe	LM
611.3115	150 MM Galvanized Steel Water Pipe	LM
611.3205	50 MM Cement Lined Steel Water Pipe	LM
611.35260	600 MM Casing Pipe With 150 MM DIA. Class 52 D.I.M.J. Carrier Pipe	LM
611.403	32 MM Brass Water Pipe	LM
611.50018	18 MM Service Connections	LM
611.50025	25 MM Service Connections	LM
611.50038	50 MM Service Connections	LM
611.50050	50 MM Service Connections	LM
611.50102	19 MM Copper Water Pipe	LM
611.50103	25 MM Copper Water Pipe	LM
611.51002	19 MM Corporation Stop	LM
611.52002	19 MM Curb Stop	LM
611.6003	25 MM Plastic Water Pipe	LM
611.6004	40 MM Plastic Water Pipe	LM
611.6005	50 MM plastic water pipe	LM
611.6115	150 MM plastic pressure water pipe	LM
611.6908	Laying 75 MM PVC Plastic Water Pipe	LM
611.70015	150 MM Fittings	EA
611.70020	200 MM Fittings	EA
611.70025	250 MM Fittings	EA
611.70030	300 MM Fittings	EA
611.70035	350 MM Fittings	EA
611.71015	150 MM Gate Valves	EA
611.71020	200 MM Gate Valves	EA
611.71025	250 MM Gate Valves	EA

611.71030	300 MM Gate Valves	EA
611.71035	350 MM Gate Valves	EA
611.72025	250 MM Butterfly Valve	EA
611.74	Chlorine Injection Tap	EA
611.81	Hydrants	EA
611.811	Adjusting/Relocating Hydrants	EA
611.812	Installing Dry Hydrant System	U
611.813	Relocating Dry Hydrant System	U
611.814	Removing Hydrant	U
611.9	Water Regulator Chamber Iron Water Pipe	U
611.90001	Adjusting Water Gates And Shutoffs Set By Others	EA
611.91	Removing & Relaying Water Pipe	LM
611.951	Water Main Insulation	M2
611.99	Temporary Water & Appurtenances	LM

END OF SECTION