SECTION 02610
WATER UTILITIES

PART 1 – GENERAL

1.0 RELATED DOCUMENTS: This section is only a portion of the Contract Documents. All of the Contract Documents, including Division 1 General Requirements, apply to this section.

1.1 SECTION INCLUDES

A. See Section 02616 for Ductile Iron Pipe and Fittings

B. See Section 02640 for Valves, Hydrants and Appurtenances

C. This Section specifies requirements for the proposed garden water system pipe, fittings appurtenances and services.

D. The work includes:

1. Furnishing and installation of garden water distribution pipe, valves and valve boxes, hydrants, pipe fittings, anchors, thrust blocks, required accessories and connections to existing water systems.
2. Furnishing and installing meter pit, backflow prevention assembly, pressure-reducing valves and other related appurtenances.
3. Disinfection and testing of the system.

1.2 COORDINATION WITH THE MUNICIPALITY:

A. Work shall conform to Standard Specifications and Details: Town of Andover, Department of Public Works.

B. The Water Department shall be notified prior to starting construction of any portion of the water system.

B. The closing of valves necessary for making connections with the existing system will be done by the Water Department employees, assisted by the Contractor. Sufficient notice shall be given to the Water Department of planned connection. No allowance will be made for any delay in closing of valves. A 48-hour notice shall be given to residents or businesses affected by the shutdown, and shall be done by the Contractor under the direction of the Engineer. The Water Department may require the work to be done at night during the low use time period.

C. All work will conform with the Water Department standards.

1.3 STANDARDS

A. ASTM D 2765 - Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics.

B. ASTM D 6394 - Specification for Sulfone Plastics (SP).

C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

E. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. ASTM F 876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

G. ASTM F 877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.

H. ASTM F 1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Crosslinked Polyethylene (PEX) Tubing.

I. American Water Works Association AWWA C904 Standard for Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2 in. Through 3 in., for Water Service.

J. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF)

K. ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials.

L. ANSI/NSF Standard 61 Drinking Water System Components - Health Effects.

M. ANSI/NSF Standard 359 Valves for Crosslinked Polyethylene (PEX) Water Distribution Tubing Systems.

N. American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL)

O. ANSI/UL 263 Standard for Safety for Fire Tests of Building Construction and Materials.

P. ANSI/UL 2846 Standard for Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics.

1.3 SUBMITTALS:

A. Shop Drawings:

1. Submit Shop Drawings or descriptive literature, or both, showing dimensions, joints and other details of all materials to be furnished. Shop Drawings shall be submitted to the Engineer for approval prior to ordering materials.

B. As-Built Drawings:

1. Submit 2 copies of As-Built Drawings upon completion and acceptance of work.
2. As-Built Drawings shall be complete and shall indicate the true measurements and locations, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three ties to each gate valve box from fixed permanent objects. As-Built Drawings shall also contain any additional information required by the municipality, and shall be stamped with the seal of a Licensed Land Surveyor and Licensed Professional Engineer.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Storage of pipe, fittings, valves, hydrants and other water line appurtenances on the site shall be in accordance with the manufacturer's recommendations, subject to the approval of the Engineer.

B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, fittings, valves, hydrants, and other water line appurtenances. 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 pipe and fitting coatings shall be repaired as directed by the Engineer.

C. Pipe, fittings, valves, hydrants and other water system appurtenances which are defective from any cause, including damage caused by handling, and determined by the Engineer as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner.

D. Pipe and all water system appurtenances that are damaged or disturbed through any cause prior to acceptance of the work shall be repaired, realigned or replaced as required by the Engineer at no additional cost to the Owner.

PART 2 – PRODUCTS

2.1 GENERAL:

A. The Drawings are diagrammatic only and are intended to indicate the extent, but not all details, of the system which shall be constructed. All materials are not shown; but the Contractor shall furnish and install all materials required for the complete system.

2.2 PIPE:

A. PEX piping shall be PEX-a (Engel-Method Crosslinked Polyethylene) Piping: ASTM F 876 and F877 (CAN/CSA-B137.5)

B. PEX-a Fittings: elbows, adapters, couplings, plugs, tees and multi-port tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:
   1. UNS No. C69300 Lead-free (LF) Brass.
   2. UNS No. C27453 Lead-free (LF) Brass.
   3. 20% glass-filled polysulfone as specified in ASTM D 6394.
   4. Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D 6394.
   5. Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D 6394.
   6. Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D 6394.
   7. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".

C. Copper piping shall be type “K” tubing.

D. Couplings, if required, for existing to new service pipe connections shall have compression on the inlet and compression on the outlet.

E. All compression joints shall have stainless steel stiffeners.

2.3 GATE VALVES:

A. Gate valves shall be either resilient seated conforming to the requirements of AWWA C509 or double disk, parallel, inclined or soiled wedge type valves conforming to the requirements of AWWA Standard C500, of the type used by the municipal Water Department.

B. Gate valves shall be cast iron body, bronze mounted, double disk, non-rising stem, O-ring type stuffing box.

C. Gate valves shall open to the right (clockwise) and have mechanical joint or flanged ends.

D. Bolts, studs and nuts shall be made from a corrosion-resistant material such as low-zinc bronze, nickel copper alloy, or stainless steel.

E. Operating nut shall be 2 inches square at the base, tapering to 1-15/16 inches square at the top.

2.7 VALVE BOXES:

A. Each gate valve shall be provided with a valve box and cover.

B. Valve boxes shall be of the adjustable, telescoping, heavy-pattern type designed and constructed to prevent the direct transmission of traffic loads to the pipe or valve.

C. Valve boxes shall be cast iron, asphalt coated with cast iron covers. The smallest inside diameter of the shaft shall not be less than 5-1/4 inches. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve. Provisions shall be made for adjustment through at least 6-inches vertically while retainage lap of at least 4 inches between sections.

D. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. The word Water shall be cast in the top surface of the cover.

2.9 TAPPING SLEEVE AND VALVE:

A. Tapping sleeves shall meet the requirements of AWWA and shall be of the bolted-sleeve type with a mechanical joint connection to the existing water pipe and flanged end outlets for connecting the tapping valves. The tapping sleeves shall be suitable for a working water pressure of 200 psi and outlet flanges shall conform to the 125-pound American Standard complying with ANSI B16.1, with Cor-Ten or cadmium plated cast iron nuts and bolts. The tapping sleeve shall be as manufactured by Mueller Company or approved equivalent.

B. Tapping valves shall be non-rising stem, resilient seat type with O-ring sealed stuffing box and shall comply with ANSI/AWWA C500 and C509, as applicable. Sizes 2”-12” shall have a maximum working pressure of 200 psig and sizes 14”-24” shall have a maximum working pressure of 150 psig.

2.10 THRUST BLOCKS:

A. Thrust restraints shall be installed in accordance with the details shown on the Drawings and as required by the Engineer.

B. The Contractor shall discuss with the Engineer the method[s] to be used to restrain thrust prior to installing fittings and hydrant. Test pits may be required in areas of existing utilities to determine the exact location and dimensions of thrust restraints required.

C. Concrete for thrust blocks shall have a minimum 28 day compressive strength of 3,000 psi.

2.11 CORPORATION STOPS AND CURB STOPS:

A. Corporation stops shall be Mueller 300 ball type corporation valves threaded to receive compression-type fitting, or approved equivalent.

B. Curb stops shall be Mueller 300 ball valve curb stop or approved equivalent, threaded to receive compression-type fittings.

C. Stops shall be sized to receive the service tubing without the use of enlargement/reduction fittings.

2.11 SERVICE BOXES:

A. Service boxes shall be cast iron improved extension type with arch pattern base. Covers shall be held in place with bronze bolts and the word Water shall be cast into the top surface of the cover. Service box shafts shall have a minimum inside diameter of 2-1/2 inches. Service boxes shall be as manufactured by Mueller Corp. or approved equivalent.

2.12 WATER SERVICE:

A. Services two inches or smaller shall be Pex type A, for underground water service and shall be in accordance with ANSI/AWWA C800.

B. Water service fittings including couplings and adapters, check valves and service saddles shall be in conformance with ANSI/AWWA C800, Underground Service Line Valves and Fittings.

Joints in copper tubing shall be made with three part compression couplings or an approved equal.

C. Services 3 inches and greater shall be ductile iron pipe.

PART 3 – EXECUTION

3.1 GENERAL:

A. All water pipes, fittings, valves, hydrants and other appurtenances shall be installed at the locations as shown on the Drawings. The proposed location and vertical alignment may be altered to avoid conflicts with existing and proposed utilities, as approved by the Engineer.

3.2 LAYING PIPE AND FITTINGS:

A. Pipe and fittings shall be installed in accordance with the requirements of ANSI/AWWA C600.

B. Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained. The type of materials to be used in bedding and backfilling and method of placement shall conform to the requirements of the plans and specifications.

C. All pipes shall be clean before lying. When laying is stopped for any reason, the open ends of the pipe shall be closed by watertight plugs or other approved means. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe has been eliminated.

Fittings, in addition to those shown on the Drawings, shall be provided if required to avoid utility conflicts.

D. When cutting of pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.

E. Maximum allowable deflection for pipe laid without fittings shall not exceed the allowable amount established by the pipe manufacturer and shall not exceed those shown in AWWA C600.

F. The pipe shall be laid with a minimum cover of 5 feet below finished grade.

3.3 CONCRETE THRUST BLOCKS:

A. Where pipes change horizontal and vertical direction, at hydrants, tees and other fittings, and wherever abnormal thrust forces may be developed, the Contractor shall construct thrust and anchor blocks as detailed on the Drawings. They shall be concrete, of minimum dimensions as detailed on the drawings or of adequate additional size to suit actual conditions to withstand pressures anticipated, and shall be founded in undisturbed soil.

B. Concrete for thrust blocks shall have a minimum 28 day's compressive strength of 3,000 psi.

C. Fittings which do not use thrust blocks resting against natural occurring material with passive resistance pressure of 1,500 psf shall be installed with a restrained joint system as specified in Article 3.06.

3.4 WATER/SEWER SEPARATION:

When a sewer pipe crosses above or below a water pipe, the following procedures shall be utilized. The Contractor shall comply with these following procedures:

A. Relation to Water Mains:

1. *Horizontal Separation*: Whenever possible sewers shall be laid at a minimum at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:

a. It is laid in a separate trench, or if

b. It is laid in the same trench with the water mains located at one side on a bench of undistributed earth, and if

c. If either case the elevations of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

2. *Vertical Separation*: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe or other equivalent based on water tightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure water tightness or both pipes shall be encased in concrete. When crossing an existing water main, the water main shall be encased in concrete per the Drawings.

3.5 GATE VALVES AND BOXES:

A. Valves shall be set in firmly compacted and shaped soil. Where the soil in the trench subgrade is found to be soft, loose, freshly filled earth, unstable or unsuitable as a base, the unsuitable material shall be excavated to such additional depth and width as required. The excavated area shall be backfilled with gravel or crushed stone, compacted and shaped.

B. Valve boxes shall be set centered and plumb over the operating nuts of all valves. The top of each valve box shall be set to finished grade with at least 10 inches of overlap remaining between the upper sections for vertical adjustment. Minimum overlap for lower, extension pieces shall be 4 inches.

C. Boxes shall be adequately supported during backfilling to maintain vertical alignment.

3.6 TAPPING SLEEVES AND GATE VALVES:

A. Installation shall be made under pressure and the flow of water through the existing pipe shall be maintained at all times. The diameter of the tap shall be a minimum of 1/4 inch less than the inside diameter of the branch line.

B. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves, and under supervision of qualified personnel furnished by the manufacturer. The tapping machine shall be furnished by the Contractor.

C. The Contractor shall determine the location of the existing pipe to be tapped to confirm that interference will not be encountered from existing utilities or a joint or a fitting. No tap shall be made closer than 3 feet from a pipe joint.

D. Pipe upon which tapping sleeve is to be installed shall be thoroughly cleaned of all foreign matter with scraping tools and wire brushes to a minimum of six inches beyond each side of the sleeve. The cleaned area shall be washed with a hypochlorite solution. The interior of tapping valve shall also be washed with hypochlorite solution.

E. Tapping sleeves and valves with boxes shall be set vertically and squarely centered on the pipe to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks shall be provided behind all tapping sleeves. the supporting earth around and under the valve and sleeve shall be compacted. After completing the tap, the valve shall be flushed to ensure that the valve set is clean.

F. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeve together shall be heavily coated with two coats of bituminous paint equivalent to Bitumastic No. 50, by Kopper Company, Inc.

3.7 WATER SERVICES:

A. Service Pipe: Care shall be exercised in placing and laying of services to prevent kinks or sharp bends and contact with sharp stones or ledge which would damage to the pipe. At least 6 inches of sand shall be placed adjacent to, under, and above the pipe, and no stone larger than 2 inches shall be placed over the pipe until the depth of backfill above the pipe is in excess of 1 foot.

B. Corporation Stop: Taps to the pipe shall be threaded and shall be made at the horizontal diameter of the main. The tap shall be made by means of a tapping machine manufactured for this purpose and supplied by the Contractor. The tap and drill shall be kept sharp and shall have threads matching those of the stop. Corporation stop threads shall be coated with sealing compound and the stop screwed firmly into the water with the key upward and the inlet end projecting at least 1/8-inch beyond the inside face of the pipe. Corporation stop shall be left in the on open position after installation of the service pipe.

C. Curb Stop and Curb Boxes shall be of a size equal to the size of the service pipe and shall be installed in the locations shown on the Drawings or as ordered by the Engineer. The boxes shall be set in a vertical position and flush with the proposed finish grade.

D. Ductile Iron Service Pipe: Ductile iron service pipe connections to the water pipe shall be made with tee fittings or tapping sleeves. Engineer to review availability of

tees, reducers, etc. in order to ensure feasibility of connection for lower size ductile iron services.

3.8 POLYETHYLENE ENCASEMENT:

A. Installation of polyethylene encasement shall be in accordance with the recommended procedures contained in ANSI/AWWA C105.

B. Care shall be taken during backfilling to prevent damage to polyethylene wrap. backfilling shall be in accordance with AWWA C600.

3.9 PRESSURE TESTING:

A. Hydrostatic and leakage test shall be conducted in accordance with AWWA Standard C600, and as directed by the Engineer. Testing shall be conducted by a certified independent water testing company.

B. Conduct pipe tests after concrete thrust blocks have cured to the required 3000 psi strength. Fill pipe 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.

C. Prior to pressure testing, the entire pipe section shall be flushed to remove any rocks or debris which may have inadvertently entered the pipe during construction.

D. Once the pipe section has been filled at normal pressure and all entrapped air removed, the Contractor shall raise the pressure to 150 psi or two times the operating pressure (whichever is greater) by a special pressure pump, taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumpage into the pipe. This pressure shall be maintained for a minimum of 2 hours, during which time the line shall be checked for leaks. Measured rate of water leakage shall not exceed the allowable leakage listed below.

Allowable leakage in gallons per hour, per 1,000 feet of exterior pipeline:

Test Pressure	Nominal Pipe Diameter [inches]					
	4	6	8	10	12	16
150 psi	0.36	0.55	0.74	0.92	1.10	1.47

Interior piping in vaults, buildings, etc. shall have zero leakage.

Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair them. Pipe will be accepted only when leakage is zero, or less than the allowable amount. Approval does not absolve the Contractor from responsibility if leaks develop later within the period of warranty.

3.10 DISINFECTION:

A. Before being placed in service, all new water pipe shall be chlorinated in accordance with ANSI/AWWA C651 Standard for Disinfecting Water Mains.

B. The location of the chlorination and sampling points will be determined by the Engineer in the field. Taps for chlorination and sampling shall be installed by the Contractor. The Contractor shall uncover and backfill the taps as required.

C. The pipe section being disinfected shall be flushed to remove discolored water and sediment from the pipe. a 25 mg/l chlorine solution in approved dosages shall be inserted through a tap at one end while water is being withdrawn at the other end of the pipe section. The chlorine concentration in the water in the pipe shall be maintained at a minimum 25 mg/l available chlorine during filling. To assure that this concentration is maintained, the chlorine residual shall be measured at regular intervals in accordance with procedures described in Standard Methods and AWWA M12, Simplified Procedure for Water Examination.

D. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the pipe supplying the water. Chlorine application shall not cease until the entire pipe section is filled with chlorine solution. The chlorinated water shall be retained in the pipe for at least a twenty-four hour period. the treated water shall contain a chlorine residual throughout the length of the pipe section as indicated in AWWA C651.

E. Following the chlorination period, all treated water shall be flushed from the pipe section and replaced with water from the distribution system. Prior to disposal of treated water the Contractor shall check with local authorities to determine if the discharge will cause damage to the receiving body or sewer and, if required, the Contractor shall neutralize the chlorinated water in accordance with Appendix B, AWWA C650. Bacteriological sampling and analysis of the replacement water may then be made by the Contractor in full accordance with AWWA Specification C651. A minimum of three samples shall be taken by the Contractor at locations directed by the Engineer along the length of water pipe being chlorinated and sent to a State approved private laboratory for analyses. The Contractor shall re-chlorine if the samples show presence of coliform, and the pipe section shall not be placed in service until all of the repeat samples show no presence of coliform.

F. Furnish two copies of a Certificate of Disinfection Report to the Engineer.

G. The Contractor shall pay all costs for all testing, flushing, chlorinating; laboratory analyses, sampling, water supply and municipal charges.

END OF SECTION 02610