

**SEABROOK WATER DEPARTMENT**

SEABROOK, NEW HAMPSHIRE

**WATER MAIN SPECIFICATIONS**

June 15, 2015

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WATER MAIN SPECIFICATIONS

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SECTION I

SPECIAL REQUIREMENTS

1.01 GENERAL

- A. It is the intent of these specifications entitled “Seabrook, NH Water Main Specifications” to provide the requirements for water main and water service construction in the Town of Seabrook, New Hampshire.
- B. With respect to any work to be performed on a water main and water service construction, modification, repair, replacement, or any other valid action, the property owner shall give the Town prior notice of the proposed action, shall obtain an approved Application for Water Service, shall pay all applicable fees, shall follow all directions of the Superintendent or his appointee, shall comply with all requirements of the Seabrook Municipal Water System Ordinance, and shall promptly and safely and at the property owner's own expense complete the action and restore public property in a manner satisfactory to the Town.
- C. The person responsible for water main and water service construction (hereinafter referred to as “the Contractor”) shall furnish all labor, materials, tools, and equipment necessary for the satisfactory installation of the water mains, water services and appurtenances.
- D. All work shall conform to these specifications and the Drawings approved by the Town.
- E. The Contractor shall have a set of these Specifications and the final approved Drawings on-site during the construction.
- F. Resurfacing and related work shall be in compliance with the “Town of Seabrook Ordinance Governing Work in Public Ways and Places and the Excavation of Streets”.

1.02 DEFINITIONS

- A. “Superintendent” shall mean the Water Superintendent of the Town of Seabrook, or an authorized representative, such representative acting within the scope of the particular duties entrusted to him.
- B. “Contractor” shall mean any person or persons, firm, partnership, association, society, corporation, company, or organization of any kind.
- C. “Board” shall mean the Board of Selectmen (or Water Commissioners) of the Town of Seabrook, New Hampshire.
- D. “Town” shall mean the Town of Seabrook, New Hampshire.
- E. “Drawings” shall mean the drawing or drawings approved by the Seabrook Planning Board or Superintendent showing the location, nature, extent and form of the work, together with applicable details.

- F. "Public Way or Place" shall mean any way or place which, by law, is open to the movement of the general public without restriction, is maintained, owned or granted by easement to the Town of Seabrook, and/or as defined in New Hampshire Revised Statutes Annotated Chapter 259, Section 125, under the definition of the word "way".

1.03 INSURANCE REQUIREMENTS

- A. Prior to commencing work on any water work thereto which is located on any public property, easement, or right-of-way, the Contractor and his subcontractors shall each have adequate certificates of insurance on file with the Town. The amount of insurance required shall be determined by the Town. Said certificates are to be written for the benefit of the Town and to hold the Town harmless for any damages or claims which may arise as a result of the work.

1.04 PERMITS AND EASEMENTS

- A. When working within the right-of-way, the Contractor shall be bound by the conditions, restrictions, and regulations made by the appropriate governing bodies. All such regulations shall be in addition to those set down in these specifications.
- B. All permits that may be necessary for the prosecution of the work shall be obtained by the Contractor, including street opening permits.
- C. Where a public water main or structure crosses private property, the Town may require that easements be obtained.

1.05 TOWN INSPECTION AND TESTING

- A. All aspects of the water main and water service construction shall be inspected by the Town. The Contractor shall provide the Town with a minimum of twenty four (24) hours notice prior to the work being started.
- B. Inspection of work by the Town does not imply acceptance. All periodic work will be subject to final inspection and testing procedures before acceptance.

1.06 SAFETY AND HEALTH REGULATIONS

- A. The Contractor shall comply with all federal *Safety and Health Regulations for Construction* (29 CFR 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor. Contractors are urged to become familiar with the requirements of these regulations.

1.07 TECHNICAL SPECIFICATIONS

- A. Where reference is made to ASTM, AWWA, ANSI specifications or other associations, it is understood that the latest revisions shall apply.

1.08 NOTIFICATION OF CONSTRUCTION

- A. As required by law, any person who will be responsible for actual digging (e.g., a backhoe operator) shall notify "Dig Safe" at 1-888-344-7233 (1-888-DIGSAFE) a minimum of 72 hours prior to digging.

1.09 PRE-CONSTRUCTION MEETING

- A. A pre-construction meeting shall be held between the Town and the Contractor prior to startup of construction.

1.10 TRAFFIC WARNING AND REGULATING DEVICES

- A. Provide warning signs, barricades and other devices in accordance with the specifications provided in the Manual of Uniform Traffic Control Devices (MUTCD) published by the U.S. Department of Transportation. Size of signs, lettering, colors, method of support and other factors prescribed in the MUTCD shall be adhered to.

1.11 NOTICES OF PLANNED OUTAGES

- A. The Town shall notify customers at least 48 hours in advance of scheduled work activities that are likely to result in the interruption of service to customers.
- B. The Contractor shall notify the Town five (5) working days prior to connecting to any water main. Only the Town's personnel shall operate existing gate valves.

1.12 HOURS OF WORK

- A. Normal hours of operation shall be 7:00 AM to 3:00 PM Monday through Friday except with the express written permission of the Superintendent.

1.13 WATER LINE CONSTRUCTION STAKING

- A. Water lines and appurtenances shall be staked prior to installation of new pipe.

1.14 ASBESTOS CEMENT (AC) WATER MAINS

- A. The Contractor is advised that handling, removal and disposal of any asbestos cement (AC) water pipe, if encountered, shall strictly conform to all applicable local, state and federal requirements associated with asbestos products.
- B. It is the Contractor's responsibility to determine all applicable requirements and to adhere to all applicable regulations.

1.15 TERM OF GUARANTEE

- A. The guarantee shall cover the workmanship and materials for a period of one (1) year from the date of acceptance.

- B. The Contractor shall maintain all trenches and backfill any settlement and provide and place any necessary base and/or resurfacing (new or old) needed due to trench settlement for the maintenance period which shall run for one (1) year after the date of acceptance of the work.

END OF SECTION

SECTION II

TRENCH EXCAVATION, BACKFILL AND COMPACTION

PART 1 GENERAL

1.01 SCOPE

- A. The work of this section includes the furnishing of all labor, tools, equipment and materials necessary to satisfactorily complete excavation of earth and rock, removal of unsatisfactory materials, dewatering, placing bedding materials, backfilling, filling, compaction, grading, and all incidental work pertaining thereto for the installation of the water mains, water services and appurtenances.

1.02 PROTECTION OF WORK

- A. Prosecute the work so that no damage occurs to adjacent utilities, structures, property, or any other installation located in or adjacent to work areas. Damaged utilities shall be repaired with similar or better materials of the same size and to the requirements of the utility owner. Have on the project the necessary manpower, materials and equipment such as pumps, piping and the like to protect and maintain uninterrupted flows in existing utilities during construction. Only manual methods of excavating shall be employed around buried utilities. All utility services shall be supported by suitable means provided by the Contractor so that water services do not fail.
- B. Excavations shall be kept free from water, snow and ice during construction. Bedding and backfill material shall not be placed in water. Water shall not be allowed to rise upon or flow over bedding and backfill material.
- C. Maintain all bench marks, monuments and other reference points and, if disturbed, replace them at the Contractor's expense.
- D. Excavating equipment shall be of such size and type, and used in a manner, that will not damage existing items such as but not limited to paved surfaces, lawn areas, utilities, structures and trees.
- E. Take all steps necessary to prevent catch basins and drain lines from receiving silt and sediment from the work site. Clean catch basins and drain lines not properly protected.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The Contractor shall provide the following materials for installation of the water mains, services and appurtenances. Fill materials meeting the requirements of these specifications may be obtained from either on-site excavations or from sources as approved by the Town.

2.02 COMMON FILL

- A. Common Fill shall be granular material, consisting of hard, sand and gravel with less than 15 percent passing the No. 200 sieve, when tested in accordance with ASTM C136 and ASTM C117 and shall be free of organic matter, trash, roots or other deleterious material.
- B. Common Fill material shall contain no stone measuring greater in any dimension than two-thirds of the loose lift thickness or 12 inches, whichever is smaller. Common Fill material shall be capable of forming a firm, stable base when spread and compacted. In addition, the Common Fill shall be non-plastic (plasticity index zero, defined as liquid limit minus plastic limit). Any materials excavated from the trench not conforming to this specification shall be legally disposed of by the Contractor and replaced with approved material.

2.03 GRAVEL FILL

- A. Gravel Fill shall consist of hard, durable gravel and sand, free from trash, organic matter and clay, surface coatings, and other deleterious materials.
- B. Gravel Fill shall have a maximum stone size of two thirds of the loose lift thickness or 8-inches whichever is smaller. Gravel Fill used for pipe bedding shall have a maximum stone size of 2 inches. That portion passing the 4-inch sieve shall meet the following gradation requirements, as determined by ASTM C136 and ASTM C117:

<u>U.S. Sieve Size</u>	<u>Percent Passing</u>
4 inch	100
1/2 inch	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-10

2.04 SELECT FILL

- A. Select Fill shall consist of hard durable sand or sand and gravel, free from trash, organic matter, clay, surface coatings and other deleterious materials.
- B. Select Fill placed between the mid-height of a pipe and 12-inches above a pipe shall have a maximum stone size of 4 inches. Select Fill used for other purposes shall have a maximum stone size of two thirds of the loose lift thickness and that portion passing the 4 inch sieve shall meet the following gradation requirements, as determined by ASTM C136 and ASTM C117:

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<u>U.S. Sieve Size</u>	<u>Percent Passing</u>
4 inch	100
No.10	30-100
No. 40	0-70
No. 200	0-15

2.05 SAND FILL

- A. Sand Fill used for bedding the polyethylene water service pipe shall consist of hard, durable sand, free from trash, organic matter, clay, surface coatings, and other deleterious materials.
- B. Sand Fill shall meet the following gradation requirements, as determined by ASTM C136 and ASTM C117:

<u>U.S. Sieve Size</u>	<u>Percent Passing</u>
No. 4	100
No.10	60-100
No. 40	20-60
No. 100	6-20
No. 200	0-5

2.06 CRUSHED STONE

- A. Crushed stone shall consist of clean, crushed, non-porous rock, or crushed gravel, uniformly blended.
- B. Crushed stone shall meet the following gradation requirement as determined by ASTM C136 and ASTM C117:

<u>U.S. Sieve Size</u>	<u>Percent Passing</u>
1 inch	100
¾ inch	90-100
½ inch	20-55
3/8 inch	0-15
No. 4	0-5
No. 10	0-2

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

- A. Trench excavation shall consist of the removal of all materials encountered. Excavations shall be made to accommodate the elevation, depth of cover, or detail shown on the plate entitled "Typical Trench Section for Water Main" and as specified. Trench widths shall be kept to the minimum practicable but shall be at least 3 feet wide or 2 feet plus the diameter of the pipe, whichever is greater. The bottom of all trenches shall be firm and free of water and shall be accurately graded and shaped to allow placement of required bedding beneath the bottom of all barrels, bells or couplings of all pipes and appurtenant materials installed.
- B. Pipe design criteria requires that pipe be laid in trench conditions, therefore trenches for pipes in fill areas shall be excavated after all fill materials have been placed, spread and compacted to an elevation at least 12 inches above the top of the pipes. This requirement is necessary to fulfill the pipe design criteria and should not be construed as a dictation of means and methods of construction.
- C. If, through error, the excavations are carried beyond the specified limits, or if inadequate dewatering causes softening of the subgrade which necessitates removal, backfill shall be Gravel Fill, placed and compacted as specified hereinafter under Trench Backfilling.
- D. When trenching occurs around trees to remain, the tree roots shall not be cut but rather, the trench shall be tunneled under or around the roots by careful hand digging and without injury to roots.
- E. Excavate to provide a minimum cover over the top of pipe and fittings of five (5) feet below finished grade unless otherwise approved by the Town.
- F. If pavement is removed, it shall not be mixed with other excavated material, but shall be disposed of away from the work site before the remainder of the excavation is made.

3.02 ROCK AND/OR BOULDER EXCAVATION

- A. Rock and/or boulders shall be removed to provide a clearance of at least twelve (12) inches below the outside barrel of the pipe, valves, or fittings, and to a clear width of twelve (12) inches on each side of all pipe and appurtenances (minimum trench width shall be 3 feet). Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes.
  - 1. Rock shall include such rocks as are not decomposed, weathered or shattered and which will require blasting, barring, wedging or use of air tools for removal.
  - 2. The Contractor's method of blasting shall be in accordance with federal, state and local regulations.

3.03 EXCAVATION OF UNSUITABLE FOUNDATION MATERIALS BELOW TRENCH GRADE AND/OR SUBGRADE

- A. If, in the opinion of the Town, the material at or below the depth of the trench is unsuitable foundation material, it shall be removed to such depths as directed by the Town and shall be replaced with Gravel Fill.
- B. 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 Gravel Fill.

3.04 CONTROL OF WATER

- A. The Contractor shall provide trench shoring and dewatering, if necessary, to provide a stable and dry trench at all times.
- B. 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. The Contractor shall assume full responsibility and expense for the adequacy of the dewatering system.
- C. The dewatering system shall be capable of developing an excavated sub grade relieved of any hydrostatic pressure that could cause a decrease in the stability of the excavated sub grade and which will provide the necessary groundwater control for the proper performance required for completion of the work.
- D. Dispose of all subsurface water in a manner that conforms to all applicable local and state ordinances, statutes and laws.
- E. 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.

3.05 PIPE BEDDING AND TRENCH BACKFILLING

- A. General.
  - 1. The requirements for pipe bedding and trench backfilling shall be as shown on the Plate entitled "Typical Trench Section for Water Main" and as specified herein.
  - 2. Pipe and appurtenances shall be placed on specified bedding materials, to provide uniform support and a stable foundation for the pipeline(s) and appurtenances and backfill material. No bedding shall be placed on unstable subgrade soils. An unstable subgrade is defined as a condition of running sand, running silt, quick bottom, or otherwise soft, soupy or spongy bottom. If an unstable condition exists, or develops during the excavation, excavate, dewater and stabilize the subgrade to the extent necessary to provide a firm stable foundation prior to placing bedding, pipe and appurtenances.

3. The height of fill adjacent to the pipelines and appurtenances shall be increased at approximately the same rate on all sides to prevent displacement.

B. Trench Bedding

1. Pipelines and appurtenances shall be laid in the bedding material, from the bottom of the excavation to the mid-diameter of the pipe, for the full width of trench. Bedding materials shall be compacted to a minimum density of 95 percent of the maximum density as determined by ASTM D698 (Standard Proctor) and shall meet the requirements for Gravel Fill or crushed stone.
2. The type and thickness of bedding material shall be adjusted based on field conditions, as follows:
  - a. Where the bottom of trench is stable and the existing material at trench grade meets the requirements for Gravel Fill, as determined by the Town, excavation to 6 inches below the pipeline for placement of bedding material will not be required. Gravel Fill or crushed stone bedding shall be placed and compacted to the mid-diameter of the pipe as specified hereinbefore.
  - b. When the subgrade material does not meet the specification for Gravel Fill, the excavation shall be made to a depth of 6 inches below the bottom of pipe for placement of bedding material.
  - c. Where the bottom of the trench excavation is below the groundwater level and pumping of water is done from within the excavation, utilize a bedding system which provides a stable working surface which limits the disturbance of the subgrade and prevents migration or washing of fine soils from the subgrade due to the flow of water into the trench. If the subgrade is stable and meets the requirements of Gravel Fill, excavation of bedding material is not required.
  - d. If crushed stone is used as a bedding material, a 12 inch wide impermeable clay cutoff barrier ("Control Dam") shall be constructed across the trench from the bottom of the excavation to the mid-point of the pipe every 300 feet, or as otherwise directed by the Town, to prevent groundwater from flowing unimpeded along the pipe trench, through the crushed stone. No more than 6 inches of crushed stone bedding shall be placed beneath the bottom of any pipe or appurtenance.

C. Trench Backfilling

1. Backfill materials, meeting the requirements for Select Fill, shall be placed above the mid diameter of the pipe to 12 inches above the pipe. The Select Fill backfill shall be compacted to a density of at least 95 percent of the maximum density as determined by ASTM D698 (Standard Proctor).
2. Backfill materials placed from 12 inches above the pipe to the bottom of the roadway base course in paved areas or to the bottom of loam shall meet the requirements for

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Common Fill. Fill shall be placed and compacted so that a density of at least 92 percent of the maximum density is achieved by ASTM D1557 (Modified Proctor), Select equipment and establish procedures consistent with the backfill materials being used to achieve the required density. Backfill materials with more than 15 percent passing the No. 200 sieve shall be placed at a moisture content as determined by ASTM D1557.

3. Where hardened surfaces or roadways, driveways, or walls are disturbed, special attention shall be given to backfilling and compaction prior to resurfacing.

D. Resurfacing

1. All roadway base course materials and pavement work shall be accordance with NH DOT Standards and be approved by the Seabrook Department of Public Works for town streets and the NH DOT for state roadways.

E. Cleanup

1. Provide street sweeping as necessary to reduce dust, siltation, nuisance problems, and to provide safe passage for vehicular and pedestrian traffic.

END OF SECTION

SECTION III

WATER MAINS AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE

- A. The work of this section includes the furnishing of all labor, tools, equipment and materials necessary to perform all operations for the construction of water mains, fittings, valves, hydrants, water services and other related items necessary to complete the work as specified.
- B. All products shall conform to the applicable standards of ANSI and AWWA and as specified herein.

1.02 SUBMITTALS

A. Shop Drawings

- 1. Two (2) copies of shop drawings and descriptive literature showing dimensions, joints and other details of all materials shall be furnished to the Town for review and approval prior to ordering the materials.
- 2. Submittals required under this section include, but are not limited to the following: pipe and fittings, gaskets, thrust restraint glands, couplings and solid sleeves, hydrants, valves, tapping sleeves and valves, warning tape, blow-off materials, water service pipe, curb stops and boxes, corporation stops, water service pipe inserts and water service tracer wire.

B. As-Built Drawings

- 1. The Contractor shall submit to the Superintendent within thirty (30) days after the completion of the testing and chlorination, one set of As-Built drawings for the project. The drawings shall include all changes, additions and deviations from the original set of drawings.
- 2. Above ground features, such as hydrants, valve covers, and curb stop covers, shall be surveyed and included as part of the As-Built drawings.
- 3. As-Built Drawings shall be complete and shall indicate true measurements and locations, horizontal and vertical, of all water main and water service construction including bends and tees. As-Built Drawings shall include a minimum of three ties to each fitting, gate valve box, corporation cock and curb box from fixed permanent objects. As-Built Drawings shall also contain any additional information required by the Town.
- 4. As-Built Drawings shall be prepared in accordance with the Town's Planning Board guidelines in AutoCAD and GIS format.

1.03 PRODUCT HANDLING

- A. All pipe when shipped shall be packed and separated by wood separators such that pipe-to-pipe contact is prevented during transit and storage.
- B. Take appropriate measures during the loading, trucking, unloading, and handling of pipe and appurtenant materials so as not to damage them or roadway surfaces. Dropping of materials directly from the trucks upon the ground will not be permitted. Suitable effective buffers or runners shall be provided. Metal chain shall not be used for lifting materials.

PART 2 MATERIALS

2.01 DUCTILE IRON PIPE

- A. All ductile iron pipe shall be designed and manufactured in accordance with ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51. Pipe shall be designed for the rated working pressure in pounds per square inch shown below and for laying condition Type 2 (Flat bottom trench, backfill consolidated to centerline of pipe) and for 8 feet of earth cover. The pipe shall be in nominal laying lengths of 18 feet to 20 feet. The grade of iron from which the pipe is made shall be 60-42-10; having 60,000 psi minimum tensile strength, 42,000 psi minimum yield strength and 10 percent minimum elongation.

Pipe Diameter (Inches)	Thickness (Inches)	Special Thickness Class	Pressure Class
4	0.29	52	350
6	0.31	52	350
8	0.33	52	350
10	0.35	52	350
12	0.37	52	350

- B. Ductile iron pipe shall have either push-on-joints or restrained joints. Restrained joint pipe shall be used in lieu of thrust blocks at joints before and after any fittings to resist the movement of the pipe. Refer to the plate entitled "Minimum Restrained Joint Pipe Length – Water Mains" for the length of restrained joint pipe that is required on each side of fittings to resist the forces developed at fittings. All other pipe shall have push-on joints.
- C. Restrained joint pipe shall be TR FLEX® as manufactured by the U.S. Pipe. Restraint Joint gaskets shall be Field Lok 350 as manufactured by U.S. Pipe, Sure Stop 350 by McWane or Fast-Grip by American to form the required number of restraint joints before and after each mechanical joint fitting. The gaskets must be provided by the pipe manufacturer and be rated for the pressure class of the pipe.

- D. The interior of the pipe shall be cement-mortar lined to twice the thickness specified in ANSI/AWWA C104/A21.4. The pipe manufacturer under controlled factory conditions shall apply the cement-mortar lining and field application is strictly prohibited.
- E. The cement-mortar lining shall be seal coated with an asphaltic material in accordance with ANSI/AWWA C150/A21.50 and NSF Standard 61. Asphaltic seal-coat shall not impart taste or odor, or toxic or carcinogenic compounds to the water contained therein. Asphaltic seal coat shall be a product acceptable to the NSF for use in potable water and shall be so listed in the NSF summary of approved products. The asphaltic seal coat shall be applied and cured in strict conformance with the coating manufacturer's instructions. The pipe manufacturer under controlled factory conditions shall apply the asphaltic seal coat and field application is strictly prohibited.
- F. The outside of the pipe shall be asphaltic coated to a minimum 1 mil thickness in accordance with ANSI/AWWA C150/A21.50.

## 2.02 DUCTILE IRON FITTINGS

- A. Fittings shall be mechanical joint ductile iron. Tees for hydrant branches shall be mechanical joint anchoring tees. Fittings shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11. Compact fittings shall conform to ANSI/AWWA C153/A21.53.
- B. All ductile iron fittings shall be Class 350 and conform to the weights and dimensions shown in the latest edition of the Ductile Iron Pipe Research Association (DIPRA) "Handbook of Ductile Iron Pipe" and be provided complete with all joint accessories.
- C. Plugs, caps and blank flanges shall be ductile iron and shall conform to the weights and dimensions shown in the latest edition of the DIPRA "Handbook of Ductile Iron Pipe" and be provided complete with all joint accessories.
- D. The interior surface of all fittings shall be cement-mortar lined to twice the thickness specified in ANSI/AWWA C104/A21.4. The pipe manufacturer under controlled factory conditions shall apply the cement-mortar lining and field application is strictly prohibited.
- E. The cement-mortar lining shall be seal coated with an asphaltic material in accordance with ANSI/AWWA C150/A21.50 and NSF Standard 61. Asphaltic seal coat shall not impart taste or odor, or toxic or carcinogenic compounds to the water contained therein. Asphaltic seal coat shall be a product acceptable to the NSF for use in potable water and shall be so listed in the NSF summary of approved products. The asphaltic seal coat shall be applied and cured in strict conformance with the coating manufacturer's instructions. The fitting manufacturer under controlled factory conditions shall apply the asphaltic seal coat and field application is strictly prohibited.
- F. All ductile iron fittings shall be American made.

- G. The outside of all fittings shall be asphaltic coated to a minimum 1 mil thickness in accordance with ANSI/AWWA C150/A21.50.
- H. Fittings for restrained joint pipe systems shall be as manufactured specifically for the restrained joint pipe system and shall be designed and manufactured as specified previously for ductile iron fittings.

2.03 SOLID SLEEVES

- A. Solid sleeves shall be long body type, ductile iron with mechanical joints. The minimum laying length shall be 12 inches. All sleeves shall conform to the weights and dimensions shown in the latest edition of the DIPRA "Handbook of Ductile Iron Pipe" and be provided complete with all joint accessories.

2.04 FLEXIBLE COUPLINGS AND TRANSITION COUPLINGS

- A. Flexible couplings shall be as manufactured by Romac Industries, Inc. (Macro Style) or approved equal.
- B. Transition couplings shall be as manufactured by Romac Industries, Inc. (Macro Style) or approved equal.

2.05 RESILIENT SEAT GATE VALVES

- A. Valves shall be manufactured in full compliance with the content and intent of this specification. Valve shall be cast iron conforming to the latest edition of ASTM A126, Class B. Valves shall have mechanical joints, with 2 inch operating nut, stainless steel bonnet nuts and bolts and shall conform in every respect to AWWA C509. Valves shall be designed for 200 psi working pressure and shall be hydrostatically tested with twice the specified rated pressure applied to one side of the gate and zero pressure on the other side.
- B. When mechanical joint ends are specified for use, the gasket seating areas shall be fully machined to fixed dimensions and tolerances as per AWWA specifications. All valves shall be provided with "O" rings. The design of the valve shall be such that the seal plate can be fitted with new "O" rings while the valve is under pressure in a fully open position.
- C. Valve interiors and exterior surfaces shall have a 100% solids thermoset or fusion bonded epoxy protective coatings, holiday-free in the waterway, which shall meet all requirements of AWWA C550. The epoxy coating shall not impart taste or odor to the water. The coating shall be a product acceptable to the NSF for use in potable water and shall be so listed in the most current NSF summary of approved products. The coating shall be applied and cured in strict conformance with the coating manufacturer's cautions and instructions. The valve manufacturer shall apply the coatings under controlled factory conditions and field application is strictly prohibited.

- D. Valves shall open left and shall be as manufactured by American Flow Control or approved equal.
- E. Valves with damaged interior and exterior coatings shall be rejected.

#### 2.06 TAPPING SLEEVES AND VALVES

- A. Tapping sleeves and valves shall conform to the most current AWWA specifications for tapping sleeves and valves. Tapping sleeves shall be mechanical joint, two (2) part ductile iron castings, flanged on the vertical centerline, and come complete with all joint accessories. The surface area of each flange shall be thoroughly machined, and the sleeve flanges shall be fitted with gaskets recommended by the manufacturer. Each gasket shall cover the entire surface area of each joint for the full length of the sleeve. Bolts used to assemble the sleeves shall pass directly through each flange and through each gasket. Bolts shall be properly spaced to ensure uniform gasket pressure and compression. Stainless steel tapping sleeves will not be accepted.
- B. Sleeve outlets shall have counter-bored flanges to ensure proper centering of the tapping valve.
- C. The tapping valve shall be flanged by mechanical joint and open left. Tapping sleeve valve shall be AWWA approved and shall meet all applicable requirements including test pressure and exterior coating as specified for resilient seated gate valves. The mechanical joint end shall include restraint glands and accessories as specified in these specifications for mechanical joints.
- D. Prior to ordering the sleeve, the Contractor shall check the dimensions of the pipe on which the tapping sleeves are to be installed.

#### 2.07 VALVE BOXES

- A. Valve boxes shall be cast iron, tar coated, adjustable sliding type with cast iron covers. Valve box covers shall be drop type with "WATER" cast into the cover. Valve boxes shall be Buffalo Style adjustable sliding type with flange upper section, with 24 inch top section and 30 inch bottom section except when the depth of cover over the pipe is greater than 5 feet, then extensions shall be provided that allow a minimum of 12 inches overlap between the top and bottom sections.
- B. Bell end of the lower sections shall in all cases be sufficiently large enough to fit over the stuffing boxes of the valves. The smallest inside dimension of the shaft shall not be less than 5-1/4 inches. Upper section shall have a flange sufficiently strong enough to furnish the bearing for that section so that all weight or jolting from street traffic or the like shall not be transmitted to the valve. Each valve box including cover shall weigh at least 100 pounds.

2.08 HYDRANTS

- A. Hydrants shall be of the following type and manufacturer only. The Owner is standardized on this hydrant.

Make and Model	Eddy F-2641 (Clow Valve Company) (Hydrant shall have drain plugged)
Type of Thread	National Standard
No. of Outlets	2-1/2" hose connections (2 required) 4-1/2" steamer connection(1 required)
Diameter Valve Opening	5-1/4 inches (minimum)
Diameter of Barrel	7- 1/4 inches (minimum)
Hub	Mechanical joint
Direction of Opening	Open left
Depth of Bury	5 feet 6 inches
Color	To match existing hydrants of the Owner.

- B. Hydrants shall be designed for 250 pounds per square inch working pressure and shall conform in every respect to AWWA C502.
- C. Hydrants shall be manufactured within the past 12 months as determined from the date stamped on the hydrant.
- D. Hydrants shall be thoroughly cleaned and given two shop coats of paint in accordance with AWWA Specification C502. After installation, hydrants shall be field painted with two (2) coats of red paint with white reflector paint on the bonnet and caps. The hydrant paint shall be Rustoleum Fire Hydrant Red and the white reflector paint shall be ALERT Reflective Liquid or approved equal.
- E. Hydrant markers shall be five foot heavy duty fiberglass rods with reflective bands and include a one piece galvanized spring steel at the bottom equipped with an L-bracket for hydrant flange bolt mounting as supplied by USA Blue Book.
- F. Hydrant barrel extensions shall be as recommended by the manufacturer of the hydrant and shall include all couplings, pins, flanges, gaskets, nuts and bolts necessary to provide a complete and workable installation. If more than one type of extension is available, the Town shall approve the type to be provided.

2.09 THRUST RESTRAINT GLANDS

- A. Thrust restraint glands shall be used on all mechanical joints fittings, valves and sleeves. The thrust restraint system shall incorporate individually activated gripping surfaces integral to the follower gland that makes up the mechanical joint.

- B. Glands shall be manufactured of ductile iron conforming to ASTM A536. Gland dimensions shall be such that they can be used with standard mechanical joint bells and tee head bolts that conform to the latest of ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.53/C153. Twist-off nuts, sized the same as tee-head bolts shall be used to ensure proper actuating of restraining devices. The mechanical joint restraint shall have a working pressure of at least 150 psi with a minimum safety factor of 2:1. The restraint device shall have a fully bonded coating system.
- C. Glands shall be specifically designed for use with mechanical joint ductile iron pipe, fittings and valves. Glands shall be Series 1100 MEGALUG by EBBA Iron, East Land, Texas.

2.10 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

- A. Warning and identification tape shall be detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic instrument. Provide tape in rolls, 3 inches minimum width, solid blue in color with warning and identification imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification shall read "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.11 BLOW-OFFS

- A. Permanent blow-offs shall be as shown on the plate entitled "Typical Blow-Off Detail" and shall meet the materials requirements in this Section.
- B. Temporary blow-offs, sample taps, and chlorination taps shall consist of a corporation cock, Type K copper or polyethylene tubing and a curb stop, each of at least 1 inch in diameter. Corporation cocks shall be as specified.

2.12 CONCRETE THRUST BLOCKS

- A. Concrete Thrust Blocks shall be premade concrete blocks as manufactured by Tuff-Crete Corporation of South Hampton, NH or approved equal.
- B. Concrete Thrust Blocks are required at hydrants and on the back side of tapping sleeves and valves.

2.13 WATER SERVICES

- A. Water service pipe (1 inch through 2 inch diameter) shall be high density polyethylene pipe (HDPE) PE 4710, SDR-9, pressure rating of 250 psi, copper tubing size (CTS) conforming to AWWA C901/ASTM D2737 and NSF 14/61 standards. Use of Type K copper tubing for water service pipe shall be approved by the Town. The trademark of the manufacturer and type shall be stamped at intervals along the pipe. Stainless steel inserts shall be used at all terminations points with HDPE pipe. The tubing shall be American made and of a manufacturer approved by the Town.

- B. Corporation cocks shall be lead free, ball-type, open left, with AWWA (CC) standard thread by compression fittings and be manufactured by A.Y. McDonald or Mueller Company.
- C. Curb stops shall be lead free, open left and be manufactured by A.Y. McDonald or Mueller Company.
- D. Curb boxes shall be tar coated, cast iron, sliding type with inlaid covers. Covers shall have the word "WATER" cast in the top, and shall be held in place with bronze bolts. Shaft shall be 2-1/2 inches inside diameter with extension rods, and be extension type to accommodate any bury depth with 1'-0" adjustment height. Service boxes shall be 2 hole Erie Type with stainless steel rod. Curb boxes shall be American made.
- E. Service saddles for water services on asbestos cement water pipe shall be nylon-coated ductile iron with double stainless steel strap. The screws and nuts shall be stainless steel and the screws shall be 5/8 inch diameter.
- F. Tracer wire shall be #12 AWG high-strength copper clad steel conductor (HS-CCS), insulated with a 30 mil, high density, high molecular weight polyethylene (HDPE) insulation. Tracer wire shall be rated for direct burial use at 30 volts and be RoHS compliant. Jacket color shall be blue. Tracer wire shall be PRO-TRACE HF-CCS PE30 as manufactured by Pro-Line Safety Products, or approved equal.

#### 2.14 OTHER MATERIALS

- A. Furnish all other necessary materials required for a complete installation.
- B. Sprinkler service pipe (4 inch through 12 inch diameter) shall meet all applicable requirements as specified for ductile iron pipe.
- C. In special cases, the Town will consider the use of HDPE water pipe, where soil conditions warrant its use.

### PART 3 INSTALLATION

#### 3.01 SEPARATION OF WATER AND SEWER MAINS

- A. As per State Standards, water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, it is permissible to install a water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.
  - 1. Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. It is preferred that the water main cross above the sewer. At crossing, one full length of water pipe shall be located so both joints will be

as far from the sewer as possible. Special structural support for the water and sewer pipes may be required, as well as special materials of construction and connecting devices.

2. No water pipe shall pass through or come in contact with any part of a sewer manhole.

### 3.02 SEPARATION OF WATER AND SEWER SERVICE LINES

- A. A water service line may parallel or cross a sewer line if the sewer line is installed at least 18 inches below the water line.
- B. A water service may parallel a sewer service at a horizontal separation of less than 10 feet if: the building gravity sewer is constructed with DR 25 PVC pipe or the water service line is thickness Class 52 ductile iron. If the water service is small diameter HDPE tubing (e.g., 2 inches or less) it shall be placed in a casing approved by the Town.

### 3.03 INSTALLATION OF PIPE, FITTINGS AND APPURTENANCES

- A. Pipes shall be thoroughly cleaned before being installed. Particular attention shall be made to the proper positioning of the rubber gaskets. Jointing of the pipe and fittings shall be done in accordance with the manufacturers written instructions.
- B. Provide and maintain on the project site the temporary watertight plugs in the various sizes required for the installation of the specified piping. Temporary watertight plugs shall be utilized at the end of each working day or during the pipe installation, if necessary, to prevent the intrusion of silt, debris and water into all pipelines. When working in areas with a high potential for flooding of the pipe from groundwater, streams, storm drains, sewers and other means, a temporary plug shall be used on each pipe length during installation.
- C. In the event of flooding of the pipeline, all pipe installation shall cease until the pipeline has been thoroughly cleaned, as determined by the Town.
- D. When joined together, the pipeline shall form a smooth continuous line and grade on straight sections and on curved sections (both horizontal and vertical) shall have uniform deflections within the required limits and conforming in general to the line and profile of the adjacent roadway or easement. The location of rubber rings shall be determined with a checking gauge before backfilling the pipe.
- E. Pipe shall be joined and laid in accordance with the manufacturer's latest published instructions.
- F. Pipe shall not be laid with deflection of more than one half (1/2) the maximum deflection recommended by the manufacturer.

- G. Backfill shall be placed on both sides and compacted simultaneously with approved tamping bars for the full length of the pipe. Bell holes shall be excavated as necessary to ensure that the pipe and not the pipe bells are bearing the weight of backfill and the traffic load.
- H. Bells or other joints shall not be installed directly under existing utilities or structures. Use short or random lengths to avoid such conditions.
- I. Pipe shall not be installed in areas where excavations have been carried below trench grade, or where groundwater conditions create unstable bottoms, until such time as the trench is excavated, refilled and compacted as specified.

#### 3.04 MECHANICAL JOINTS

- A. Mechanical joints shall be installed with all required joint accessories, including gaskets, thrust restraint glands with drilled bolt holes, tee head bolts, and hexagonal nuts.
- B. Torque wrenches shall be used to take up such joints. Wrenches shall be equipped with adjustable breakable tension gauge, set to break the tension at the tension loading recommended by the manufacturer. Mechanical joints shall be made so as to secure tight joints, every means being taken to secure this result.

#### 3.05 CUTTING OF PIPE

- A. All cuts of ductile iron pipe shall be made with a power saw. Blades shall be as recommended by the manufacturer of the pipe.
- B. When lengths of pipe are field cut to provide for short lengths, the outside of the cut ends shall be tapered back about 1/8 inch at an angle of 30 degrees with the centerline of the pipe and as recommended by the manufacturer before field cut pieces are installed.

#### 3.06 PIPE BLOCKING

- A. Provide wood blocking where required as approved by the Town.
- B. Blocking shall be new spruce plank 1 inch and 2 inches in thickness. Blocks shall be bedded firmly and level across the bottom of the trench and when any block has sunk too deeply additional blocking of suitable thickness shall be placed to bring the pipeline to the required grade.
- C. Blocks shall be placed at a point 1/5th of the span from each joint. Each block shall be 2 inch by 4 inch with a length of 4 inches larger than the diameter of the pipe. A sufficient quantity of wedges 12 inches long of 4 inch by 4 inch fir shall be furnished to properly hold valves and special castings in place. A 4 inch by 4 inch timber shall be used to brace hydrant posts.

3.07 CONNECTIONS TO EXISTING MAINS

- A. Forty-eight (48) hours prior to connecting to any existing water main, notify the Town. Only the Town's personnel shall operate existing valves.
- B. Make all taps, whether wet or dry and install the required sleeves, tees, couplings, adaptors, reducers, pipe nipples, jointing materials, and other fittings which may be required and make all joints watertight, as specified, where shown on the Drawings and/or as approved by the Town. All existing materials removed shall remain the property of the Town, as determined by the Town. Legally dispose of all removed materials that the Town does not want stockpiled.
- C. The cutting, removal, plugging and bracing of parts of the existing water system in order to make connections as required by the Drawings is considered part of the work. The work may also include subsequent pumping of water from the draining of the water mains, hand excavation, time required by the Town to notify water takers of shutdowns, time required to effect tight closures of existing valves, and any reasonable changes that may be required by the Town to accomplish the work.
- D. All work shall be coordinated with the Town and such connections that may be required shall be made at such times and in such a manner as to cause as little interference in water service within the existing system as is practicable.

3.08 VALVE BOXES

- A. Furnish and install valve boxes for each valve provided.
- B. Valve boxes shall be cut with a wheel cutter if necessary, to adjust them for height, as approved by the Town.
- C. Valve boxes shall be properly adjusted over the operating nuts of valves and adjusted to the proper height to correspond to the roadway or ground surface. Operating nuts shall be centered in the valve boxes.

3.09 HYDRANT BRANCHES

- A. Install hydrants on hydrant branches as shown on the plate entitled "Hydrant Installation" and/or as approved by the Town.
- B. Each hydrant shall consist of a valve anchoring tee with 6-inch branch, 6-inch gate valve (mechanical joint), a 6-inch mechanical joint ductile iron pipe nipple of the required length and thrust restraint glands provided on the joints of all valves, fittings, and hydrants. The base of all hydrants shall be set on a concrete pad. A precast concrete block shall be placed between the hydrant and the soil for restraint.
- C. Hydrant barrel extensions shall be installed where necessary to provide a hydrant elevation acceptable to the Town.

- D. Construct hydrant drainage wells of 1/2 cubic yard capacity of 2 inch stone placed in the excavation below and around the hydrant bottom.
- E. Hydrants shall be given two (2) coats of paint after installation as specified previously.

### 3.10 WATER SERVICE LINE CONNECTIONS

- A. A typical water service installation is shown on the plate entitled "Typical HDPE Water Service Detail".
- B. Water service lines shall only be initiated after the new pipeline has been successfully pressure and leakage tested, disinfected and approved for service by the Town.
- C. Make only "wet taps" into the new pipeline(s) and install corporation cocks, polyethylene tubing, curb stops, service boxes, fittings, stainless steel inserts and make all joints water tight.
  - 1. Pipe shall be tapped in accordance with the manufacturer's latest published recommendations (i.e., depth of tap, number of threads exposed, allowable sizes, etc.) and shall strictly adhere to these recommendations.
  - 2. Drills and taps shall be inspected frequently for signs of wear. Do not exceed the number of taps specified by the manufacturer before reconditioning or replacing drills and taps. Service pipe shall be cut only with approved wheel cutters.
- D. Water service lines shall be installed to a minimum depth of five (5) feet and shall be buried in an 8 inch envelope of Sand Fill around the pipe and have no sharp objects within 8 inches.
- E. Curb stops shall not be placed in driveways.
- F. Water service lines shall come off the main as close to a 90 degree angle as possible and laid in a straight line whenever practicable to the structure to be serviced.
- G. Water services shall be installed in such a manner as not to cross other utilities and have a minimum of ten feet between utilities.
- H. Tracer wire for water services shall be installed from the corporation cock along the service line to the curb stop or into to the interior of the residence per the detail on the plate entitled "Typical HDPE Water Service Detail".

### 3.11 BLOW-OFFS

- A. Blow-offs shall consist of a corporation cock, polyethylene tubing between the corporation cock and the curb stop and from the curb stop to the top of a gate valve box, an Erie service box and cover for the curb stop and a Buffalo gate box and cover for the polyethylene tubing installed at a 45 degree angle from the curb stop to the

ground surface. A tracer wire shall be installed the entire length of the polyethylene tubing terminating with a coil of wire in the gate box below the cover. The polyethylene tubing shall be cut flush with the top of the gate box and a quick disconnect fitting shall be installed on the end. Refer to the plate entitled "Typical Blow-off Detail".

- B. Temporary blow-offs, sample taps and chlorination taps shall be provided for testing purposes where approved by the Town. The temporary blow-off, sample tap and chlorination tap materials shall be completely removed after successful testing. The corporation(s) shall be removed and the water main plugged. If the temporary blow-off is to remain as a permanent blow-off as determined by the Town, then the blow-off connection shall be constructed as described in Paragraph A. above.

### 3.12 CONCRETE THRUST BLOCK RESTRAINTS

- A. Furnish and place precast concrete thrust blocks for thrust restraint where restrained joint pipe cannot be used as directed by the Town. Precast concrete thrust blocks shall be as made by Shea Concrete, Amesbury MA or Tuff Crete Co., South Hampton, NH.
- B. Care shall be taken to ensure that all concrete thrust blocks bear against undisturbed trench walls. Where unsuitable bearing material is encountered, excavate and place sufficient concrete ballast, with the approval of the Town, to offset the anticipated thrusts.
- C. Thrust block bearing areas and volumes shall conform to the minimum dimensions found on the plate entitled "Minimum Thrust Block Sizing", for the various soil and fitting types noted.
- D. Mechanical joint restraint glands shall be used in conjunction with precast concrete thrust blocks for the hydrant installation or as otherwise directed by the Town.
- E. Friction clamps and thrust rods shall be installed in accordance with the manufacturer's instructions at locations as directed by the Town. All exposed rods shall be coated twice with asphaltum after installation.

### 3.13 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

- A. Place buried utility warning and identification tape over all ductile iron pipelines.

### 3.14 ABANDONED WATER SERVICES

- A. On existing water services to be abandoned, The Contractor shall excavate to the existing corporation stop, shut off the corporation stop, and disconnect the service pipe from the corporation. The existing saddle for the corporation stop shall be inspected by the Town and if it is found to be corroded, the Contractor shall install a wrap-around stainless sleeve. The abandoned curb stop box shall be removed and disposed of off site by the Contractor.

END OF SECTION

SECTION IV

FLUSHING, TESTING AND DISINFECTION OF WATER MAINS

PART 1 GENERAL

1.01 SCOPE

- A. The work of this section includes the furnishing of all labor, tools, equipment and materials and performing all operations necessary for flushing, pressure testing, leakage testing, disinfection of water mains and appurtenances as specified herein and as required to complete the work.
- B. The work of this section shall be coordinated with the Town. Use of water will only be as approved by the Town. All work shall be in accordance with this Specification and AWWA C651, Disinfecting Water Mains. Where conflicts appear between these Specifications and the applicable AWWA Standard, the more stringent requirement shall apply.
- C. All testing shall be done by an independent qualified testing Contractor approved by the Town.
- D. All flushing, pressure testing, leakage testing and disinfection shall be done in the presence of the Town.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Each temporary blow-off, sample tap, chlorination tap and pressure tap shall consist of a corporation cock, Type K or polyethylene tubing and a curb stop, each of not less than 1 inch diameter.
- B. A pumping unit or proportionate feeder suitable for delivering a hypochlorite solution to the isolated pipeline shall be provided. The unit used shall prevent chlorine solution from flowing back into the existing water system.
- C. Chlorine solution for disinfecting pipeline(s) and appurtenances shall be made from either liquid sodium hypochlorite, or calcium hypochlorite, which shall conform to AWWA B300 Standard for Hypochlorites.

PART 3 EXECUTION

3.01 GENERAL

- A. Flushing, pressure testing, leakage testing and disinfection of pipeline(s) shall closely follow pipe laying work.

**SEABROOK, NH WATER MAIN SPECIFICATIONS**

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- B. All flushing, testing and disinfection shall be done in the presence of the Town. The method of disinfection shall be the Continuous Feed Method of a chlorine solution as described hereinafter. The heavily chlorinated water that will result from the chlorination procedure shall be thoroughly neutralized with a reducing agent prior to discharge to the environment.
- C. Final acceptance of the water main(s) shall be based on successful (negative) results of bacteriological testing, following chlorination and final flushing. Location(s) of sampling shall be as directed by the Town.
- D. With the assistance of the Town, fill mains as slowly as practicable so as not to cause dirty water and serious pressure drops within the existing water system. Vent air from the new main(s) during the filling process.
- E. Make taps on the new pipeline(s) where directed by the Town necessary to properly complete the pressure testing, leakage testing and disinfection work. After successful completion of the work, with the authorization of the Town, remove all temporary sampling and chlorination tubing and blow-offs. The corporation stop(s) shall be removed and the water main plugged as approved by the Town.

3.02 FLUSHING WATER MAINS

- A. All new water main(s) and existing water main(s) that have been drained and cut-into for making new connections shall be thoroughly flushed prior to pressure and leakage testing and final disinfection.
- B. Flushing shall be accomplished by partially opening and closing valves, hydrants, and blow-offs, under expected line pressure as necessary to obtain the required scouring velocity. Flow velocities shall be not less than 2.5 feet per second in each water main section that is being flushed. All gate valves and hydrants shall be operated by the Town.
- C. The size and number of hydrant outlets or main taps to provide the required flow (at 40 psi residual pressure) is as follows:

1. MINIMUM REQUIRED FLOW AND OPENINGS TO FLUSH PIPELINES

(40 psi Residual Pressure in Water Mains)

Pipe Diameter (Inches)	Flow to Produce 3.0 fps Minimum Velocity in Main (GPM)	Taps on Main Size and Number	Hydrant Outlets	
			Number	Size (Inches)
4	120	1" - One	1	2-1/2
6	260	1-1/2" - One	1	2-1/2
8	470	1-1/2" - Two	1	2-1/2
10	730	1-1/2"- Three	1	2-1/2
12	1,060	2" - Three	2	2-1/2

2. If less than a 40 psi residual pressure is available in the main, with the size tap shown above, then a larger number of taps or hydrant outlets will be required, as directed by the Town.
3. The length of time for flushing, at or above the minimum allowable velocity, shall be computed to allow a minimum of 3 times the total volume of water stored in the main(s) to be flushed to waste.

### 3.03 PRESSURE TESTING WATER MAINS

- A. All new water mains, or any valved sections thereof, shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure that will exist at the point of testing or 150 psi, whichever is greater. Test pressures shall meet the following requirements.
  1. Be of at least 2 hour duration.
  2. Be not less than 1.25 times the expected system working pressure at the highest point along the test section.
  3. Not exceed pipe or thrust restraint design pressures.
  4. Not vary by more than plus or minus 5 psi for the duration of the test.
  5. Not exceed 2-times the rated pressure of the valves or hydrants when the pressure boundary includes closed butterfly valves, gate valves or hydrants. Valves shall not be operated in either direction at differential pressure greater than the rated pressure.
- B. Air Removal. Following flushing, and before applying the specified test pressure, air shall be completely expelled from the pipeline segment being tested. After all air has been expelled, the air blow-offs shall be closed, and the test pressure applied.
- C. Pressure Test. Each valved section of pipeline shall be slowly raised to the specified test pressure for two (2) separate periods. The first period shall be for 15 minutes, after which the pressure in the test section shall be allowed to drop slowly back to the system pressure. The pressure shall then be slowly raised again to the specified test pressure and maintained for two (2) hours. The test pressure shall be based on the elevation of the lowest point of the pipeline in the test section and shall be corrected to the elevation of the test gauge, as directed by the Town. The test pressure shall be applied by means of a pump connected to the pipeline, in a manner satisfactory to the Town, and which will prevent any backflow into the existing water system.
- D. Examination. Any exposed pipe, fittings, valves, hydrants and joints shall be carefully examined during the test. Any damaged or defective pipe, fittings, hydrants or valves discovered following, or as a result of the pressure test shall be repaired or replaced with sound material. If faulty materials are removed and replaced, the pressure testing procedure shall be repeated until satisfactory to the Town.

3.04 LEAKAGE TESTING WATER MAINS

- A. Leakage testing shall be conducted concurrently with the pressure test.
- B. Leakage Defined. Leakage shall be defined as the quantity of water that must be pumped into the new main or any valved section thereof, to maintain pressure within plus or minus 5 psi of the specified test pressure, after the main(s) have been filled with water and all air has been expelled. Leakage shall be recorded to the nearest one-tenth (0.10) of a gallon, by means of a calibrated test meter. Drawdown may be measured in a calibrated barrel, as approved by the Town. All records and charts shall become the property of the Town. Employ only qualified personnel for all testing. Leakage testing shall not be measured as a drop in pressure over a specified period of time.

C. Allowable Leakage

- 1. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P^{0.5})}{133,200}$$

where :

- L = allowable gallons of leakage per hour (GPH)
- S = the length of pipe tested (feet)
- D = the nominal pipe diameter (inches)
- P = the average test pressure during the test (psi)

- 2. The leakage formula is based on an allowable leakage of 11.65 gallons per day, per mile of pipe, per inch (nominal) of pipe diameter, at a pressure of 150 psi. The allowable leakage in GPH per 1,000 feet of pipe at various pipe diameters is shown below:

ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE (GPH)

(Test Pressure at 150 PSI)

Pipe Diameter (Inches)	4	6	8	10	12
Allowable Leakage (GPH)	0.37	0.55	0.74	0.92	1.1

Notes: If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size. When testing against closed metal-seated valves, an additional leakage shall be allowed per closed valve of 0.0078 gallons per hour per inch of nominal valve diameter. When hydrants are in the test sections, they shall remain closed. Zero (0) leakage

will be allowed on pipeline segments that cross bridges or carrier pipes located in jackings or borings.

- D. Acceptance shall be determined on the basis of allowable leakage. If the test of any segment discloses leakage greater than that specified, the source of leakage shall be located and repaired as necessary to ensure that the allowable leakage is within the specified parameters.
  - 1. All visible leaks are to be repaired regardless of the amount of leakage.
  - 2. All water main segments shall be pressure and leakage tested in the presence of the Town, in order to qualify for acceptance.

### 3.05 DISINFECTION OF PIPELINES

- A. The method of disinfection shall be the Continuous Feed Method of a chlorine solution as described hereinafter, and as approved by the Town.
- B. Continuous Feed Method of Chlorine Solution. The continuous feed method consists of the following steps:
  - 1. Upon completion of pipeline in stallation, fill main(s) with potable water, and remove all air from high spots and/or pockets.
  - 2. Flush the completed mains(s) in accordance with the requirements specified herein to remove particulates. Following the filling and flushing of the main(s), and before chlorination, complete all hydrostatic testing as specified to the satisfaction of the Town.
  - 3. Fill the mains with chlorinated potable water, having an initial concentration of 25 mg/L free chlorine residual. After a 24-hour period, there shall be a minimum of 10 mg/L free chlorine residual in the main(s). Water from the existing distribution system or other approved source of supply shall be made to flow at a constant measured rate, into the main(s). In the absence of a meter, the rate may be approximated by methods such as placing a pitot gauge in the discharge or measuring the time to fill a container of known volume.
  - 4. At a point not more than 10 feet downstream from the beginning of the new main(s), water entering the new main shall receive a dose of chlorine solution fed at a constant rate such that the water in the main(s) will not have less than 25 mg/L free available chlorine concentration at regular intervals along the main(s), using approved chlorine test kits, or as otherwise described in the current edition of AWWA M12 - Simplified Procedures for Water Examination.
- C. The amount of chlorine required to obtain a concentration of 25 mg/L per 100 feet of various diameter mains is as follows:

**SEABROOK, NH WATER MAIN SPECIFICATIONS**

1. CHLORINE REQUIRED TO OBTAIN A CONCENTRATION OF 25 MG/L PER 100 FEET OF PIPE.

Pipe Diameter (Inches)	Sodium Hypochlorite (Gallons per 100 feet)				Calcium Hypochlorite (Ounces-Dry Weight)
	5 % Available Chlorine	10 % Available Chlorine	12-1/2 % Available Chlorine	15 % Available Chlorine	65 % Available Chlorine
4	0.03	0.02	0.02	0.01	0.32
6	0.08	0.04	0.03	0.03	0.75
8	0.13	0.07	0.06	0.05	1.30
10	0.20	0.10	0.09	0.07	2.10
12	0.28	0.15	0.12	0.10	2.95

2. Prior to the injection of a chlorine solution into the section of main being disinfected, the above quantities may be diluted into a known quantity of potable water in order to meet the requirements of the chemical feed equipment. The entire solution shall be injected into the section of main being disinfected at a feed rate that ensures that the residual chlorine concentration is a minimum of 25 mg/L. The chlorine concentration within the main(s) being disinfected shall not exceed 50 mg/L without written approval of the Town.
3. The quantities shown above are based on concentrations of available chlorine by volume. Extended or improper storage may cause a loss of available chlorine.
4. For quantities of 50 mg/L, double the quantities listed.
- D. During the application of chlorine, valves shall be closed to prevent strong chlorine solution in the new mains from flowing into the existing system. Chlorine application shall continue until the entire main(s) is filled with water having 25 mg/L of free available chlorine. The chlorinated water shall be retained in the main(s) for at least 24 hours, during which time all valves and hydrants in the section(s) being treated shall be operated, in order to disinfect the appurtenances. At the end of this 24 hour period, all portions of the main(s) and appurtenances being tested shall have a free available chlorine residual of at least 10 mg/L. If less than 10 mg/L free available chlorine residual is measured, the main shall be refushed and the entire disinfection procedure repeated.
- E. Chlorine solutions shall be applied to the main(s) with chemical feed pump(s) designed for feeding chlorine solutions. Feed lines shall be of such material and strengths as to safely withstand corrosion caused by the concentrated chlorine solutions, and also the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

**3.06 FINAL FLUSHING OF WATER MAINS**

- A. After the specified retention period, the heavily chlorinated water shall be neutralized and flushed from the main. A reducing agent shall be applied to the water to thoroughly neutralize the chlorine residual remaining in the water prior to flushing and to the

environment. No chlorinated water shall be discharged directly into designated wetland areas or water bodies. Arrangements shall be made with the Town to flush all mains as specified. Great care shall be exercised in the selection of the rate of flow and the discharge point(s), in order to prevent damage to public or private property.

### 3.07 BACTERIOLOGICAL TESTING OF WATER MAINS

- A. After final flushing and before the water main is placed in service, two consecutive sets of water samples shall be taken at least 24 hours apart at each sampling point designated by the Town. At least one set of samples shall be collected from every 1,200 feet of new water main, plus one set from the end of the line, and at least one set from the end of each branch greater than one pipe length. Water samples shall be tested for bacteriological quality in accordance with "Standard Methods for examination of Water and Wastewater". Water samples shall show the absence of coliform organisms and background bacteria. A standard heterotrophic plate count may be required at the option of the Town. Both sets of samples must pass for the main to be placed in service.
- B. If, during construction, trench water has entered the main, or if in the opinion of the Town excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of 200 feet and shall be identified as to location. Samples shall be taken of water that has stood in the main for at least 24-hours after final flushing has been completed.
- C. Sampling Procedure. Samples for bacteriological analysis shall be collected, in the presence of the Town, in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in the collection of samples. Corporation cock(s) shall be installed in the main with a Type K copper or polyethylene tube gooseneck assembly. After samples have been collected, the gooseneck assembly shall be removed.
- D. The independent qualified testing Contractor shall deliver samples with a signed chain of custody form to a laboratory approved by the NHDES for bacterial analysis. Only after all the samples are approved shall the mains be incorporated into the water system. In the event that positive reports of contamination are received, the mains shall be flushed and chlorinated as many times as may be necessary to obtain approved (negative) results.

### 3.08 RE-DISINFECTION OF WATER MAINS

- A. If the initial chlorination fails to produce satisfactory bacteriological samples, the water main shall be reflushed and resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the continuous feed method of chlorination, until satisfactory results are obtained.
- B. High velocities in the existing system, resulting from flushing the new water main(s), may disturb sediment that has accumulated in the existing water system. When check samples are taken, sample the water entering the new mains.

END OF SECTION

SECTION V

STANDARD PLATES

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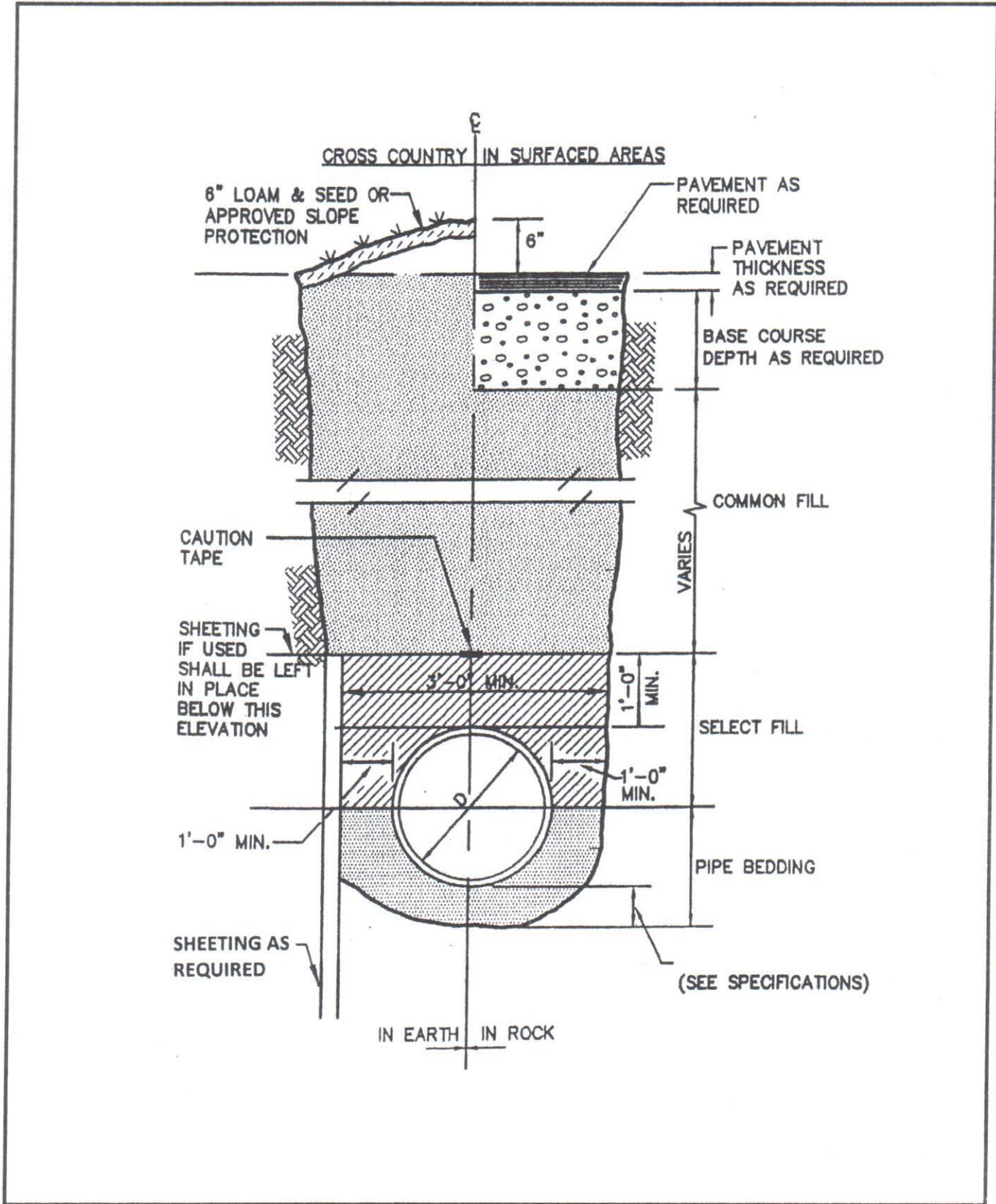


PLATE 1

TYPICAL TRENCH SECTION FOR WATER MAIN  
SEABROOK WATER DEPARTMENT

**MINIMUM RESTRAINED LENGTH (FEET)**

	DIAMETER (INCHES)			
	6	8	10	12
<u>BENDS</u>				
11 ¼°	1	2	2	3
22 ½°	3	4	5	5
45°	6	8	10	11
90°	15	19	23	27
<u>TEES</u>				
6	18	13	8	2
8	-	29	25	21
10	-	-	38	35
12	-	-	-	48
<u>REDUCER</u>				
6	-	19	34	47
8	-	-	18	34
10	-	-	-	-
12	-	-	-	-
<u>VERTICAL OFFSETS (DOWN)</u>				
11 ¼°	3 0	6 0	8 0	11 0
22 ½°	15 2	20 4	26 5	31 7
45°	54 11	49 14	60 17	71 20
<u>DEAD END</u>				
	34	45	55	65

NOTES:

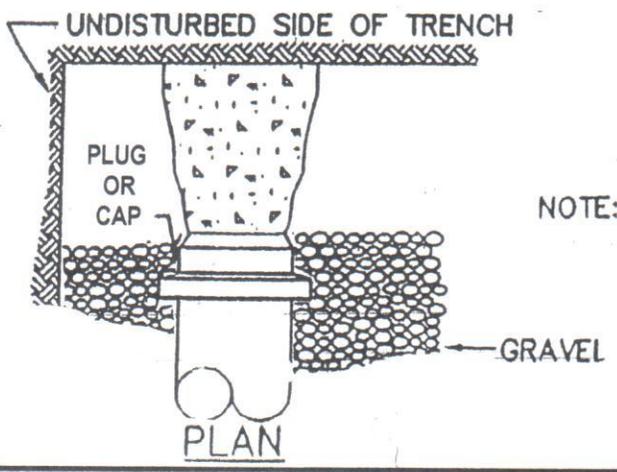
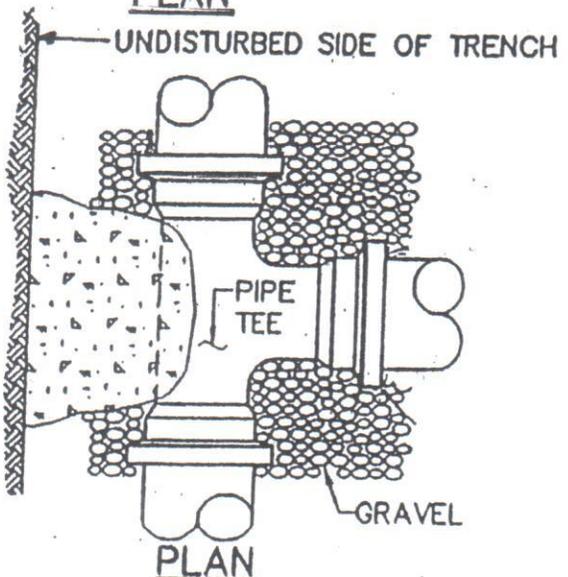
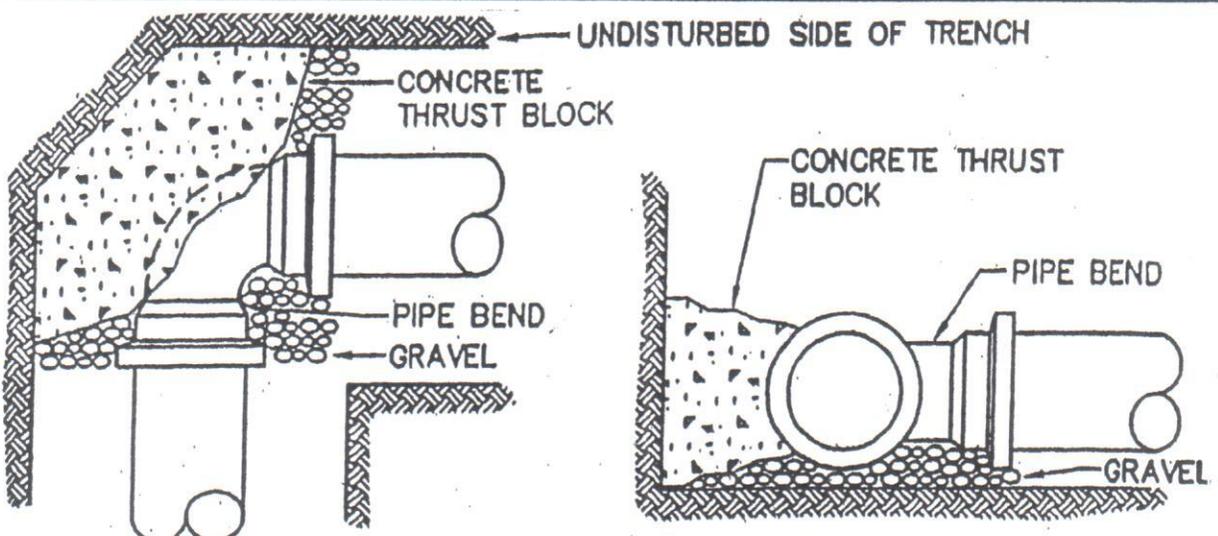
(RESTRAIN PIPE ONE BELL PAST MINIMUM DISTANCE)

1. VALUES WERE CALCULATED ASSUMING A MINIMUM OF 5 FEET OF COVER OVER THE THE PIPE OF 250 PSI (150 PSI TEST PRESSURE WITH A 100 PSI SURGE ALLOWANCE).
2. THE VALUES LISTED FOR BENDS IS THE LENGTH OF RESTRAINED JOINT PIPING REQUIRED FOR EACH SIDE OF THE FITTING.
3. THE VALUES LISTED FOR TEES IS THE LENGTH OF RESTRAINED JOINT PIPING REQUIRED FOR THE TEE BRANCH. VALUES WERE CALCULATED BASED ON A MINIMUM LENGTH OF 10 FEET BETWEEN THE NEAREST JOINTS ON BOTH SIDES OF THE TEE.
4. THE VALUES LISTED FOR REDUCERS IS THE LENGTH OF RESTRAINED JOINT PIPING FOR THE LARGER PIPE.
5. THE VALUES LISTED FOR VERTICAL OFFSETS ARE THE LENGTHS OF RESTRAINED JOINT PIPING REQUIRED FOR THE HIGHER PIPE AND THE LOWER PIPE, RESPECTIVELY, AND ASSUMING A VERTICAL OFFSET OF 3 FEET.
6. WHERE RESTRAINED LENGTH OF TWO OR MORE FITTINGS OVERLAP, THE LARGER RESTRAINED LENGTH SHALL GOVERN.
7. BACKFILL SHOULD BE COMPACTED TO AT LEAST 90 PERCENT OF MAXIMUM DRY UNIT WEIGHT DETERMINED BY ASTM TEST DESIGNATION D-1557.
8. VALUES LISTED ARE FOR THE SPECIFIC LAYING CONDITIONS LISTED ABOVE. FOR THE PIPING LENGTH OF RESTRAINED JOINT PIPING FOR OTHER CONDITIONS, SEE THE TOWN.

PLATE 2

MINIMUM RESTRAINED JOINT PIPE LENGTH - WATER MAINS

SEABROOK WATER DEPARTMENT



NOTE: ALL FITTINGS TO BE PLACED ON WELL CONSOLIDATED GRAVEL.

MINIMUM  
BEARING AREA - FT.<sup>2</sup>

PIPE DIAMETER (INCHES)	TEES, DEAD ENDS VALVES	90° BENDS	45° BENDS	22 ½° BENDS	11 ¼° BENDS
6	2.5	3.6	2.0	2.0	2.0
8	4.4	6.2	3.3	2.0	2.0
10	6.5	9.2	5.0	2.6	2.0
12	8.9	12.6	6.8	3.4	2.0

NOTES:

1. BEARING AREAS, BASED ON SOIL BEARING CAPACITY OF 4,000 PSF. MINIMUM BEARING AREA IS 2.0 SQUARE FEET.
2. IF SOIL HAS DIFFERENT BEARING CAPACITY THAN NOTED, NEW BEARING CAN BE CALCULATED BY RATIO I.E., IF SOIL HAS BEARING OF 2,000 PSF, MULTIPLY TABULATED VALVE BY 4/2.
3. TABLE IS FOR HORIZONTAL RESTRAINT ONLY.
4. VALVES SHOWN ARE FOR TEST PRESSURE OF 150 PSI WITH A 100 PSI SURGE ALLOWANCE.
5. THRUST BLOCKS SHALL NOT BE PLACED AGAINST THE FOLLOWING SOILS:  
A) PEAT, ORGANIC SILT AND ORGANIC SOILS; B) SOFT CLAY; C) RUBBISH FILL AND OTHER UNSUITABLE ARTIFICIAL FILL; D) SHATTERED SHALE;  
E) INORGANIC SILT AND VERY FINE SANDS.
6. WHERE POSSIBLE, PLACE CONCRETE ANCHOR BLOCKS AGAINST UNDISTURBED EARTH. OTHERWISE, PLACE COMPACTED BACKFILL USING GRAVEL AND WELL GRADED SAND.
7. BACKFILL SHOULD BE COMPACTED TO AT LEAST 90 PERCENT OF MAXIMUM DRY UNIT WEIGHT DETERMINED BY ASTM TEST DESIGNATION D-1557.

PLATE 4

MINIMUM THRUST BLOCK SIZING  
SEABROOK WATER DEPARTMENT

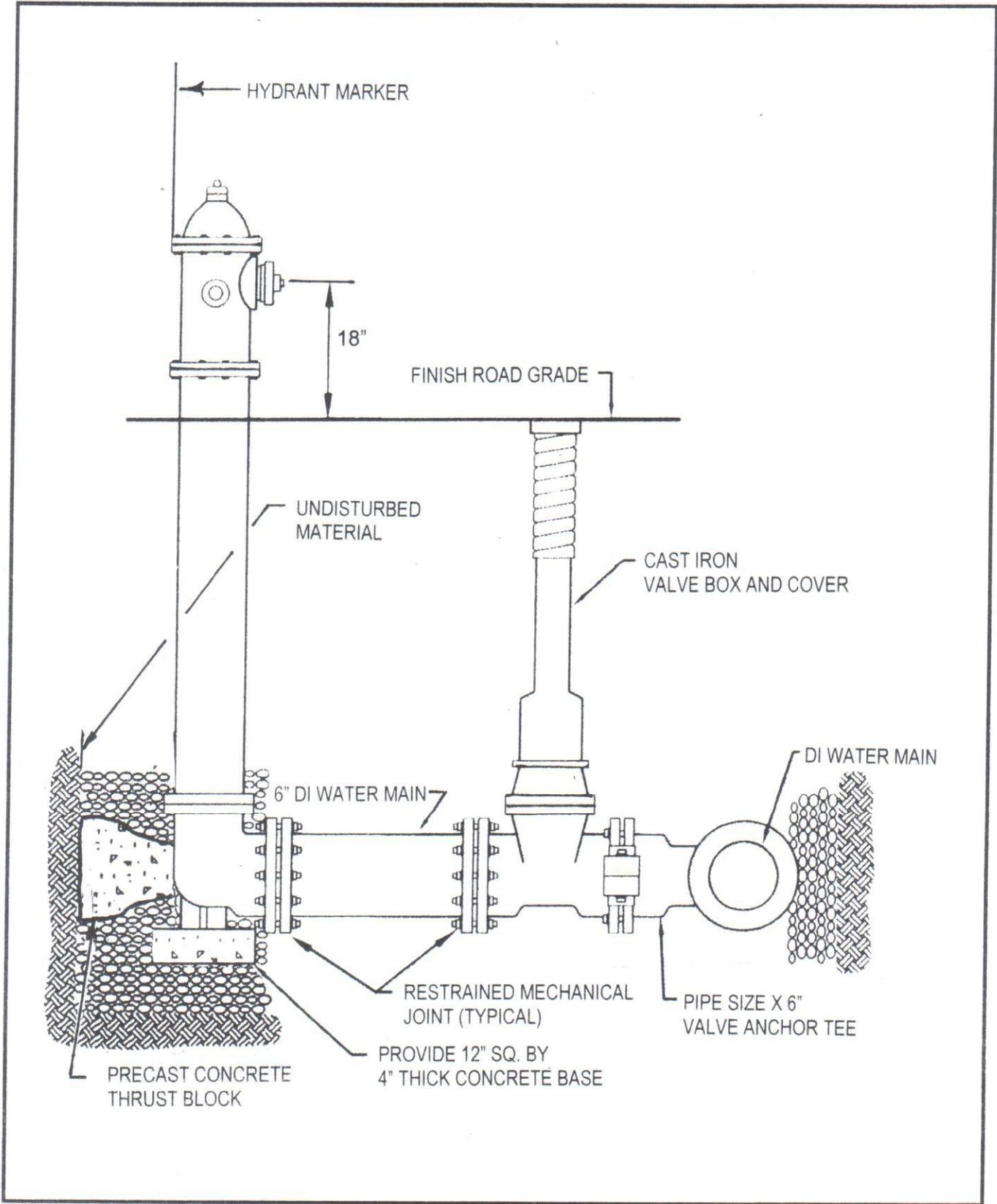
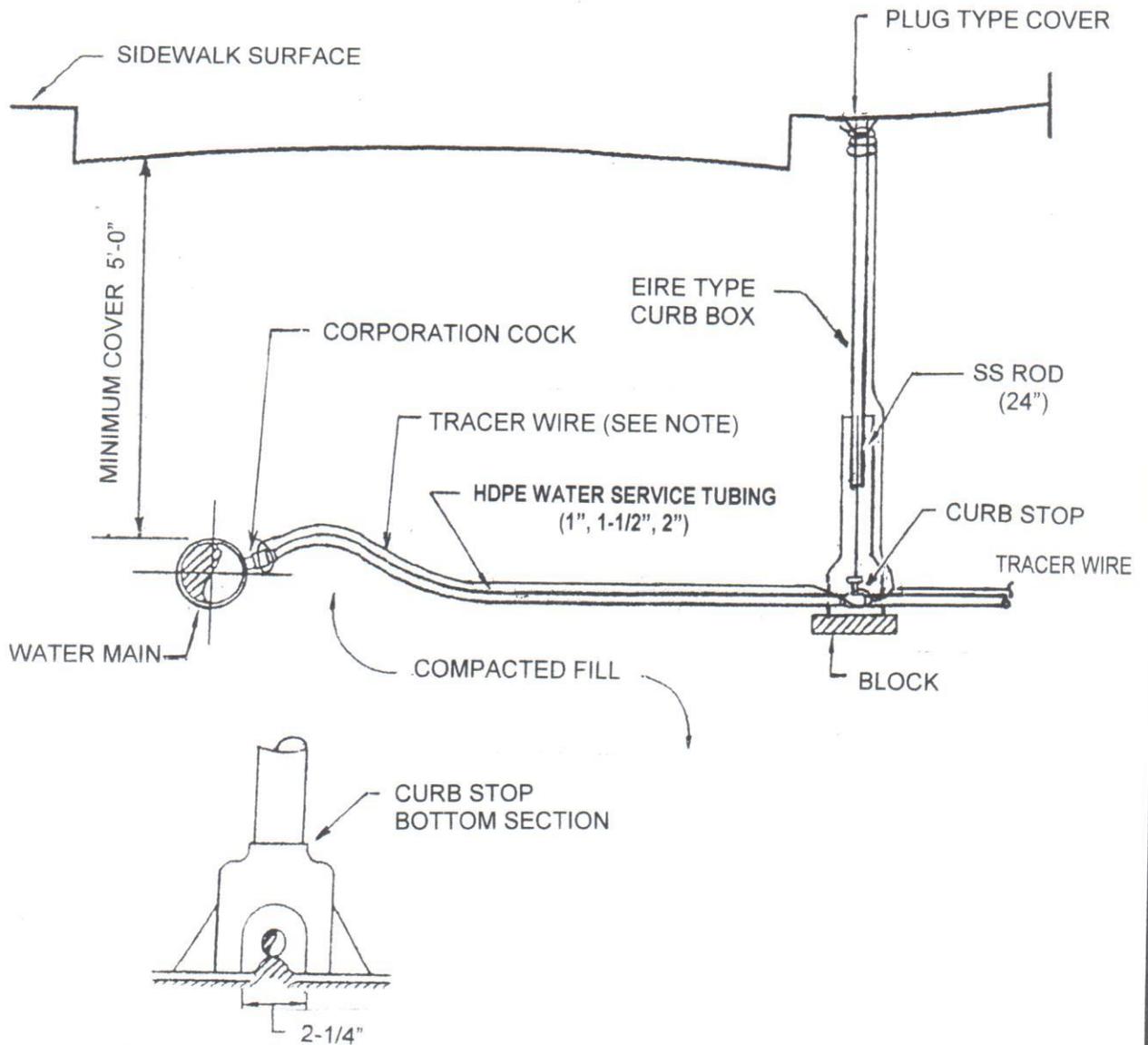


PLATE 5

HYDRANT INSTALLATION  
 SEABROOK WATER DEPARTMENT



**NOTE (TRACER WIRE):**

For water services, place water service tracer wire along side of HDPE water service line in two segments as follows:

1. 1<sup>st</sup> Segment: Wind tracer wire 3 times around corporation cock and extend to curb stop, then wind tracer wire 3 times around curb stop and extend to top of curb box, wind 3 times around curb box (approximately 1-inch below top of curb box) and leave a small coil of wire;
2. 2<sup>nd</sup> Segment: Wind tracer wire 3 times around top of curb box (leave a small coil at top of box as described in the first segment), extend tracer wire down curb box, wind around corporation and then extend into residence/building ending in a small coil.

Each tracer wire segment shall be continuous with no splices.

PLATE 6

**TYPICAL HDPE WATER SERVICE DETAIL**  
**SEABROOK WATER DEPARTMENT**

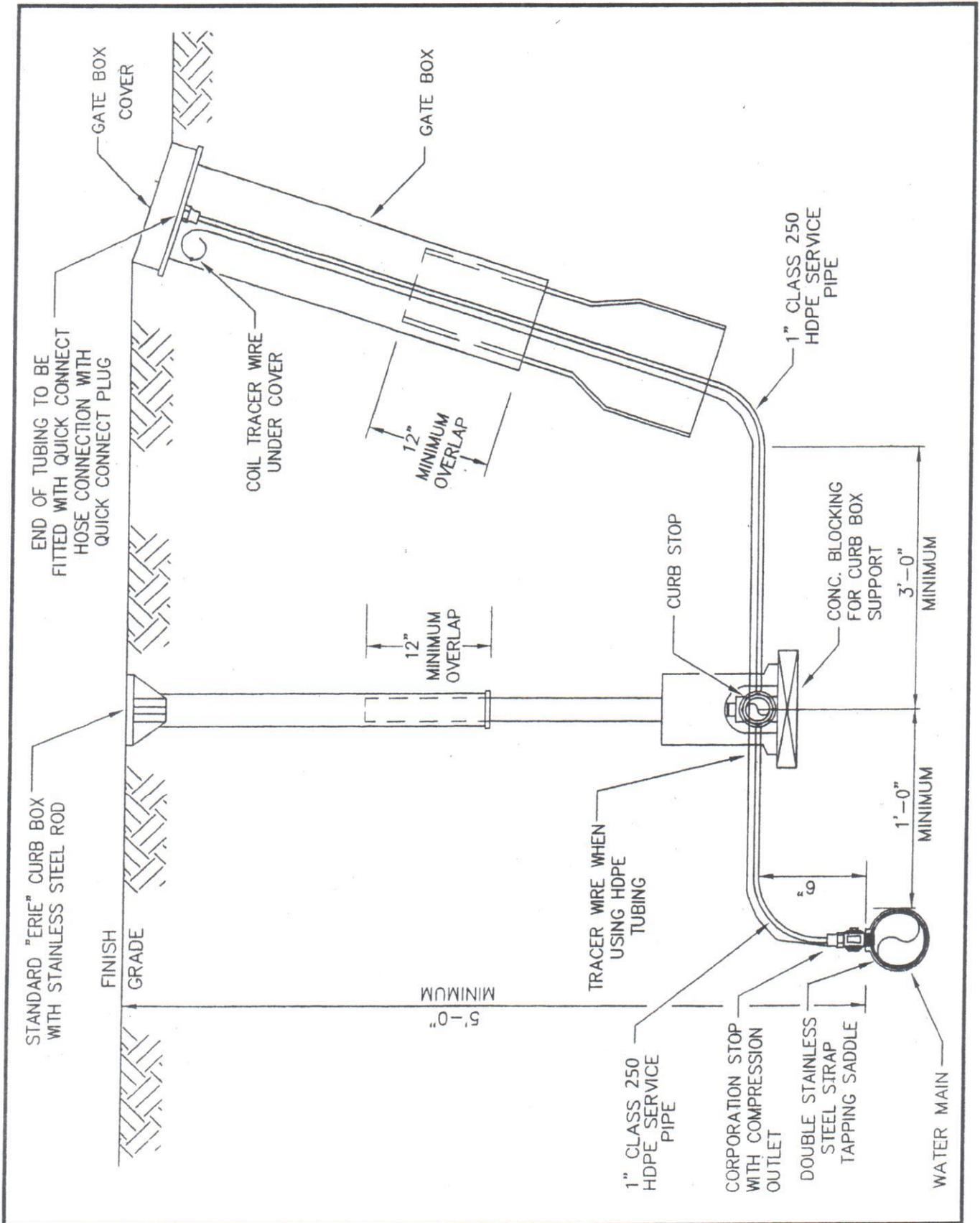


PLATE 7

TYPICAL BLOW-OFF DETAIL  
SEABROOK WATER DEPARTMENT