

TOWN OF MONTVILLE

WATER POLLUTION CONTROL AUTHORITY



SPECIFICATIONS FOR THE INSTALLATION OF WATERMAINS AND APPURTENANCES

THE CONTRACTOR SHALL CONTACT
"CALL BEFORE YOU DIG"

AT

1-800-922-4455

AND MARK THE SURFACE TO INDICATE
THE AREA TO BE EXCAVATED IN
WHITE

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ADOPTED November 6, 2006

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SECTION 1

DEVELOPERS' CODE FOR THE INSTALLATION
OF WATER MAINS
AND
APPURTENANCES

**DEVELOPERS' CODE FOR THE INSTALLATION OF
WATER MAINS AND APPURTENANCES**

1.0 APPROACH

The DEVELOPER shall be solely responsible for complying with the following requirements when installing water mains and appurtenances. These requirements are divided into three phases which indicate the order for completion.

1.01 PHASE 1

Must be completed prior to issuance of a main extension agreement:

Submit to the AUTHORITY two reproducible prints of drawings showing proposed water main installations. These drawings shall bear the seal of a Professional Engineer registered in the State of Connecticut. A detailed plan shall be provided with the exact locations of all sewers, septic systems, storm drains, manholes, culverts, and any other possible sources of pollution. Drawings shall be produced in AutoCADD.

A model Main Extension Agreement is given in Appendix B.

1.02 PHASE 2

Must be completed prior to beginning of construction of water mains and appurtenances:

1. Enter into a Main Extension Agreement with the AUTHORITY and make the required deposit at the time said Agreement is executed.
2. Furnish to the AUTHORITY the name of the CONTRACTOR who will install the water mains and appurtenances.
3. Arrange, to the satisfaction of the AUTHORITY, for field inspection services for the installation of the water mains and appurtenances.
4. Furnish the required insurance certificate as stipulated in the Main Extension Agreement.
5. Notify the AUTHORITY in writing, of the starting date of water main construction not later than ten working days in advance of construction.
6. Contact the AUTHORITY for all tie-in connections to ends of existing mains. These connections shall be made by the developer's CONTRACTOR under supervision of the AUTHORITY.
7. Establish lines and grades in the field such that, upon completion of the project, there shall be a minimum of 4'-6' of cover on all water mains and services. Fire hydrants shall be set with nozzles at proper elevations, and locations of water mains and appurtenances shall conform to the drawings approved by the AUTHORITY. Steamer connections shall face the nearest road. Hydrant break away connections shall not be buried below grade.

1.03 PHASE 3

Must be completed by the end of construction and prior to final acceptance by the AUTHORITY:

1. When installing water mains and appurtenances, adhere to the technical specifications in Section 2 of these regulations.
2. Pressure test all new water mains and appurtenances in accordance with the appropriate specification in Section 2 of these regulations.
3. Disinfect all new water mains and appurtenances in accordance with the appropriate specification in Section 2 of these regulations.
4. Contact the AUTHORITY when water is needed for filling, flushing and testing water mains and appurtenances. AUTHORITY personnel shall be the only ones

allowed to open valves off existing water mains which are in service. It is important that no water be allowed to flow from unproven mains into existing in-service mains.

5. Furnish to the AUTHORITY a maintenance bond in a form satisfactory to the AUTHORITY and issued by a carrier satisfactory to the AUTHORITY in a dollar amount specified by the AUTHORITY. Such bond shall cover a period of 24 months following completion of the installation of water mains and appurtenances. This completion date shall be established as the date of final acceptance by the AUTHORITY.
6. Furnish to the AUTHORITY the following items pertaining to installation, testing and disinfection of new water mains and appurtenances within four weeks of a satisfactory pressure test.
 - a. Signed and sealed statement by the DEVELOPER addressed to the AUTHORITY stating: (1) that all work involved with installation of water mains and appurtenances has been completed in accordance with drawings approved by the AUTHORITY and in accordance with the specifications contained in Section 2, "Technical Specifications for Materials and Construction of Water Distribution Systems," of these regulations; (2) that all valves and hydrants are open and in satisfactory operating condition; (3) that all water mains and appurtenances have met the required pressure test; and (4) that all water mains and appurtenances have been satisfactorily disinfected.
 - b. One print of the record drawing, scale 1" = 40', showing the constructed location of all water mains with ties to all fittings and valves and marked "As Built" and stamped with the developer's Engineer's PE license seal.
 - c. One photographic reduction or print, scale 1" = 40', above record drawing.
 - d. One disk and back-up containing AutoCADD data files for the record drawing.
7. Contact the AUTHORITY for the turning on of each water service. It shall be the responsibility of the DEVELOPER to make this contact prior to the need for any water at any individual premises. It shall further be the responsibility of the DEVELOPER to notify the AUTHORITY when a house is ready for occupancy. The DEVELOPER shall notify the WPCA when the meter is installed. The WPCA will open the curb stop, read the meter and begin service to each residence.

2.0 GENERAL INFORMATION

2.01 RESPONSIBILITY

Inasmuch as many of the preceding requirements are of an engineering nature, the required information, certificates, etc., may be submitted by the developer's Engineer. However, the DEVELOPER is responsible for seeing that all requirements are fulfilled.

2.02 REVISIONS

The AUTHORITY is to be notified promptly if any revisions are made to a project after the AUTHORITY has approved the original drawings.

Such notification is to be made by submitting two prints of the revised drawings for approval. One print will be returned with either the authority's approval or comments for corrections. If corrections are required, two revised prints are to

The AUTHORITY cannot be responsible for any water distribution systems which are revised after approval of the original drawings unless proper notification is received as outlined above.

2.03 SERVICE CONNECTION SIZE

Corporation stops, valves, service lines and curb stops between the main and premises shall be 1" for single residential units; and shall be as required, but at least 1", for multi-family residential and commercial units.

SECTION 2

TECHNICAL SPECIFICATIONS FOR
MATERIALS AND CONSTRUCTION
OF
WATER DISTRIBUTION SYSTEMS

TECHNICAL SPECIFICATIONS

I. GENERAL CONDITIONS

1. Water service and house sewer pipes shall be laid in separate trenches at least ten (10) feet apart. When approved to be laid in the same trench due to warranted conditions, the water pipe shall be laid on a bench at least 18 inches above the top of the sewer pipe and 18 inches from the side of the sewer pipe.
2. Minimum cover on water mains and services shall be 4'.
3. In general, separate units (each separate residential unit in a condominium) shall be separately metered and have separate water services.
4. Water mains should be at least ten (10) feet from any building.
5. Curb boxes should be at least six (6) feet from any building.
6. Hydrant branch lines shall not be connected to water mains of less than eight (8) inches.
7. Minimum hydrant branch line size is six (6) inches.
8. Meters:

Exterior meters located in meter pits shall be so located as to be accessible to the main distribution line for proper service connection. The meter pit shall be installed as to be unaffected by climatic conditions, reasonably secure from damage and in areas not subject to vehicular traffic if possible.

Interior meters installed inside buildings shall be located as near as possible to the point where the service pipe enters the building and so as to be reasonably secure from damage.

9. Water mains insofar as practicable shall be designed to avoid dead ends. Where dead ends are necessary, hydrants or blow-offs for the purpose of flushing the mains must be installed.
10. Remote Water Reading Devices are required on all residential units with interior meters.
11. Backflow Prevention Devices are required on all commercial services or for other potentially contaminating situations.
12. No backfilling over pipe shall be done until an inspection has been made by an authorized representative of the AUTHORITY and installation has been approved.

TECHNICAL SPECIFICATIONS
II. EXCAVATION. BACKFILL AND FILL

1.0 EARTH

1.01 GENERAL

The CONTRACTOR shall clear the site and remove all trees and stumps where necessary and approved by the Town, and shall make all earth excavation, including removal of existing pavements, curbs and walks encountered in the construction of the water mains, appurtenances and structures as required for the proper completion of the work and shall dispose of all excavated materials as specified herein.

The excavation shall include the removal, handling, filling and disposal of any and all materials encountered within the limits of the work, and shall include all pumping, bailing, draining, sheeting, shoring, cofferdamming, backfill, refill, and protection thereof.

1.02 SEPARATION OF SURFACE MATERIALS

The CONTRACTOR shall remove only as much of any existing pavement as is necessary for the pursuance of the work. Wherever the removal of bituminous and/or concrete pavement is required in order to install water mains and equipment, the CONTRACTOR shall cut all pavement with pneumatic tools or saws. Ripping of pavement in any form shall not be tolerated. Excavated pavement shall not be placed back in the trench under any circumstances.

1.03 TRENCH EXCAVATION SPECIFICATIONS

a. Trench Width

Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.

Trenches shall be excavated with approximately vertical sides between the elevation of the center of the pipe and an elevation one foot above the top of the pipe.

The trench width shall be measured at the top of the pipe barrel and shall conform to the following limits:

<u>Earth</u>	
Minimum	Outside diameter of the pipe barrel plus 8 inches, i.e., 4 inches each side.
Maximum	Nominal pipe diameter plus 24 inches.

Rock

	<u>Pipe Diameter</u> <u>24 inches or less</u>	<u>Pipe Diameter</u> <u>Larger than 24 inches</u>
Minimum	Outside diameter of the pipe barrel plus 12 inches, i.e., 6 inches each side.	Outside diameter of the pipe barrel plus 18 inches, i.e., 9 inches each side
Maximum	Nominal pipe diameter plus 24 inches	

If, for any reason the trench width exceeds the maximum trench width, the CONTRACTOR, shall provide compacted stone bedding, additional strength pipe or concrete encasement, at no cost to the AUTHORITY.

b. Trench Depth and Bottom Preparation

(1) General. The trench shall be excavated to a depth which will provide a minimum cover of 4' measured from the top of the pipe unless prior approval is granted by the AUTHORITY.

(2) Earth. The trench shall be excavated to a depth of four (4) inches below the pipe barrel and so as to provide a uniform and continuous bearing and support for the pipe barrel on solid and undisturbed ground at every point between joints, except that it will be permissible to disturb the finished trench bottom over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. When required, bell holes shall be provided. The finished trench bottom shall be accurately prepared by means of hand tools.

(3) Rock. Where excavation is made in rock or boulders, the trench shall be excavated six (6) inches below the pipe barrel for pipe 24 inches in diameter or less, and nine (9) inches for pipe larger than 24 inches in diameter. All loose material shall be removed from the trench bottom. After preparation of the trench bottom, a pipe bed shall be prepared using crushed stone or crushed gravel meeting the following requirements:

<u>Nominal Pipe Size</u>	<u>Stone or Gravel</u>
Less than 16"	3/4"
16" - 30"	3/4" or 1"
Greater than 30"	3/4" or 1"

The bedding material shall be spread the full width of the trench bottom.

(4) Foundation. The mains are to be built on a good foundation. If material unsuitable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried, the CONTRACTOR shall remove such material to the required width and depth and replace it with thoroughly compacted, screened gravel or concrete, as directed.

Where pipe is to be laid in gravel bedding, the trench may be excavated by machinery to, or to just below, the designated subgrade, provided that the material remaining at the bottom of the trench is no more than slightly disturbed.

Pipe shall not be laid in areas where excavation has been carried below trench grade, or where water conditions create unstable bottoms, until such time as the trench is excavated, refilled and compacted to the satisfaction of the Engineer.

1.04 EXISTING UTILITIES AND STRUCTURES

Attention is directed to the fact that there are pipes, drains and other utilities in certain locations. Most of these have been indicated on the drawings, but the completeness or accuracy of the information given is not guaranteed.

a. Protection. All existing walks, pipes, conduits, poles, wires, fences, stairways, signs, posts, guard rails, curbing, property line markers, walls, buildings and other structures which do not, in the opinion of the Engineer, require change of location, shall be carefully supported and protected from injury by the CONTRACTOR, and in case of injury, they shall be restored by him to as good condition as that in which they were found.

Materials for temporary support, adequate protection and maintenance for all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the CONTRACTOR at his own expense.

b. Subsurface Explorations. It shall be the responsibility of the CONTRACTOR to determine the exact location of all existing underground structures and utilities, such as pipes, drains, sewers, electric lines, telephone lines, cable TV lines, gas lines and water lines and the character of all soil materials and conditions before actual construction commences. In addition to any requirements imposed by law, the CONTRACTOR shall perform such subsurface excavation and/or other investigations as will fully inform him of the location of all underground structures and utilities and the character of all soil materials and conditions.

The cost of any subsurface investigation, including, without limiting the generality thereof, exploratory excavations, backfills and repairs, that may be necessary shall be borne by the CONTRACTOR.

c. Obstructions by Other Utility Structures. Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers or main drains, the obstruction shall be permanently supported, relocated, removed or reconstructed by the CONTRACTOR in cooperation with the owners of such utility structures. Before proceeding, the CONTRACTOR shall reach an agreement with the AUTHORITY on the method to avoid obstruction.

No deviation shall be made from the required line or depth except with the consent of the AUTHORITY.

d. Repairs. Existing pipes or conduits crossing the trench, or otherwise exposed, shall be adequately braced and supported to prevent trench settlement from disrupting the line or grade of the pipe or conduit, all in accordance with the directions of the AUTHORITY. Utility services broken or damaged shall be repaired at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Temporary arrangements, as approved by the AUTHORITY, may be used until any damaged items can be permanently repaired. All items damaged or destroyed by construction and subsequently repaired shall be properly maintained by the

done until approval is received from the owner of the utility or structure being changed.

1.05 SHEETING AND SHORING

Unsupported open cut for mains shall not be permitted where trenching may cause unnecessary damage to street pavement, trees, structures, poles, utilities or other private or public property. During the progress of the work, whenever and wherever it is necessary, the CONTRACTOR shall, at his expense, support the sides of the excavation by adequate and suitable sheeting, shoring, bracing, trench boxes or other approved means. Such trench support materials and equipment shall remain in place until backfilling operations have progressed to the point where the supports may be withdrawn without endangering persons or property. The CONTRACTOR may leave in place to be embedded in the backfill of the excavation any sheeting or bracing which the Engineer considers necessary for that purpose.

It is the sole responsibility of the CONTRACTOR to ensure that all safety regulations pertaining to earth work are strictly adhered to. The AUTHORITY shall not be responsible for any fines or injuries which occur to the contractors equipment or personnel as a result of failing to comply with regulations concerning trench supports.

1.06 REMOVAL OF WATER

Until final acceptance of the work, the CONTRACTOR shall pump out or otherwise remove and dispose of as fast as it may collect, any water, sewage or any other liquids which may be found or may accumulate in the excavations, regardless of whether it be water or liquid wastes from his own contract or from any existing conduits, works or surface runoff.

There shall be upon the work at all times during the construction, proper and approved machinery of sufficient capacity (including spare units kept ready for immediate use in case of breakdowns) to meet the maximum requirements for the removal of the water or other liquids and their disposal in such a manner as not to withdraw sand or cement from the concrete, nor interfere with the proper laying of pipe and/or masonry or the prosecution of work under this or other contract, nor endanger existing structures.

Trenches shall be sufficiently dewatered so that the laying and joining of the pipe is made in the dry. The CONTRACTOR shall convey all trench water to a natural drainage channel or storm sewer without causing any property damage.

Disposal of silt and debris which accumulates during construction shall be performed in strict accordance with State or local requirements. The CONTRACTOR shall obtain and pay for any permits required for dewatering and disposal.

1.07 PROTECTION TO EXISTING VEGETATION

Special care shall be taken to avoid damage to trees and their root systems. Machine excavation shall not be used when, in the opinion of the AUTHORITY, it would endanger the tree. In general, where the line of trench falls within the limits of the limb spread, headers are required across the trench to protect the tree. The operation of all equipment, particularly when employing booms; the storage of materials; and the disposition of excavation shall be conducted in the manner which will not injure trees (trunks, branches or roots), unless such trees are designated for removal.

Tree roots shall not be mutilated nor cut except by permission of the Engineer. When cutting is permitted, the root ends shall be cut off smooth, without splitting or shattering. The trunks of the trees shall be carefully protected from damage,

and if unavoidable or accidental damage occurs, the injured portions shall be neatly trimmed and covered with an application of grafting wax or other approved preparation. Branches shall not be cut off except by special permission of the Engineer.

The CONTRACTOR shall dig up, handle, protect and properly reset hedges, small trees, shrubbery and the like along the line of or adjacent to the work, and shall take all reasonable care in this work not to disturb any object that can be saved in its existing condition. Existing trees and shrubbery outside the clearing limits shall be protected from damage.

1.08 BACKFILLING PIPE TRENCHES

As soon as practicable after the pipes have been laid or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, the backfilling shall be started and thereafter it shall proceed until completion. Refer to Figure A-1 for the following paragraphs.

a. Zone Around Pipe. A minimum four (4) inch layer of sand shall be provided under the entire length of pipe regardless of the texture of the existing soils. The sand shall be tamped and leveled to ensure the pipe will be evenly supported and will not experience any points of stress. Bell holes shall be excavated as necessary to ensure that the pipes and not the pipe bells are bearing the weight of backfill and traffic load.

Once the pipe has been satisfactorily laid on the bed of sand, additional sand shall be placed on both sides of the pipe and compacted simultaneously with approved tamping bars for the full length of the pipe.

Sand shall then be slowly backfilled in six inch layers over the pipe to a depth of one (1) foot measured from the top of the pipe. The sand shall then be tamped with approved tamping equipment which ensures that the entire length of pipe is supported evenly throughout its circumference. No sand shall be placed above the top of the pipe until sand under and at the sides of the pipe has been compacted. Care shall be taken in the use of mechanical or other tampers not to injure or move the pipe or to cause the pipe to be supported unevenly.

Where granular bedding or granular backfill is required, the CONTRACTOR shall place bulkheads of clay soil across the trench at 100 foot intervals to resist the movement of groundwater through the granular material. Such bulkheads shall be carefully compacted and shall extend approximately three (3) feet in a direction parallel to the pipe and shall extend from the bottom of the trench to a height of six (6) inches above the top of the pipe barrel.

Under extreme circumstances where the placement of sand around the pipe is unreasonable (i.e. river crossings, high ground water), alternate materials approved by the AUTHORITY will be used (e.g., 3/4 inch stone, process gravel, etc.).

b. Remainder of Trench. Above the zone around the pipe (from one (1) foot above the pipe barrel to the surface).

(1) Materials. The nature of the materials will govern both their acceptability for backfill and the methods best suited for their placement and compaction in the backfill. In general, material used for backfilling trenches and excavations around structures shall be suitable material which was removed in the course of making the construction excavations.

No stone or rock fragment larger than ten (10) inches in greatest dimension shall be placed in the backfill. Material for backfilling shall be earth materials entirely free from vegetation, trash, lumber, frozen, soft or organic materials, and earth with an exceptionally high void content. Pieces of bituminous pavement shall be excluded from the backfill.

(2) Trench Backfilling. Mechanical equipment may be used to place the backfill. This shall be done in such a manner that the material does not free fall, but shall be so placed that it will flow onto the previously placed material. If necessary, a timber grillage shall be used to break the fall of material dropped from a height of more than five feet.

The backfill shall be consolidated in such a manner (water jetting, puddling or tamping) as will insure the minimum possible settlement and the least interference with traffic. No compacting of the backfill with mechanical equipment, such as wheeled vehicles, will be permitted unless sufficient cover is provided over the pipe to prevent damage to the pipe. Waterjetting or puddling shall be used wherever the material does not contain so much clay or loam as to delay or prevent satisfactory drying.

The trench surface shall be regularly attended to during the course of the Contract. The CONTRACTOR shall take prompt corrective measures to correct any settlement or wash-out. The trench surface shall be maintained in a safe condition and shall not interfere with natural drainage.

(3) Waterjetting. If the backfill is to be compacted by waterjetting, the material shall be placed in uniform layers not exceeding four feet deep. Before the succeeding layer is placed, each layer shall be thoroughly saturated throughout its full depth and at frequent intervals across and along the trench until all slumping ceases. To accomplish this, the CONTRACTOR shall furnish one or more jet pipes, each of sufficient length to reach to the specified depth and of sufficient diameter (not less than 1-1/4 inch) to supply an adequate flow of water to compact the material. The jet pipe shall be equipped with a quick-acting valve and be supplied through a fire hose from a hydrant or a pump having adequate pressure and capacity.

(4) Puddling. If the backfill is to be compacted by puddling, the material shall be deposited in water of sufficient depth so that the material will be submerged when in place. Dams or dikes constructed in the trench to hold the water used for puddling shall be compacted by tamping as specified below.

(5) Tamping. If the material is unsuitable for jetting or puddling, compaction shall be accomplished by tamping or, under appropriate circumstances, rolling. The material shall be deposited and spread in uniform, parallel layers not exceeding eight (8) inches thick before compaction. Before the next layer is placed, each layer shall be tamped as required so as to obtain a thoroughly compacted mass. If necessary, the CONTRACTOR shall furnish and use an adequate number of power driven tampers, each weighing at least 20 lbs., for this purpose. Care shall be taken that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval, be compacted by the use of suitable rollers, tractors or similar powered equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities furnished by the CONTRACTOR for its spreading, leveling and compacting.

If necessary to ensure proper compaction by tamping (or rolling), the material shall first be wet by sprinkling. However, no compaction by tamping (or rolling) shall be done when the material is too wet either from rain or too great an

application of water to be compacted properly; at such times, the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compacting, or such other precautions shall be taken as may be necessary to obtain proper compaction.

(6) Miscellaneous Requirements. Whichever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material. Only approved quantities of stones and rock fragments shall be used in the backfill. The CONTRACTOR shall, as part of the work done under the items involving earth excavation as appropriate, furnish and place all other necessary backfill material.

1.09 FILL AND BACKFILL UNDER STRUCTURES AND STATE HIGHWAYS

All fill and backfill under structures and pavements adjacent to structures shall be compacted bank-run gravel containing not more than five percent material passing a 200 sieve. The entire backfill shall be compacted to 95 percent of maximum density of optimum moisture as determined by Method D of ASTM D1557 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457 mm) Drop.

1.10 DISPOSAL OF MATERIALS

Any excavated materials not required or not suitable for backfilling shall be removed from the site of the work and disposed of by the CONTRACTOR at his own expense.

The CONTRACTOR will not be allowed to store excess excavated material on the public highway. Any excavated material which is not to be used immediately for backfilling shall be carted away and stored until such time as the material is to be used for backfilling.

All materials obtained as a result of the clearing and grubbing operations shall be disposed of in an approved manner. Burning of logs, stumps, roots, cuttings and other material on the site shall not be permitted. Chipping of brush materials will be permitted.

2.0 ROCK EXCAVATION

2.01 GENERAL

The CONTRACTOR shall excavate within the lines and grades as shown or required, and shall satisfactorily dispose of any rock, boulders or existing concrete, stone or masonry which may be encountered in the work.

The word "rock" shall mean boulders and pieces of masonry or concrete exceeding one cubic yard in volume or solid ledge rock which, in the opinion of the Engineer, requires removal, drilling, and blasting or wedging, sledging, barring or breaking up with a power operated tool. No soft or disintegrated rock which can be removed with a hand pick or power operated excavator or shovel, no loose, shaken or previously blasted rock or broken stone in rock fillings or elsewhere, and no rock exterior to the minimum limits of excavation allowed, shall be measured or allowed.

2.02 BLASTING AND EXPLOSIVES

Where blasting is necessary, it shall be done in accordance with all ordinances and other pertinent regulations and with all orders given by the Engineer relative to the storing and handling of explosives and the firing of blasts. Such ordinances, regulations and orders shall not, however, relieve the CONTRACTOR of any responsibility for damages caused by him or his employees.

Prior to the firing of blasts, all persons in the vicinity shall be given ample warning, and blasting shall be done only by licensed persons. All blasts shall be well covered and provisions shall be made to protect all pipes and structures and all persons or property along and adjacent to the site of the work. Necessary permits shall be secured and paid for by the CONTRACTOR. The CONTRACTOR shall perform whatever pre-blast surveys and investigations which may be required by the circumstances and/or by Federal, State or local laws.

All blasting shall be completed within a distance of 25 feet before any portion of a masonry structure is placed or any pipe is laid. In case any injury occurs to any portion of the work or to the materials surrounding or supporting the same through blasting, the CONTRACTOR, at his own expense, shall rebuild or repair the work and replace the material surrounding or supporting the same.

3.0 MATERIALS

3.1 SAND

a. Composition. Sand shall be the fine granular material naturally produced by the disintegration of rock and shall be sufficiently free of organic material, mica, loam, clay and other deleterious substances. In no case shall sand containing lumps of frozen materials be used.

b. Gradation. In case visual inspection of the sand indicates that it is too coarse, the following gradation shall determine its acceptability:

Sieve Size	Percentage Passing Sieves	Sieve Size	Percentage Passing Sieves
3/8 inch	100	#30	30 - 50
#4	95 - 100	#50	10 - 22
#8	65 - 90	#100	2 - 8
#16	45 - 75	#200	3

3.2 BANK-RUN GRAVEL

a. General. The CONTRACTOR shall furnish, place and compact bank-run gravel as indicated on the drawings or directed and as herein specified.

b. Gravel. Bank-run gravel shall be a granular material, well graded from fine to coarse, with a maximum size of three (3) inches, obtained from approved natural deposits and unprocessed, except for the removal of unacceptable material and stones larger than the maximum size permitted. It shall not contain vegetation, masses of roots or individual roots more than 18 inches long or more than 1/2 inch in diameter. It shall be substantially free from loam and other organic matter, clay, silt and other fine or harmful substances.

c. Placing and Compacting. The bank-run gravel shall be spread in layers of uniform thickness not exceeding eight inches before compaction and moistened or allowed to dry as directed. Then it shall be thoroughly compacted by means suitable, power-driven tampers or other power-driven equipment.

3.3 CONCRETE

3.31 GENERAL

The CONTRACTOR shall furnish all labor, materials, tools and equipment necessary to construct the concrete work required. This shall include thrust blocks at pipe bends and tees in trenches, and for all miscellaneous concrete work.

All materials are to be carefully selected so as to be free of deleterious amounts of acid, alkali and organic material. If these materials are stored at the job,

they shall be placed where no foreign materials will be introduced and no deterioration of the cement will take place. Latest revisions of ASTM Specifications are to be followed.

3.32 COMPONENT PARTS

- a. Portland Cement. Portland Cement shall conform to ASTM C150.
- b. Aggregate. Aggregate shall conform to ASTM C33. Coarse aggregates shall be a maximum of 3/4" in size.
- c. Reinforcing Bar. Reinforcing bar shall conform to ASTM A615 or ASTM A617 Grade 40. Reinforcing bars shall be new stock, free from rust, scale or other coating tending to destroy or reduce bond.
- d. Welded Wire Mesh. Welded wire mesh shall conform to ASTM A185.
- e. Water. Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, organic materials or other deleterious substances. In effect, the water used shall be potable.

3.33 CONCRETE QUALITY

Concrete shall have a minimum ultimate 28 days compressive strength of 3,000 psi. Concrete shall be proportioned to contain not more than 5-1/4 gallons of water per sack of cement including the free water in the fine and coarse aggregates. A workable concrete with minimum slump of three (3) inches and a maximum slump of five (5) inches shall be produced not exceeding the water-cement ratio.

Concrete for pavement replacement shall conform to the requirements of the State of Connecticut, Department of Transportation.

3.34 MIXING AND PLACING

Concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturer and mixing shall be continued for at least one minute after all materials are in the mixer.

Ready-mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the standard specifications for Ready-Mixed Concrete ASTM C94.

Provisions shall be made for maintaining all concrete in a moist condition for at least five days after placement. Concrete shall be protected against wash by groundwater in ditches.

Adequate equipment shall be provided for protecting the concrete from freezing. No frozen material or materials containing ice shall be used. No dependence shall be placed on salt or other chemicals for the prevention of freezing. The CONTRACTOR shall supply such heating apparatus as stoves, salamanders or steam equipment and the necessary fuel. When dry heat is used, means of maintaining atmospheric moisture shall be provided. The temperature of the concrete shall be not less than 60° at the time of placing in the forms.

Admixtures shall be in conformance with the recommendations and requirements of Form 813 and shall be approved by the Engineer prior to use.

3.4 FILTER FABRIC

Where used in association with laying pipe, filter fabric shall be non-woven, synthetic fiber material with sieve design to prevent the material in the pipe bedding and haunching to migrate into the surrounding soils.

III. INSTALLATION

1.0 DUCTILE-IRON PIPE AND FITTINGS

1.01 GENERAL

The CONTRACTOR shall furnish, lay, joint and test all piping, fittings (including special castings) and appurtenant materials and equipment as indicated on drawings and as herein specified.

All material, equipment, fixtures and devices furnished and such materials, equipment, fixtures and devices shall comply with the requirements and standards of all Federal, State and local laws, ordinances, codes, rules and regulations governing safety and health.

1.02 STANDARD SPECIFICATIONS

All pipe, fittings and accessories, shall conform to the requirements of the latest revisions of the following standard specifications as applicable:

AMERICAN NATIONAL STANDARDS INSTITUTE
AND
AMERICAN WATER WORKS ASSOCIATION

ANSI/AWWA	A21.4/C104	Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water. Lining shall have the following minimum thickness: <div style="margin-left: 400px;">3"-12" Pipe - 1/16" 14"-24" Pipe - 3/32" 30"-54" Pipe - 1/8"</div>
ANSI/AWWA	A21.5/C105	Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
ANSI/AWWA	A21.10/C110	Gray-Iron and Ductile-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.
ANSI/AWWA	A21.11/C111	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
ANSI/AWWA	A21.15/C115	Flanged Gray-Iron and Ductile-Iron Pipe with Threaded Flanges.
ANSI/AWWA	A21.50/C150	Thickness Design of Ductile-Iron Pipe.
ANSI/AWWA	A21.51/C151	Ductile-Iron Pipe Centrifugally Cast in Metal or Sand-Lined Molds for Water or Other Liquids.

1.03 DUCTILE-IRON PIPE

All ductile-iron pipe shall be designed in accordance with ANSI A21.50/AWWA C150 and shall be manufactured in accordance with ANSI A21.51/AWWA C151.

Unless otherwise indicated or specified, all ductile-iron pipe shall be Class 52. Class 54 pipe shall be used in heavy traffic or high loading areas.

Restrained joint pipe shall be U.S. Pipe's Uniflex pipe or Engineer-approved equal.

1.04 PIPE FOR USE WITH COUPLINGS

Pipe for use with sleeve-type couplings shall be as specified above except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.

1.05 FITTINGS

Fittings shall conform to the requirements of ANSI A21.10/AWWA C110 and shall be of a pressure classification at least equal to that of the pipe with which they are used.

Unless otherwise indicated or specified, all fittings shall be bell fittings with mechanical joints.

Fittings shall be provided with standard bases where so indicated. The gaskets shall have metallic tips to provide electrical continuity through the joint.

Restrained joint fittings and the restraining components shall be ductile iron in accordance with applicable requirements of ANSI A21.10/AWWA C110 with the exception of the manufacturer's proprietary design dimensions.

Restrained joint fittings shall be U.S. Pipe's Uniflex or Meg-A-Lug fittings or Engineer-approved equal.

1.06 ADAPTERS

Where it is necessary to joint pipe of different types, the CONTRACTOR shall furnish and install the necessary adapters, unless solid sleeves are indicated on the drawings or approved. Adapters shall have ends, conforming to the above specifications for the appropriate type of joint, to receive the adjoining pipe. Adapters joining two classes of pipe may be of the lighter class provided that the annular space in bell-and-spigot type joints will be sufficient for proper jointing.

1.07 JOINTS

Where so indicated, pipe and fittings shall be furnished with approved lugs or hoods cast integrally for use with bolts or bridle rods and socket clamps to keep the piping from pulling apart under pressure.

Beads of spigot ends of pipe or fittings shall be cut (pipes only) or ground off, if necessary, to ensure that the spigot enters the bell correctly.

Joints for push-on pipe shall conform to ANSI A21.11/AWWA C111.

The plain end of push-on pipe shall be factory machined to a true circle and chamfered to facilitate fitting the gasket.

Push-on pipe and fittings shall be provided with sufficient quantities of accessories conforming to AWWA C111.

Restrained push-on joints for pipe fittings shall be designed for a water working pressure of 350 psi for sizes 4 inch through 24 inch and 250 psi for sizes 30 inch through 54 inch.

Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly.

Gaskets shall be of a composition suitable for exposure to the liquid within the pipe.

Serrated bronze pipe wedges shall be installed in the joints for push-on pipe to provide electrical continuity through the joint. Each pipe wedge shall be driven into the opening between the plain end and the bell until snug (see Figure A-2). Pipe wedge requirements are as follows:

- 2" through 12" diameter pipe - two per joint;
- Larger than 12" diameter pipe - four per joint, inserted side by side in pairs.

1.08 FLEXIBLE CONNECTIONS

Where flexible connections in the pipe are specified or indicated on the drawings, they shall be obtained through the use of sleeve-type couplings and/or fittings as herein specified.

1.09 SLEEVE-TYPE COUPLINGS

To ensure correct fitting of pipe and couplings, all sleeve-type couplings and accessories shall be furnished by the supplier of the pipe and shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed. Sleeve-type couplings shall be made by Dresser Mfg.; Smith-Blair, Inc.; R.H. Baker & Co., Inc.; or Engineer-approved equal.

Couplings for buried pipe shall be of cast iron and shall be Dresser Style 53, Smith-Blair Style 431, Baker Allcast, or Engineer-approved equal products. The couplings shall be provided with black, steel, trackhead bolts with nuts which shall be thoroughly coated with an approved bituminous paint when buried in the ground.

All couplings shall be furnished with the pipe stop removed. Couplings shall be provided with plain, Grade 27, rubber gaskets. The gaskets shall have metallic tips to provide electrical continuity through the joint.

1.10 LINING AND COATING

All pipe and fittings shall be lined and coated as follows. Cement mortar lining and seal coating for pipe and fittings, where applicable, shall be in accordance with ANSI A21.4/AWWA C104. Bituminous outside coating shall be in accordance with ANSI A21.51/AWWA C151 for pipe and ANSI A21.10/AWWA C110 for fittings.

Machined surfaces shall be cleaned and coated with a suitable rust-preventative coating at the shop immediately after being machined.

1.11 INSPECTION AND TESTING

All pipe and fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured.

Before being laid or installed, cast metal pipe and fittings shall be inspected for cracks by ringing with a light hammer while suspended.

1.12 HANDLING AND CUTTING PIPE

Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe and linings, scratching or marring machined surfaces, and abrasion of the pipe coating or lining.

Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portions, if so approved, may be cut off by, and at the expense of, the CONTRACTOR before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least twelve (12) inches from the visible limits of the crack.

Except as otherwise approved, all cutting shall be done with a machine having rolling wheel cutters or knives adapted to the purpose, or with either an electric or gasoline powered saw with carbide-tipped blades for cutting cement lined ductile iron pipe. Hammer and chisel shall not be used to cut pipe. Flame cutting of metal pipe shall not be permitted. All cut ends shall be examined for possible cracks caused by cutting.

The cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe or lining. The end shall be smooth and at right angles to the axis of the pipe. Cut ends to be used with push-on joints shall be carefully chamfered at an angle of roughly 30 degrees with the centerline of the pipe to prevent cutting the gasket when the pipe is laid or installed.

Lined and coated pipe and fittings shall be installed as, and assembled with, approved packing or gaskets of the type recommended by the pipe manufacturer for the particular lining used.

1.13 INSTALLING PIPE AND FITTINGS

a. General. No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece.

Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.

If the pipe is to be strung out, it shall be done so in a straight line or in a line conforming to the curvature of the street. Each length of pipe shall be adequately blocked to prevent movement. Stockpiled pipe shall be adequately blocked to prevent movement. No pipe, material or any other object shall be placed on private property, obstruct walkways or driveways, or in any manner interfere with the normal flow of traffic.

Pipe shall be laid and joined in accordance with the manufacturers latest published instructions and AWWA C600 for ductile iron water mains and appurtenances.

Pipe shall be laid accurately to the lines and grades indicated on the drawings or as required. No deviation shall be made from the required alignment, depth or grade except with the written consent of the AUTHORITY. Care shall be taken to ensure a good alignment both horizontally and vertically.

Fittings, valves and hydrants shall be at the required locations and with joints centered, spigots home and all valve hydrant stems plumb and otherwise in strict accordance with the Specifications. Refer to Figure A-3.

Pipe shall be laid with bell ends facing in the direction of laying, unless otherwise directed by the AUTHORITY. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home. Under no conditions shall the pipe be "popped" home; only approved methods such as driving

the pipe home with a bar and block, by using the bucket of the backhoe to push the pipe home (utilizing a block in front of the bell to push against) or other methods as may be approved by the Engineer will be allowed.

The CONTRACTOR shall take all necessary precautions to prevent flotation of the pipeline in the trench. In buried pipelines, each pipe shall have a firm bearing along its entire length.

b. Deflection Limits. Whenever it is necessary to deflect pipe from a straight line, either in a vertical or horizontal plane, the amount of deflection in each joint shall not exceed the maximum limits specified by the pipe manufacturer and/or as prescribed below:

PIPE DEFLECTION ALLOWANCES (FULL LENGTH PIPE)

Maximum Permissible Deflection, In. *

Size of Pipe, In.	Maximum Joint Deflection in Degrees	Tyton Joint	Approx. Radius in Feet of Curve Produced by Succession of Joints
4	5	19	205
6	5	19	205
8	5	19	205
10	5	19	205
12	5	19	205
14	4	15	260
16	4	15	260
20	3	11	345
24	3	11	345

* Maximum permissible deflection for 18 foot length;
maximum permissible deflections for other lengths
shall be in proportion of such lengths to 18 feet.

c. Proximity to Other Utility Lines. The CONTRACTOR shall maintain the minimum required distance between the water line and other utility lines in strict accordance with all Federal, State and local requirements and all right-of-way limitations.

Where water lines and sewers (sanitary and storm) are to be located on the same street, a 10-foot horizontal separating distance shall be maintained at all times. In areas where it is not practical to maintain a 10-foot horizontal separating distance, either (1) the sewer or water main shall be encased in concrete and extra heavy materials (mechanical joints) shall be used, or (2) if in the same trench, the water pipe shall be laid on a bench at least 18 inches above the top of the sewer pipe and at 18 inches from the nearest side of the sewer pipe.

Where water lines and sewer lines must cross, a minimum of 18 vertical inches shall be maintained with the water main being laid over the sanitary sewer. In those cases where the water line will be installed below the sanitary sewer, the existing sewer pipe above the water main shall be replaced with a cast iron pipe of 20-foot minimum length, centered on the water main. Refer to Figure A-4. If the 18-inch separation cannot be attained, the minimum separation shall be 6 inches and either (1) the sewer shall be reinforced with an approved sleeve or by encasement in concrete, (2) the water pipe shall be encased in concrete, or (3) other precautionary measures shall be taken, subject to review and approval. In all cases, the water main shall be installed so that one full length of pipe will be located with both ends as far from the crossing as possible.

For force sewer lines there shall be no deviation from the 10-foot horizontal separation or the 18-inch vertical crossing separation, as applicable.

d. Thrust Block Installation. Thrust and reaction blocking shall be installed at all bends, tees, reducers, plugs, caps, hydrants and other areas as indicated on the plans. See Figures A-3 and A-5 through A-8 for typical thrust block applications.

e. Miscellaneous

Bells or other joints shall not be installed directly under existing utilities or structures. Use short or random lengths to avoid such conditions.

All buried steel lugs, rods, brackets and flanged joint bolts and nuts shall be given one (1) coat of an approved bituminous paint prior to backfilling and wrapped if the specifications require wrapping of pipe.

The CONTRACTOR shall make all necessary cuts on pipe and shall provide all required pipe supports, hangers, brackets and like items.

All pipe sleeves shall be installed with 4 1/2 inch long metal spacer rings, which shall be cut from surplus pipe pieces, to prevent movement of the pipe.

Special care shall be exercised to avoid damage to the bells, spigots or flanged ends of ductile iron pipe. If damaged pipe cannot be repaired to the authority's satisfaction, it shall be replaced at the contractor's expense.

The CONTRACTOR shall remove all existing pipe, fittings, valves, pipe supports and blocking and all other items necessary to provide space for making connections to existing pipe and installing all new piping.

Piping shall be encased in polyethylene to prevent contact with surrounding backfill and bedding material in areas shown or designated by the AUTHORITY. Polyethylene material shall be installed in accordance with ANSI A21.5/AWWA C105 Standards.

The CONTRACTOR shall place facility warning tape in the trench with a minimum separation of 24 inches above water main piping. Facility warning tape will be furnished by the AUTHORITY.

1.14 ASSEMBLING PUSH-ON JOINTS

Push-on joints shall be made up by first cleaning the surfaces with which the rubber gasket comes in contact, then inserting the gasket into the groove of the bell and applying a thin film of special nontoxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot end of the pipe. The chamfered end of the plain pipe shall be inserted into the gasket and then forced past until it seats against the bottom of the socket.

1.15 ASSEMBLING MECHANICAL JOINTS

Mechanical joints shall be of an approved type with the required joint accessories, cast iron follower glands with drilled holes, cast iron teehead bolts, hexagonal nuts, etc. Torque wrenches shall be used to take up such joints. Wrenches shall be equipped with adjusting breakable tension gauge, set to break the tension at the tension loading recommended by the manufacturer. The torque wrench shall be calibrated within six (6) months of its use.

Surfaces against which the gasket will come in contact shall be thoroughly brushed with a wire brush prior to assembly of the joint. The gasket shall be cleaned. The gasket, bell and spigot shall be lubricated by being washed with soapy water. The gland and gasket, in that order, shall be slipped over the spigot, and the spigot shall be inserted into the bell until it is correctly seated. The gasket shall then be seated evenly in the bell at all points, centering the spigot, and the gland shall be pressed firmly against the gasket.

After all bolts have been inserted and the nuts have been made up fingertight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint to the following normal torques:

<u>Bolt Dia.</u>	<u>Range of Torque in Foot-Pounds</u>
5/8"	40 - 60
3/4"	60 - 90
1"	70 - 100
1-1/4"	90 - 120

If effective sealing of the joint is not attained at the maximum torque, indicated above, the joint shall be disassembled and thoroughly cleaned, then reassembled. Bolts shall not be overstressed to tighten a leaking joint.

1.16 ASSEMBLING SLEEVE-TYPE COUPLINGS

Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of eight inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about six inches from the end and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flare. After the bolts have been inserted and all nuts have been made up finger-tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, by use of a torque wrench of the appropriate size and torque for the bolts.

The correct torque as indicated by a torque wrench shall not exceed the values indicated below:

<u>Nominal Pipe Size, Inches</u>	<u>Bolt Dia.</u>	<u>Maximum Torque, Ft.-Lb.</u>
3 - 24	5/8"	75
3 - 24	3/4"	90

After assembly and inspection and before being backfilled, all exterior surfaces of buried sleeve-type couplings, including the middle and follower rings, bolts and nuts, shall be thoroughly coated with an approved heavy-bodied bituminous mastic. Care should be taken and appropriate devices used to ensure that the underside, as well as the more readily accessible parts, are well coated.

1.17 TAPPED CONNECTIONS

a. General. Tapped connections in pipe and fittings shall be made in such a manner as to provide a watertight joint and adequate strength against pullout. The maximum size of taps in pipe or fittings without bosses shall not exceed that listed in the appropriate table of the Appendix to ANSI A21.51, based on three full threads for cast iron and two full threads for ductile iron.

Dry taps shall not be allowed unless permission is granted by the AUTHORITY. Wet taps shall include corporation cocks, copper tubing, curb stops, curb box and fittings, etc., which will make all joints water tight. Service lines shall be installed to the location which appears on the drawings or to the satisfaction of the AUTHORITY.

All drilling and tapping of ductile-iron pipe shall be done normal to the longitudinal axis of the pipe; fittings shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics in strict adherence to the latest manufacturers recommendations such as the depth of tap, number of threads exposed, allowable sizes, etc.

Tools shall be adapted to the work and be in good condition so as to produce good, clean-cut threads of the correct size, pitch and taper. Tapping machines and drill bits shall be inspected regularly for signs of wear and shall be changed as needed. Copper tubing shall be cut by an approved wheel cutter only.

b. Installing Tapping Sleeves. Saddles and Valves. Tapping sleeves or saddles shall not be installed without approval of the AUTHORITY. All tapping sleeves, saddles and valves shall be designed for a working pressure of 200 psi.

Tapping sleeves shall be either hub-end calk type or mechanical joint type, two piece, and be so designed as to assure uniform gasket pressure and permit centering of the sleeve on the pipe.

Tapping saddles shall consist of ductile iron outlet castings, attached to the pipeline with high strength steel straps. Castings shall be sealed to pipeline with O-ring seals. Saddles shall have ANSI A21.10 flanged outlets counter-bored for use with tapping valves and tapping equipment.

Tapping valves shall have a flange on one end for bolting to the tapping sleeve or saddle and a mechanical joint type end connection on the outlet with slotted standard flange or other adapters for connection to the tapping machine. Tapping valves shall conform to AWWA C500 except that the end shall be as specified above and the seat rings shall be oversized to permit entry of the tapping machine cutter.

Pipe upon which a tapping sleeve is to be installed shall be thoroughly cleaned of all foreign matter with scraping tools and a wire brush a minimum of six inches on either side of the sleeve. The flanged surface of the sleeve shall be cleaned with a wire brush to remove any excess bituminous coating or burrs.

Sufficient blocking and wedges shall be used to secure the sleeve once it has been leveled and positioned. Sleeve bolts shall be alternately tightened from the extreme end on one side to the extreme end on the opposite side with an approved torque wrench until all are securely tightened. Thrust blocks shall be poured or approval received for an alternative from the AUTHORITY. Blocking shall be left in place after completing the tap.

Care shall be taken to ensure that the tapping machine is kept in a level horizontal position and securely supported so as not to transmit any additional weight to the tapping valve.

1.18 SETTING APPURTENANCES

All valves, fittings and appurtenances shall be set and jointed as indicated on the drawings. See Figures A-3 and A-5 through A-8 for typical details of valve, fitting and other appurtenance installations.

1.19 TEMPORARY PLUGS

During laying operations no debris, tools, clothing or other material shall be placed in the pipe. Pipelines shall not be used as conduits for trench drainage during construction.

At all times when pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed. In the event of flooding of the main, all pipe laying shall cease until the mains have been thoroughly cleaned and approved by the Engineer.

1.20 SOCKET PIPE CLAMPS, TIE RODS AND BRIDLES

Where indicated or necessary to prevent bell-and-spigot joints or sleeve couplings from pulling apart under pressure, suitable socket pipe clamps, tie rods and bridles shall be provided. Bridles and tie rods shall be of wrought iron at least 3/4" in diameter except where they replace flange bolts of smaller size in which case, they shall be fitted with a nut on each side of the pair of flanges. The socket clamps and tie rods or bridles shall be coated with an approved bituminous paint after assembly or, if necessary, prior to assembly.

Where required, bends, tees and other fittings in ductile-iron pipelines buried in the ground shall be backed up with concrete placed against undisturbed earth where firm support can be obtained. If the soil does not provide firm support, then suitable bridle rods, clamps and accessories to brace the fittings properly shall be provided. Such bridle rods, etc., shall be coated thoroughly and heavily with an approved bituminous paint after assembly or, if necessary, before assembly.

1.21 THRUST BLOCKS

Blocking shall be constructed back against the vertical face of undisturbed earth or sheeting left in place as directed. The concrete shall be prevented from enclosing more than half the circumference of the pipe and shall be kept away from joints or bolts in the piping.

Blocking shall be of a size and shape necessary to provide the required bearing area perpendicular to the resultant thrust. Thrust block bearing areas shall conform to the table below.

TABLE OF BEARING AREAS IN SQUARE FEET AGAINST UNDISTURBED MATERIAL FOR WATER MAIN FITTINGS			
SIZE OF MAIN (IN.)	90 BEND	TEES	45 BEND
6,8	6	5	4
12	16	9	7
20		24	
NOTES: 1. FOR FITTINGS WITH LESS THAN 45 DEFLECTION, USE BEARING AREAS FOR 45 BEND. 2. BEARING AREAS BASED ON HORIZONTAL PASSIVE SOIL PRESSURE OF 1000 psf AND INTERNAL WATER PRESSURE OF 150 psig. 3. JOINTS SHALL NOT BE ENCASED IN CONCRETE. 4. BEARING AREAS MAY BE DISREGARDED FOR TRENCHES IN ROCK WHERE THE TOP OF THE ROCK FACE IS AT OR ABOVE THE CROWN OF THE PIPE. HOWEVER, CONCRETE BACKING SHALL BE PLACED BETWEEN THE PIPE AND ROCK FACE.			

Where unsuitable bearing material is encountered, the CONTRACTOR shall excavate and place sufficient concrete ballast, as required to offset the anticipated thrusts. See Figures A-3 and A-5 through A-8 for typical thrust block applications.

Galvanized thrust rods or approved equivalent retaining devices can be used if prior approval is given by the AUTHORITY as detailed in paragraph 1.20.

Thrust blocking for hydrants shall not hinder hydrant draining.

2.0 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS

2.01 GENERAL

The CONTRACTOR shall not install PVC pipe and fittings without the expressed approval of the AUTHORITY. The CONTRACTOR shall furnish, lay, joint and test all piping, fittings (including special castings) and appurtenant materials and equipment, as indicated on drawings and as specified herein.

2.02 STANDARD SPECIFICATIONS

All pipe, fittings and accessories shall conform to the requirements of the latest revision of AWWA C900 - "Polyvinyl Chloride (PVC) Pressure Pipe" - Class 150 shall meet the requirements of DR 18. Elastomeric rings shall conform to ASTM-F-477 specifications and the manufacturer's installation instructions. Pipes shall be furnished with cast iron outside diameter and beveled ends.

2.03 PHYSICAL REQUIREMENTS - STANDARD LAYING LENGTHS

Standard laying lengths shall be 20 feet ($\pm 1"$) for all sizes. At least 85% of the total footage of pipe of any class and size shall be furnished in standard lengths. The remaining 15% can be furnished in random lengths. Random lengths shall not be less than ten feet long. Each standard and random length of pipe shall be tested to four times the class pressure of the pipe for a minimum of five seconds.

2.04 PIPE FOR USE WITH COUPLINGS

Pipe for use with sleeve-type couplings shall be as specified above except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.

2.05 FITTINGS

Fittings shall conform to the requirements of AWWA C900 and shall be at least equal to Class 150 pressure classification. Unless otherwise indicated or specified, fittings shall be all bell-end fittings with elastomeric-gasket joints.

2.06 ADAPTERS

Where it is necessary to join pipe of different types, the CONTRACTOR shall furnish and install the necessary adapters unless solid sleeves are indicated on the drawings or approved. Adapters shall have ends, conforming to the above specifications for the appropriate type of joint, to receive the adjoining pipe. Adapters joining two classes of pipe may be of the lighter class provided that the annular space in bell-and-spigot type joints will be sufficient for proper jointing.

2.07 FLEXIBLE CONNECTIONS

Where flexible connections in the piping are specified or indicated on the drawings, they shall be obtained by the use of sleeve-type couplings and/or fittings as herein specified.

2.08 SLEEVE-TYPE COUPLINGS

To ensure correctness of fit, all sleeve-type couplings and accessories shall be furnished by the supplier of the pipe and shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed.

2.09 INSPECTION AND TESTING

All pipe and fittings shall be inspected and tested at the factory as required by the standard specifications to which the material is manufactured. Pipes and fittings shall be subjected to a careful inspection just before being laid or installed.

2.10 HANDLING AND CUTTING PIPE

Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe and linings, scratching or marring machined surfaces.

Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

Cut ends to be used with push-on joints shall be carefully chamfered to prevent cutting the gasket when the pipe is laid or installed.

2.11 INSTALLING PIPE AND FITTINGS

The CONTRACTOR shall have a copy of the manufacturer's installation instructions at the job site at all times and follow the procedure described in the publication.

No defective pipe or fittings shall be laid or placed in the piping. Any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece.

Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.

Pipe and fittings shall be laid accurately to the lines and grades indicated on the drawings or as required. Care shall be taken to ensure a good alignment both horizontally and vertically.

The CONTRACTOR shall take all necessary precautions to prevent flotation of the pipeline in the trench. In buried pipelines, each pipe shall have a firm bearing along its entire length.

2.12 CONNECTIONS

All connections made on the pipe barrel shall use a tapping saddle specifically manufactured for the size of PVC pressure pipe used.

All drilling and tapping of the pipe shall be done normal to the longitudinal axis of the pipe; fittings shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be

is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed. Pipelines shall not be used as conduits for trench drainage during construction.

IV. PRESSURE TESTING AND DISINFECTING

1.0 PRESSURE AND LEAKAGE TESTS

The CONTRACTOR shall test all piping installed. Testing shall be performed concurrent with installation and with no more than 1000 feet of pipe being installed without being tested. The pipelines shall be given combined pressure and leakage tests in accordance with the AWWA Standard Specification C600.

The scheduling of pressure and leakage tests shall be monitored by the AUTHORITY. The exact location and acceptable format for the test shall be approved by AUTHORITY personnel.

Hydrostatic pumping equipment shall be tested daily on dead end piping prior to testing of water mains. Two (2) gauges shall be used and shall be calibrated within six months of use and shall show no signs of damage or physical abuse. A relief valve shall be installed in the hydrostatic test rig piping and shall be set to relieve at 110% of hydrostatic test pressure. The relief valve shall be capable of relieving twice the maximum capacity of the hydrostatic test pump.

Prior to the pressure and leakage tests, the piping shall be thoroughly flushed and cleaned of all dirt, dust, debris, oil, grease and other foreign material. This work shall be done with care to avoid damage to linings and coatings. The piping shall then be purged of all air. Purging shall be accomplished by filling the pipes slowly with water of approved quality and allowing the air to escape by means of hydrants, blow-offs or air release valves. If hydrants or blow-offs are not available at high points for releasing air, the CONTRACTOR shall make the necessary taps at such points and shall plug said holes after completion of the test.

Each section of pipe to be tested shall be isolated by valves, approved plugs or dead-ends. The CONTRACTOR shall supply all equipment necessary to perform the test. The CONTRACTOR shall furnish a water meter, two pressure gauges, the hydrostatic test pump and a relief valve, and shall install them in such a manner that all water entering the section under test will be measured and the pressure in the section to be tested will be continuously monitored. Gauges in the test system shall not be isolated from the system being tested at any time.

The section under test shall be maintained full of water for a period of 24 hours prior to the combined pressure and leakage test being applied. The pressure and leakage test shall consist of first raising the water pressure (based on the elevation of the lowest point of the section under test and corrected to a gauge pressure) to a pressure in pounds per square inch numerically equal to the pressure rating of the pipe. While maintaining this pressure, the CONTRACTOR shall make a leakage test by metering the flow of water into the pipe. All joints within chambers and all flanged joints shall be no -visible leakage. Any leakage at these joints shall be cause for failure of the test. No caulking of compound joints with lead or other foreign material shall be allowed. No lead in any form shall be used in a distribution system in the Town of Montville.

Should any test reveal greater than permitted leakage, the CONTRACTOR shall, at his own expense, locate and repair the defective joints and/or pipe until the leakage is within the permitted allowance and otherwise to the satisfaction of the AUTHORITY.

Allowable leakage in gallons per hour per 1,000 feet of pipeline shall be as follows (taken from AWWA C600):

Average Test Pressure (PSI)	Pipe Diameter							
	2	3	4	6	8	12	16	24
100	0.15	0.23	0.30	0.45	0.60	0.90	1.20	1.80
125	0.17	0.25	0.34	0.50	0.67	1.01	1.34	2.01
150	0.19	0.28	0.37	0.55	0.74	1.10	1.47	2.21
175	0.20	0.30	0.40	0.59	0.80	1.19	1.59	2.38
200	0.21	0.32	0.43	0.64	0.85	1.28	1.70	2.55
225	0.23	0.34	0.45	0.68	0.90	1.35	1.80	2.70
250	0.24	0.36	0.47	0.71	0.95	1.42	1.90	2.85

Hydrostatic testing shall be conducted under the following conditions:

1. All thrust backing shall be installed and cured prior to testing.
2. Testing should be accomplished prior to backfilling. However, if the CONTRACTOR decides to backfill prior to testing, the CONTRACTOR shall assume all the cost for labor and materials associated with the excavation, repair and retesting of the failed portion of the system.
3. Pressure shall not be allowed to exceed the pipe manufacturer's specification at any time.

2.0 DISINFECTING AND FLUSHING

Disinfection shall be conducted in accordance with the latest revision of AWWA C601. For all work involved, the CONTRACTOR shall furnish all equipment, material and labor required. The CONTRACTOR shall also furnish means for disposal of the water used for disinfecting and flushing the main. The water shall be wasted in such a manner as to eliminate possibility of damage to roadways, adjacent property and contamination of water supply.

After a section of the main has been flushed, hydrostatically tested and found to be acceptable, it shall be disinfected by the CONTRACTOR. The CONTRACTOR shall disinfect the main with a solution consisting of 50 ppm of chlorine which shall be retained in the main for at least 24 hours.

The new mains shall be disinfected by one of the following methods:

A. The line may be disinfected by the use of hypochlorite tablets. The number of tablets in each length of pipe shall be as required by the AUTHORITY. Fasten the required number of tablets to the top of the inside of each length of pipe, using a non-toxic water resistant adhesive which shall not cover the sides or face of the tablet. Water from an approved source of supply shall be controlled to flow slowly into the pipe to be disinfected. The number of hypochlorite tablets required for dose of 50 mg/l shall be as follows (taken from AWWA C601):

Length of Section (Feet)	Diameter of Pipe (In.)					
	2	4	6	8	10	12
13 or less	1	1	2	2	3	5
18	1	1	2	3	5	6
20	1	1	2	3	5	7
30	1	2	3	5	7	10
40	1	2	4	6	9	14

B. A chlorine gas-water mixture shall be applied by means of a solution feed chlorinating device, a hypochlorite solution injected or pumped into the line, or the gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe. The chlorinating devices shall provide means to prevent backflow of water into the chlorine cylinder.

Water from an approved source of supply shall be controlled to flow slowly into the pipe to be disinfected during the application of chlorine. Chlorine required to produce 50 ing/I concentration in 100 feet of pipe shall be as follows (taken from AWWA C601):

Pipe Diameter (Inches)	100 Percent Chlorine (lbs.)	1 Percent Chlorine Solutions (gal.)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

After the chlorine treated water has been retained for the required time, the chlorine residual shall be at least 10 ppm.

Following chlorination, all treated water shall be thoroughly flushed from the disinfected pipe at its extremities until the replacement water throughout its length shall, upon test, be proved comparable to the quality of water served from the existing water supply system.

Should the initial treatment, in the opinion of the AUTHORITY, prove ineffective, the chlorination procedure shall be repeated until satisfactory results are obtained.

The CONTRACTOR shall remain solely liable to the authority's customers and all third parties for any injuries or damages which may be sustained by reason of the disinfection process, and shall indemnify and hold harmless the AUTHORITY and its affiliated companies, agents and employees from any and all claims, damages, losses and expenses including attorneys fees arising out of or resulting from the performance of the disinfection, notwithstanding any compliance by the CONTRACTOR with these Specifications.

After disinfecting and testing, bacteriological tests will be taken by the AUTHORITY. No section shall be put in service until approval has been granted by the AUTHORITY.

V. VALVES. APPURTENANCES AND MISCELLANEOUS REQUIREMENTS

1.0 GATE VALVES 3 IN. AND LARGER IN SIZE

Buried gate valves shall be of the resilient-seated wedge type with non-rising bronze stem and iron body having mechanical ends for connecting pipe. The valves shall be suitable for 200 psi working pressure for 3-in. to 12-in. sizes and shall conform to AWWA C509, Standard for Resilient-Seated Gate Valves, 3 through 12 NPS for Water and Sewage Systems. Valves shall be as manufactured by Mueller Co., Kennedy Valve Co., Waterous (Division of Amhoist), American Valve Co., or an Engineer-approved equal.

All valves shall be designated for a working pressure of 200 pounds per square inch (psi) unless otherwise noted on the plans or directed by the AUTHORITY. The CONTRACTOR shall make all valves tight under their working pressures after they have been placed and before the main is placed in operation. Any defective parts shall be replaced at the contractor's expense.

They shall, in addition, meet the following requirements:

- a. Gate valves shall be of the inside-screw type with an operating nut.
- b. All valves furnished shall open counter-clockwise.
- c. Mechanical end connections shall be furnished with all necessary joint materials.
- d. Valves shall have a full opening flow-way of a diameter equal to the nominal size of the connecting pipe. Resilient-seated valves shall have no recesses at the bottom of the bore where stones or other debris could collect or prevent closure.
- e. All internal ferrous metals shall be coated with an epoxy coating. The coating shall be non-toxic, impart no taste to water, protect all seating and adjacent surfaces from corrosion and prevent build-up of scale or tuberculation. It shall meet all requirements of AWWA C550, Standard for Protective Interior Coatings for Valves and Hydrants.
- f. The sealing mechanism shall provide zero leakage at working water pressures up to 200 psi with flow in either direction.
- g. Valves shall be provided with two O-ring stem seals, with at least one O-ring above the stem thrust collar and bearing surfaces. At least one anti-friction washer shall be located above the thrust collar to minimize operating torque.
- h. All internal parts shall be accessible without removing the main body from the pressure line.

2.0 GATE VALVES SMALLER THAN 3 IN. IN SIZE

Gate valves smaller than 3 in. in size shall meet the standards noted above for gate valves 3 in. and larger in size.

3.0 VALVE BOXES

All valves shall be provided with valve boxes. Valve boxes shall be three-section cast-iron, adjustable screw type, heavy pattern. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve and rest on the backfill. The length shall be that necessary to suit the ground elevation. The inside diameter of the boxes shall be at least 4-1/2 inches, including cover.

Valve boxes shall be supported so that no load can be transmitted from the valve box to the valve.

Tops shall be set at established grade, and the valve box cover marked "WATER." See Figure A-7.

4.0 CORPORATION STOPS

Corporation stops shall be of bronze with a lapped, ground key. The inlet thread shall be of steep taper type. Outlet connections shall be as required to suit the type of pipe or tubing connected. The stops shall be as manufactured by Ford Company, or an Engineer-approved equal. See Figure A-9.

5.0 SERVICE CONNECTIONS

The CONTRACTOR shall provide and install new service connections between the new sections of water mains and new curb stops as indicated on the drawings. Refer to Figure A-9 for a typical service connection configuration. New services shall consist of one-inch type K copper tubing rated at 200 psi for water service, copper tubing size (CTS) extended from the new water main to a new curb stop and curb box as located on the drawings. Class 200 PVC piping may be used with the approval of the AUTHORITY. The curb stop shall be of the ball type as manufactured by Mueller Company, or an Engineer-approved equal. The curb box shall be of the telescopic type to adjust for variable depths of placement. The type shall be consistent throughout the system. As specified on the drawings, the CONTRACTOR shall connect the existing service lines to the new curb stops. An alternate service connection configuration for commercial applications is depicted in Figure A-10. Requirements cited elsewhere in these Specifications for gate valves and meter pits shall be adhered to for this configuration.

Location of Service Pipe: The service pipe shall extend through that point on the customer's property line or the street line easiest of access to the utility from its existing distribution system and, where practicable, from a point at right angles to the existing distribution line in front of the premises to be served. Service pipes shall not cross intervening properties or operate in place of a proper water main extension running in the street and fronting the property. The approval of the utility shall be secured as to the proper location of the service pipe.

6.0 SERVICE METERS

In general, meters shall be installed for each individual service connection. Residential meters shall be installed within the building. Commercial customers may install meters internal or external to the building. External installations shall require the concurrence of the AUTHORITY. In all cases, freeze protection shall be the responsibility of the owner. Internal installations shall conform to the applicable details of Figures A-11 and A-12. External installations shall be made in meter pits, and shall conform to the applicable details of Figures A-13 through A-17.

Remote Water Meter reading devices shall be installed for all residential services.

7.0 HYDRANTS

Hydrants shall be breakaway type standard AWWA hydrants conforming to applicable requirements of the AWWA C502, Standard Specifications for Fire Hydrants for Ordinary Water Works Service. Hydrants shall be furnished with one pumper and two hose connections. The size of the connections and threads shall be as required by the AUTHORITY. Operating nuts shall turn counterclockwise to open the hydrants. Hydrants shall have 5-1/4 inch valve and 6-inch mechanical joint inlet connection. Hydrants, valves and connecting piping shall be rated for a working water pressure of at least 150 psi. Hydrants shall be either Model B-62-B Quik-Fix hydrant manufactured by American Valve Co. or Model A-423 Super Centurion 200 hydrant manufactured by Mueller Co..

8.0 SETTING VALVES AND HYDRANTS

Valves, hydrants and valve boxes shall be set plumb and centered with the valve box directly over the operating nut. The hydrant installation shall consist of a valve anchoring tee, a six-inch gate valve (mechanical joint) and a six-inch ductile, mechanical joint type pipe of necessary length.

Hydrants shall be set upon a slab of stone or concrete not less than four inches thick and fifteen inches square. The side of the hydrant opposite the pipe connection shall be firmly wedged against the vertical face of the trench with a concrete thrust block as indicated on the installation drawings, or with thrust rods or equivalent retaining devices. Not less than four cubic feet of screened gravel shall be placed around the base of each hydrant at the location of the drain holes. See Figure A-3 for a typical configuration of a hydrant and hydrant piping.

Backfill around the hydrants shall be as specified under Section II, "EXCAVATION, BACKFILL AND FILL." A hydrant riser shall be installed to provide a hydrant elevation acceptable to the AUTHORITY. The hydrant connecting pipe shall have at least the same depth of cover as the distribution main.

The hydrant shall be given two coats of a quality paint, the color approved by the AUTHORITY.

9.0 CONNECTIONS TO EXISTING MAINS

Connection to existing pipelines may require shutdown of AUTHORITY facilities. Construction work and connections shall be closely coordinated with the AUTHORITY. The AUTHORITY may select the time, including Saturdays, Sundays, holidays, which in the opinion of the AUTHORITY will cause the least inconvenience to the AUTHORITY and/or its customers for connection to existing pipeline. The CONTRACTOR shall perform such connections at such times as may be directed by the AUTHORITY at no charge by the CONTRACTOR for premium time or additional costs.

The CONTRACTOR shall make all connections to the existing mains as indicated on the installation drawings and as herein specified.

Unless otherwise directed by the AUTHORITY, the CONTRACTOR shall furnish all pipe, fittings, valves and appurtenances. The CONTRACTOR shall do all required excavation and backfill.

Existing pipeline outside contract items damaged by the CONTRACTOR shall be replaced or repaired by the CONTRACTOR.

Where, in the opinion of the Engineer, the connection to existing mains would put residents out of water for a significant period of time, the CONTRACTOR shall provide temporary piping to be put in place prior to the connection.

10.0 TIE RODS AND CLAMPS

The CONTRACTOR shall furnish and install tie rods, clamps, couplings and accessories to prevent the movement of branch valves as indicated on the drawings or as directed. The clamps, etc., shall be of the sizes, materials and construction indicated on the drawings. After field installation, all steel surfaces shall have one coat of an approved bituminous paint applied before backfill.

11.0 POST FLUSHING (BLOW-OFF) HYDRANTS WITH FREEZE PROTECTION

Where dead ends in water mains occur without fire hydrant installation, a post flushing (blow-off) hydrant shall be installed. Blow-offs shall be non-freezing, self-draining and lockable. Blow-off hydrants shall be furnished with a 2" FIP inlet and a 2-1/2" NSFT outlet. Blow-off hydrants shall be as manufactured by GIL

Industries, Inc., Kupferle Foundry Co., or an Engineer-approved equal. See Figure A-8 for a typical installation arrangement of a blow-off hydrant.

12.0 AIR RELEASE VALVES

Manual air release valves shall be installed at high points on the distribution system as specified by the installation drawings. See Figure A-18 for a typical view of an air release valve installation.

13.0 BACKFLOW PREVENTION DEVICES

Backflow prevention devices shall be installed on all commercial services or for other potentially contaminating situations. Refer to Figures A-19 and A-20 for details of typical Backflow Preventer installations.

14.0 AS-BUILT DRAWINGS

The CONTRACTOR shall prepare as-built drawings for all work included in the contract, including, but not limited to, water mains, service connections, hydrants, valves, appurtenances and other construction. As-built drawings shall be provided in AutoCADD format (i.e., a master disk and back-up containing the drawing data files) to the AUTHORITY, and shall not be complete until accepted by AUTHORITY. Reproducible copies (mylar or equivalent) shall be supplied to the AUTHORITY. The dimensions to existing above grade items as well as depth of all buried piping installed or encountered during construction shall be shown.

VI. SITE MAINTENANCE AND MANAGEMENT

1.0 NOISE, ODOR AND DUST CONTROL

The contractor's construction activities shall be conducted so as to eliminate all unnecessary noise, dust and odors.

Calcium chloride shall be applied at locations, at such times and in an amount as directed by the Engineer. The CONTRACTOR shall keep an adequate supply of Calcium chloride on hand at all times. It shall be spread in such a manner and by such devices that uniform distribution is attained over the entire area on which it is ordered and placed.

2.0 GROUND COVER MAINTENANCE

2.01 EROSION AND SEDIMENTATION CONTROL

The CONTRACTOR shall comply with the highest erosion and sedimentation control standards, whether Conservation District, Federal, State or local. If the CONTRACTOR is in doubt as to the applicable standard, he shall notify the AUTHORITY and comply with the authority's directions.

All materials such as seeds, mulch and bales shall conform to the Specifications of the Conservation District and all other applicable requirements or standards.

Prior to construction, diversion ditches with catch basins and drains shall be constructed at the lowest area of the sites in question. All run-off water shall be directed to these locations. The settled water from the catch basins shall be drained to the natural local drains. The catch basins shall be cleaned regularly. The area shall be seeded with appropriate seed in the required amount per acre and mulched after final grading.

Permanent vegetation cover, mulching and baling shall be in accordance with the Conservation District Specifications and all other applicable Federal, State and local requirements.

2.02 LOAMING AND SEEDING

Any existing grass areas which are disturbed by the contractor's operations shall be refinished with 4" of organically-enriched (not less than 25% well rotten manure or compost and lime) topsoil and seeded with an approved perennial grass seed. Grass seed shall be furnished in sealed bags or containers from the supplier and clearly labeled. Reseeding and watering shall be continued until a satisfactory stand of grass is obtained.

3.0 RESTORATION

The CONTRACTOR shall restore and/or replace paving, curbing, sidewalks, gutters, shrubbery, fences, sod or other disturbed surfaces and structures to a condition equal to that before the work began and to the satisfaction of the AUTHORITY and shall furnish all labor and materials incidental thereto. In restoring improved surfaces, new pavement is required, except that sound granite paving blocks or sound brick may be reused if written approval is received by the CONTRACTOR from the AUTHORITY. Determination as to whether such materials may be reused will be at the authority's sole discretion.

4.0 PAVEMENT REPLACEMENT

4.01 GENERAL

The CONTRACTOR shall furnish all labor, materials and equipments necessary to restore or replace (as directed) all paved surfaces and curbs removed or damaged by work under this contract to a condition at least equal to that existing immediately prior to the beginning of his operations and to the satisfaction of the AUTHORITY.

Where necessary to disturb the existing pavement, the pavement shall be line cut and the edges of the face of the old pavement or base shall be left vertical. Ragged edges shall be trimmed so as to provide a substantially straight line juncture between the old and new surfaces.

The pavement replacement shall be so placed as to conform in grade to the existing streets, drives or sidewalks.

4.02 MAINTENANCE OF TRENCH SURFACE PRIOR TO REPLACEMENT OF PAVEMENT

Trenches within highway, street, driveway or sidewalk pavements shall not be paved until at least 20 days after backfill is placed.

The CONTRACTOR, where required, shall furnish all labor, tools, material, and equipment necessary to spread and roll and/or tamp the temporary bituminous pavement, complete, in place, and shall maintain the same as specified below.

As soon as trenches have been backfilled, a temporary pavement of bituminous mixture shall be placed over the trench surface and maintained. Maintenance shall conform in all applicable respects to the provisions of the latest revision of "Temporary Pavement Repairs and Improved Shoulder Repairs" in the Encroachment Permit Regulations of the State of Connecticut, Department of Transportation, Bureau of Highways, dated 1983.

Over trenches where temporary pavement is ordered, the CONTRACTOR shall roll and tamp in place a 2" thick minimum course of bituminous material. Over those trenches where temporary pavement has been placed to the surface of the adjacent pavement, such temporary pavement shall be removed prior to the placing of the permanent pavement. The finished temporary surface shall be flush with the adjacent undisturbed surface and the CONTRACTOR shall maintain the temporary bituminous surface until the temporary surface is replaced.

4.03 BASE COURSES

Wherever the material at the top of the backfilled trenches or test pits is unsatisfactory for pavement base, it shall be removed to a depth below finished grade equal to the thickness of the pavement to be placed plus six inches and replaced by a six-inch base of acceptable bank-run gravel thoroughly consolidated by rolling and wetting.

Materials and methods of construction shall conform in all applicable respects to Section 3.02 titled, "Rolled Gravel Base," contained in the State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, Form 813, dated 1985, with subsequent revisions and addenda, if any.

4.04 BITUMINOUS CONCRETE PAVEMENT

Materials and methods of construction shall conform in all applicable respects to Section 4.06 titled, "Bituminous Concrete" contained in the above-mentioned State of Connecticut, Department of Transportation Highway Specifications, Form 813.

The type of pavement replacement shall be as shown on the pavement replacement details in accordance with applicable Federal, State and local standards. If there are no such applicable standards, the CONTRACTOR shall use materials which will

produce a result at least equal to the type of pavement which existed before the work began and to the satisfaction of the AUTHORITY.

The thickness of the bituminous mix shall be three inches or to match existing depth, whichever is greater.

4.05 MAINTENANCE OF PAVEMENT

During the entire period of construction of the project, all streets, drives and walks shall be kept in usable and safe condition for public use. Before final acceptance, and after trench settlement has been corrected to the satisfaction of the AUTHORITY, pavement, drives and walks designated by the AUTHORITY shall be repaved with the type of pavement replacement specified herein.

Following the certification of completion by the AUTHORITY, the CONTRACTOR shall maintain the surfaces of curbs and gutters, paved surfaces and sidewalks for a period of one year thereafter, or for such greater period if required by Federal, State or local authorities. All material and labor required for such maintenance shall be supplied by the CONTRACTOR, and the work shall be done in a manner satisfactory to the AUTHORITY at no additional cost to the AUTHORITY.

4.06 SIDEWALKS, GUTTERS, DRIVEWAYS, AND CURBS

All sidewalks, gutters, driveways and curbs which have been damaged by the contractor's operations, shall be restored in kind to a condition at least equal to that in which they were found immediately prior to the beginning of operations.

5.0 HANDLING AND STORAGE

The CONTRACTOR shall receive and inspect all materials and equipment as they arrive at the job site. The materials and equipment shall be inventoried and the CONTRACTOR shall replace, at his cost, any lost, defective or damaged materials and equipment.

Pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against other pipe.

The CONTRACTOR shall transport the materials and equipment in a safe and responsible fashion to the necessary location once they have arrived at the job site and store the equipment and materials in a manner acceptable to the AUTHORITY.

The CONTRACTOR shall be solely responsible for any damage to materials furnished to or by him until it has been incorporated in the completed project and accepted by the AUTHORITY.

6.0 PUBLIC SAFETY AND TRAFFIC CONTROL

The CONTRACTOR shall provide suitable and safe bridges and other crossings where required for the accommodation of travel and to provide access to private property during construction and shall remove said structures thereafter.

The CONTRACTOR shall supply, place and maintain all traffic signs, marking cones, and personnel required to provide a safe working environment which is also acceptable to the local and State authorities. All excavations shall be properly marked and protected by barricades and flasher where required.

Roads, driveways, public access locations and sidewalks shall be kept open to the maximum extent possible at all times. It is the responsibility of the CONTRACTOR to

notify and coordinate all work activities on roadways which may effect traffic in any way. Under no circumstances shall any section of a Town or State road be closed to traffic without receiving permission from Town or State officials. The CONTRACTOR shall comply with all applicable Federal, State and local safety regulations.

7.0 PLACEMENT OF SPOILS AND CONSTRUCTION EQUIPMENT

Equipment, materials and spoils shall not be placed in areas where they will obstruct streets, roads or right of ways. Excavated materials shall be placed in as neat and orderly fashion as possible so as to minimize the effects to the passability of the road. The excavated materials shall not be placed in any area which will adversely effect the natural or manmade flow of surface/storm water.

Where mains are located in or adjacent to pavements, all backfilling and materials handling equipment shall have rubber tires. Crawler equipment shall be permitted when there is no danger of damaging pavement.

8.0 CLEANUP AND APPEARANCE

The CONTRACTOR shall clear and grub only the minimum area to provide space for construction operations. Trees, down timber, shrubs, bushes, vines, roots, stumps, undergrowth, rubbish, paving materials, debris and all other objectionable materials shall be removed within the limits of clearing and grubbing.

The work area shall be maintained in a reasonably neat fashion at all times during the construction process. Unless specifically approved by the AUTHORITY, all excavations shall be backfilled each day and the roadways kept in a clean and orderly fashion. Work shall be completed in a clean and orderly fashion. Work shall be completed in daylight hours and, if necessary, work shall be scheduled to avoid heavy traffic periods. Materials and equipment shall be stored each night in a location which is off the road in a safe manner and does not create a nuisance to any homeowners.

The CONTRACTOR shall clean, restore and/or replace any property that is affected or damaged by the construction operations to a condition which is equivalent to the condition of the property immediately prior to the commencement of construction.

All materials used in the construction operation shall be removed from the site upon completion and material shall not be disposed of on adjacent properties. Trash and combustible materials shall not be allowed to accumulate in construction locations.

The CONTRACTOR shall not leave any personal belongings on the job site once the job is completed. Upon completion of the work, he shall remove all temporary construction facilities and unused materials provided for the work and put the premises in a neat and clean condition and do all cleaning required by the Specifications.

9.0 COMPLETION

The project will not be accepted by the AUTHORITY as complete until the AUTHORITY, in its sole judgment, is satisfied that the work has been satisfactorily performed and that all of the requirements of the Contract Documents have been met, that all labor and material liens have been released, and that all Federal, State, and local government requirements have been met. In addition, the AUTHORITY may withhold from the final payment an amount equal to the amount of any claim or claims asserted by any person or entity against the AUTHORITY or the CONTRACTOR by reason of the contractor's alleged failure to promptly pay for labor or materials and/or by reason of alleged damage to person or property resulting from the contractor's