Sudbury Water District

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ROAD
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SUDBURY, MASSACHUSETTS 01776

STANDARDS AND SPECIFICATIONS
For
CONSTRUCTING WATER MAINS AND SERVICES

Revised
November 5, 2024

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SECTION

PART G - GENERAL REQUIREMENTS

SECTION G1 – GENERAL CONCEPT

This section of the specifications contains the detail specifications for all major elements which enter into the project and become a permanent part thereof. These specifications are to be used in conjunction with the Sudbury Water District, hereafter referred to as (District) Rules and Regulations and intended to be so written that only materials of the best quality and grade will be furnished, that manufacturing procedures for the product be controlled with failure-preventative type processes, and that good workmanship will produce a first-class product. Material which does not meet each requirement or does not meet the total performance concept due to an imbalance between individual requirements that make up the material system shall be considered as not fully acceptable, therefore rejectable, and as such may be rejected at the discretion of the District. Special conditions may arise on any project that are not covered in these specifications. In case of such special conditions, complete detail as to materials, method of construction, or other procedures shall be submitted to the District for their review and approval.

Any person proposing a new extension to an existing public water main shall notify the District at least thirty (30) days prior to any proposed work to allow for review of the application and design and to determine if adequate water volume and pressure are provided. Analysis of the design and determination of adequate volumes and pressures may be performed by a consultant to the District utilizing a hydraulic computer model of District's System. Costs associated with the consultant's hydraulic analysis will be the responsibility of the contractor. Notification to the District shall include the filing of an application for a permit for the extension of the public water main or water service connection or any other work in relation thereto. Separate permits shall be required for water main extensions and for each individual water service connection. Permit applications shall be obtained from the District. System Development charges shall also be submitted with the application.

Permits shall not be transferable. A change in ownership of a parcel of land to be serviced, or a change in the contractor, shall require a new permit.

Installation of water mains or services in the public way shall be prohibited between the dates of November 15th and March 15th unless extenuating circumstances exist and written approval is granted by the District.

Where reference is made to a particular industry specifications (ASTM, etc.), it is hereby understood that reference is made to the latest specifications revision in effect.

G1.1 Insurance

The contractor shall purchase and maintain such insurance as will protect them from claims which may arise out of or result from the contractor's execution of the work, whether such execution be by the contractor or by any subcontractor or by anyone for whose acts any of them may be liable.

Unless otherwise specified in the contract documents, the minimum insurance requirements provided in Appendix A shall apply.

G1.2 Contract Security

The contractor shall furnish the District with a Performance Bond and a Payment Bond in penal sums equal to the project cost, conditioned upon the performance by the contractor of all

undertakings, covenants, terms, conditions and agreements. Such bonds shall be executed by the contractor and a corporate surety company licensed to transact such business in the Commonwealth of Massachusetts. The expense of these bonds shall be borne by the contractor. If at any time a surety on any such bond is declared bankrupt or loses its right to do business in the Commonwealth, the contractor shall, within ten (10) days after notice from the District to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Sudbury Water District. The premiums on such bond shall be paid by the contractor.

G1.3 Indemnification

The contractor will indemnify and hold harmless the District, its agents and employees from and against all claims, damages, losses and expenses including attorney's fees provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including or in part by any negligent or willful act or omission of the contractor, and subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

In any and all claims against the District or its agents or employees, by any employee of the contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the contractor or any subcontractor under Workmen's Compensation Acts, Disability Benefit Acts or other Employee Benefits Acts.

G1.4 Guarantee

The contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of substantial completion (date of substantial completion shall be defined as the date of acceptance by the District). The contractor shall warrant and guarantee for a period of one (1) year from the date of substantial completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The District will give notice of observed defects with reasonable promptness. In the event that the contractor should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the District may do so and charge the contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

SECTION G2 – JURISDICTION

Area of Jurisdiction:

These general requirements for water mains and appurtenances shall be required for the service area within the Town of Sudbury, Massachusetts, as may be changed from time to time and those areas outside the town limits which are served by the District or may at some time in the future become a part of the District.

SECTION G3 – STANDARDS

G3.1 Standards:

G3.1.1 Environmental Protection Agency and U.S. Public Health Services:

The governing standards of these agencies will be followed when applicable.

G3.1.2 State Health Department, Department of Environmental Protection:

The Water system shall conform to the applicable laws, policies, standards, rules and regulations of the Massachusetts State Department of Health or the Massachusetts Department Of Environmental Protection.

G3.1.3 Sudbury Water District:

All water utility construction which is in the service area of the District and Criteria for Design and Construction for Water Supply and Distribution.

G3.3 Permits:

Permits and licenses necessary for the prosecution of the work shall be secured and paid for by the contractor. Permits, licenses and easements for facilities shall be secured and paid for by the contractor, unless otherwise specified. The contractor shall give all notices and comply with all laws, ordinances, rules and regulations.

G3.4 If a conflict arises between any of these standards, the more stringent standard shall prevail.

SECTION G4 – PLANS AND SPECIFICATIONS

G4.1 Description:

This section covers the requirements of submission to the District of plans and specifications in order to obtain approval for construction of facilities.

The contractor shall provide three (3) copies of design plans and documents to the District for approval. No changes to approved plans will be permitted without prior written approval of the District. Following the completion of construction and prior to acceptance by the District, the contractor shall furnish three (3) copies of as-built drawings to the District, which shall indicate any deviations from the original plans and specifications. The submitted plans shall include measured ties to buried water system components from permanent bounds, structures or other surface features.

G4.2 Surveys:

The contractor shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the work together with a suitable number of benchmarks adjacent to the work. The contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets. Plans and profiles shall be 1"= 40' horizontal scale and profiles shall be 1"= 4' vertical scale.

The contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

All plans, specifications, and construction procedures shall conform to the standards as established by the District. All plans and specifications shall be completed by a licensed Professional Engineer registered in the Commonwealth of Massachusetts. Any deviation of work from approved plans must be approved in writing by the District.

G4.2 Preliminary Report:

When requested by the District, the developer shall prepare and submit a preliminary engineering report prior to approval of construction plans. The size,

scope, and contemplated land use of the proposed development will determine the need for a preliminary report.

G4.2.1 In all subdivisions approved by the Town Of Sudbury Planning Board, the Developer shall furnish and install, as specified by the District, all water pipes, gates, hydrants, service connections, and necessary fittings to make a complete system and provide the District with a copy of As-Built Plans for the same before water is turned into the system. Cost associated with the District's review shall be paid by the developer.

G4.2.2 The District establishes the following to insure the safe and reliable operation of the system.

G4.2.2.1 The developer shall deliver a study of the water system within the subdivision involving analysis of flows, pressures, and other applicable hydraulic data.

G4.2.2.2 A study of the subdivision impact of the existing water facilities. This work will be performed by a designated Engineer, assigned by the District, using a hydraulic model of the system, at the developer's expense.

G4.2.2.3 The Executive Director will review this report and be aided if necessary by a consultant it may elect to employ. This cost shall be paid by the applicant. The Executive Director will make a final decision based on its review of the above as to whether or not to grant permission for the proposed connection.

G4.2.2.4 A written agreement stating conditions required for the connection, and signed by both parties, will be needed before the developer will be allowed to make the connection.

G4.2.2.5 A rough grade of new roads in subdivision is required before laying pipe.

G4.2.2.6 Any water main extension must be extended at minimum to the middle of the new lot or further to have the future water service go on a straight run from the street to the foundation.

G4.3 <u>Construction Plans and Specifications:</u>

G4.3.1 <u>General:</u>

All plans shall be drawn to a scale suitable for adequately showing the facilities proposed except as stipulated herein. The plans shall be stamped and signed by a licensed professional engineer, registered in the Commonwealth of Massachusetts. The plans shall depict the entire project and show all property lines including land ties, existing and proposed utility lines, benchmark from which elevations were taken, and other pertinent information. North arrow shall be pointed toward the top or left hand side of the sheet.

G4.3.2 <u>Plan Organization:</u>

All plans shall be submitted on 24" x 36" sheets in the following order:

1. Title sheet with the Engineer's Stamp.

2. Location map, coordination block and index.
3. Right-of-way, easement drawings, and legend.
4. Construction plans.
5. Typical details.

G4.4 Approval

Three (3) sets of complete plans and three (3) sets of specifications and one summary of design data shall be furnished to the District for approval. Upon approval, one (1) set of plans and specifications will be marked, approved, signed, and returned to the Engineer. If additional copies are required for submission to the Massachusetts Department of Environmental Protection or other agencies, they must be submitted at this time.

G4.5 As-Built Drawings:

As-Built Drawings shall be in accordance with the standards established by the District and shall show complete details of the installation of the Main and appurtenances as required by the District including, but not limited to,

1) The location of the Main with respect to property lines,
2) The size, make, and location with respect to street corners of all valve and fire hydrants, manholes, and clean outs,
3) The limits and location of any and all special encasements or backfill materials including average depth of cover at such location,
4) A detailed diagram of all special installations at utility, drainage, and roadway crossings,
5) Location of other utilities encountered,
6) Flow line and rim elevation for all manholes,
7) Certified final estimate for water lines,
8) Size and material of main,
9) Location and size of easements.

The developer shall provide the District with a full size, reduced, and digital copy of the final set of As-built plans within 90 days of completed installation. The digital copy of approved as-built plans must follow the five requirements listed below:

1. All plans and specifications must be submitted on electronic media (Flash Drive using an IBM-PC or compatible file format). Acceptable file formats include: AutoCAD *.dwg, AutoCAD *.dxf, ArcView *.shp, or ArcGIS Geodatabase *.mdb. The files must be identical to the printed plan and contain all information included on the written plan. Upon project completion a digital submission of the "as-built" plan is required prior to receiving a Certificate of Completion from the Building Department.

2. All digital mapping data must be delivered in the Massachusetts State Plane Coordinate system with a horizontal datum of NAD83 and vertical datum of NGVD88.

3. Each feature type must be organized in the CAD or GIS data structure as a separate layer using logical layer names. For example, there must be separate CAD layers for buildings, roads, parcel lines, and wetlands. Having all these features in a single CAD layer or GIS

file will not be accepted.

4. Documentation of the data format must be provided with a description of the CAD layers and list of the types of features placed in each layer. Submission of multiple files must also include a list of the files and their purpose.
5. The data submitted must include documentation on the method used to gather the data, the name of the person(s) responsible for preparing the data, contact information, an estimation of the horizontal and vertical accuracy, and the date of data capture. All media shall be free from any and all defects and viruses, and labeled as to their contents.

SECTION G5 – INSPECTION AND LAYOUT

G5.1 Description:

This section covers the requirement of general inspection and layout for the construction of utility facilities.

G5.2 General Supervision:

G5.2.1 All utility facilities proposed shall be constructed under the general supervision of a Professional Engineer Inpector. General supervision shall consist of, but not be limited to, full time inspection on the construction work to observe the progress and quality of the construction work and to determine if the work is proceeding in accordance with the approved plans and specifications and with the standards set forth by District.

G5.2.2 Any defects, deficiencies or irregularities in the work found by the Engineer or reported by the inspector shall be reported to the District. Such action, as deemed appropriate by the Engineer and District, shall be taken to correct such deficiencies and notification shall be made to the District.

G5.2.3 All work done subject to these requirements shall at all times be subject to the general inspection of the District, or his assistants.

G5.2.4 The presence of an inspector or representative of the District on the job site will in no way excuse the engineer or contractor from performing the inspection, testing, supervision and reporting called for in these specifications.

G5.3 Construction Layout:

The layout and staking of the construction work shall be completed by Licensed Professional Surveyor under the supervision of the Engineer. Such layout and staking shall consist of alignment and grade stakes necessary to establish batter boards or grade lines necessary for use in attaining proper alignment and grade of the facilities.

G5.3.1 No construction in subdivision shall start until lot corners in the subdivision are marked.

SECTION G6 – RULES AND REGULATIONS

G6.1 Description:

This section covers such rules and regulations as required by law for the completion of plans, specifications, and construction work on any and all proposed water facilities.

G6.2 Laws, Regulations, and Ordinances:

All Federal, State, and Town, Laws, and District Regulations shall be complied with on all water projects.

G6.3 Permits and Licenses:

All permits and licenses required by Massachusetts Department of Environmental Agency and/or Town of Sudbury shall be obtained in strict accordance with the requirements of the respective governing agency. Cost associated with any required permit, fee, or bond shall be borne by the Developer.

SECTION G7 - EASEMENTS

G7.1 Description:

This section covers the requirements of easements for the purpose of maintaining utility lines where the proposed lines will be on private property or where the lines would not be within public rights-of-way.

G7.2 Width of Easement:

G7.2.1 Water Line Easements: Where lines are not placed in public rights-of-way, a permanent easement shall be acquired for the District and dedicated for the purpose of maintaining the utility lines. The easement shall have a minimum width of 20' and remain unobstructed. Common utility easements will be accepted provided that the easement is wide enough to accommodate the above requirements. Easements of maximum width possible will be provided to allow access.

G7.3 Filing of Easements:

Easements shall be properly recorded and filed with the Masschusetts Registry of Deeds or Land Court as applicable. A copy of all final recorded easements or subdivision plats as filed shall be furnished the District along with as-built plans. All easements for lines shall be in favor of the District. Easements as shown on a recorded plat shall be considered as public easements and adequate for this purpose.

SECTION G8 – FINAL INSPECTION AND ACCEPTANCE

G8.1 Description:

This section covers the requirements for final inspections and acceptance for water facilities upon completion of the project.

G8.2 Leakage Testing:

Methods of testing are outlined in Section TW of these standard requirements. All leakage tests shall be conducted in the presence of a representative of the District. Twenty-four hours' notice shall be given to District prior to commencing any tests.

G8.3 Final Inspection:

Before utility extensions are accepted for maintenance and service connections to these extensions approved, a final inspection will be made at the written request of the Executive Director. A list of material and workmanship defects, if any, will be forwarded to the Executive Director or his/her designee. Defects noted and all other known defects must be corrected before acceptance.

G8.4 Acceptance:

No connection of customer facilities or other utilization of utility mains will be permitted by the District until a letter of acceptance is issued. The acceptance letter will not be issued until the following requirements are met:

(a) Receipt of one copy of approved "As-built" plans.

(b) Satisfactory correction of all defects.

(c) Receipt of all required easements.

(d) Receipt of permit fees

G8.6 Final Inspection Before District Acceptance:

A final inspection will be made by the District before acceptance. A list of any defects in material or workmanship found during this inspection will be forwarded to the Developer's Engineer and a claim filed with the bonding company. As soon as defects found during this inspection are corrected, the District will issue full acceptance of the project for maintenance.

G8.7 Use of Completed Portions:

Portions of the project completed will not be allowed to be put into service without written approval from the District. Approval of the use of portions of the project will be granted only in the best interest of the Utility. Use of completed portions of an incomplete project does not constitute acceptance of the project by the Utility.

PART DW – DESIGN FOR WATER MAINS

SECTION DW1 – GENERAL

DW1.1 As a minimum, design and layout shall meet the requirement of the standards referred to in G3.

SECTION DW2 – MATERIALS

DW2.1 Valves, fire hydrants and water line material shall conform to these types listed in Section MW of these specifications. Materials not specifically authorized in these specifications are forbidden for use in the District water system unless approved in writing otherwise.

SECTION DW3 – LINE, SIZE, AND PRESSURE

DW3.1 The nominal working pressure in the system should be a minimum 20 PSI and maximum of 110 pounds per square inch (PSI). All water mains including those designed to provide fire protection shall be sized by a

hydraulic analysis based on flow demands and pressure requirements.

DW3.1.1 Minimum Diameter:

The minimum size of water mains providing fire protection and serving fire hydrants shall be 6" diameter for residential areas and 8" diameter for commercial areas. Larger mains will be required if necessary to allow the withdrawal of required fire flow whole maintaining the minimum residential pressure of 20 PSI.

DW3.1.2 Minimum Pressure:

The system shall be designed to maintain a minimum pressure of 20 PSI at the highest point in all buildings in the system under all conditions of flow.

DW3.1.3 Flow Requirements:

In sizing the distribution system water mains, the required design flow shall be the sum of the required fire flow and Peak Hour Flow.

DW3.1.4 Minimum Fire Flow:

Required fire flow for areas other than those occupied by single family dwellings shall be as determined by the Engineer and approved by the District and Sudbury Fire Department for each specific instance.

DW3.1.5 Subdivision Connections:

DW3.1.5.1 Single Connection:

A subdivision to be supplied by a public water system and having a flow requirement as determined herein of not more than 700 gallons per minute may have a single connection to the distribution system.

DW3.1.5.2 Multiple Connection:

A subdivision to be supplied by a public water system and having a flow requirement as determined herein of more than 700 gallons per minute shall have two (2) or more connections to the distribution system. A single connection may be made by using a pipe diameter sufficient to provide two (2) times the required flow as determined by DW3.3 above with provisions for future connections provided approval of the Utility is obtained.

SECTION DW4 – SYSTEM LAYOUT

DW4.1 Grid System:

All mains shall be interconnected to form a grid system. Interconnections between eight inch mains shall not be more than 1,200 feet apart unless so authorized by the District. When greater separation of interconnecting mains is necessary, larger diameter pipes will be used. If the installations of a "dead-end" main cannot be avoided, its dead-end length shall not exceed 600 feet unless authorized by the District.

DW4.2 Dead Ends:

Dead ends shall be minimized by looping the main whenever practical. When a dead-end main cannot be eliminated, they shall be provided with a fire hydrant

to be used for flushing purposes as well as fire protection.

SECTION DW5 – LINE LOCATION (GEN.)

DW5.1 Water mains shall be installed only in dedicated streets, utility easements, or public right-of-way. The main shall be placed a minimum of 5 feet from the edge of the easement or right-of-way and have a minimum cover of 5 feet.

DW5.2 New Water Mains – When new water mains are installed a minimum 5 feet of horizontal separation from other underground utilities if possible.

DW5.3 When it is necessary for water and sewer line to cross each other, the bottom of the water line shall be a minimum of 18 inches above the top of the sewer line; a length of water main pipe shall be centered over the sewer line so that the joints are a maximum distance from the sewer line and by encasing the sewer line with concrete or by constructing it of pressure type pipe for a minimum distance of 9 feet on both sides of the water line.

SECTION DW6 – HYDRANT

DW6.1 Location – Hydrants shall be located such that no residence or building shall be more than 500 feet from a hydrant, measured along a street or public right-of-way.

DW6.2 Leads: Each fire hydrant shall have a lead with a minimum diameter of 6 inches equipped with an auxiliary gate valve.

SECTION DW7 – VALVES

DW7.1 Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves should be located at not more than 1500-foot intervals. 4 way crosses are permitted.

DW7.2 A minimum of 4 valves shall be installed at a 4 way intersection and 3 valves at a 3 way intersection.

SECTION DW8 – SERVICE LINES

DW8.1 The approximate location for service lines should be shown on the drawing submitted for approval with the actual location shown on the "as- built" drawing with station number.

DW8.2 No service line shall be placed in a location that will increase the chance of it receiving damage or impair access for maintenance such as driveways or trees.

PART MW – MATERIALS FOR WATER MAIN CONSTRUCTION

SECTION MW1 – DESCRIPTION

MW1.1 General:

This part of the specifications shall govern for all materials used in the construction of water distribution facilities under the jurisdiction of the District. Projects that would necessarily involve materials other than those included in this specification shall be subject to the approval of the District. Complete

specifications covering all materials not included herein shall be submitted for approval. Any material used other than materials herein specified shall be of the kind and type normally used in the construction of water distribution facilities.

MW1.1.1 All products included in this section shall conform to AWWA standard specifications referenced herein.

MW1.1.2 Pipe size shall be as shown on the drawings.

MW1.1.3 All pipe materials and methods of jointing shall be as shown on the Drawings.

MW1.2 Reference Standards:

A. ANSI A21.4/AWWA C104 – Cement Mortar Lining For Ductile Iron Pipe and Gray Iron Pipe and Fittings for Water.
B. ANSI A21.10/AWWA C153 – Gray Iron and Ductile Iron Fittings, 4" through 48", for Water and Other Liquids.
C. ANSI A21.11/AWWA C111 – Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
D. ANSI A21.51/AWWA C151 – Ductile Iron Pipe.
E. ANSI B.16 – Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
F. ASTM A126 – Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
G. ASTM B62 – Composition Bronze or Ounce Metal Castings.
H. AWWA C502 – Dry Barrel Fire Hydrants.
I. AWWA C600 – Installation of Ductile Iron Water Mains.
J. AWWA C150 – Thickness Design for Ductile Iron Pipe.
K. AWWA C504 – Rubber Seated Butterfly Valves.
L. AWWA C500 – Gate Valves, 3" through 48".
M. AWWA C509 – Resilient-Seated Gate Valves.
N. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.

SECTION MW2 – DUCTILE IRON WATER MAINS

MW2.1 Description:

The different kinds of strengths of water pipe outlined in this section shall be used in the construction of water lines unless otherwise specified in Section CW – Construction Methods. The strength of pipe used shall be based upon standard engineering design procedures and manufacturer or trades association recommendation, and the strength proposed shall be shown on the drawings. All pipe used in the construction of water lines shall be "Underwriters Laboratory" (UL) approved. All pipes shall be circular. Only pipe materials listed in this section shall be used for main extensions unless specifically authorized in writing by the Executive Director. All minimums are just suggested minimums and in no way relieve the Engineer from performing the necessary calculations.

MW2.2 Ductile Iron Pressure Pipes:

MW2.2.1 Ductile Iron Pipe shall be designed in accordance with AWWA C150 and ANSI A21.51/AWWA C151, Class 52 and shall have push-on joints where specified. Pipe shall be double cement-lined with seal coat

inside and out conforming to ANSI A21.4/AWWA C104. Push-on joints and rubber gaskets.

MW2.2.2 The pipe shall be manufactured in the USA. The pipe manufacturer shall supply the Engineer with certificates of compliance with these specifications and certification that each piece of ductile iron pipe has been tested at the foundry with Ball Impression Test, Ring Bending or other approved test for ductility.

MW2.2.3 Ductile iron pipe may be rejected for failure to meet any of the requirements of this specification.

SECTION MW3 – SERVICE LINES

MW3.1 Description:

The service line is the line from the main to the outlet valve at the customer's meter. It shall consist of the corporation stop at the main, the tubing or pipe, the curb stop and curb box, and a meter with valves on both the inlet and outlet. The specifications for the corporation cock or stop and the curb stop will be found in Section MW4.7.

MW3.1.1 Polyethylene Service (PE) line:

Tubing for services shall be polyethylene designed for 200 psi service. Pipe shall be in accordance with AWWA C901 standard for Polyethylene Pressure Pipe, tubing and fittings.

SECTION MW4 – FITTINGS

MW4.1 Description:

The different kinds of strengths of fittings used in water line construction, outlined in this section shall be used in the construction of water lines unless otherwise specified in Section CW – Construction Methods. The strength of the fittings used shall be based upon standard engineering design procedures and manufacturer or trade association recommendation, and the strength proposed shall be shown on the drawings. All fittings used in the construction of water lines shall be "Underwriters Laboratory" (UL) for approved. All materials listed in this section shall be used for main extensions unless specifically authorized in writing by the Executive Director. All minimums are just suggested minimums and in no way relieve the Engineer from performing the necessary calculations.

MW4.2 Fittings for Ductile Iron Pipe:

MW4.2.1 Fittings shall be Cast Iron, 250 psi pressure rating, or Ductile Iron, 350 psi pressure rating, conforming to ANSI A21.10/AWWA C110 with mechanical joints. Compact Ductile Iron Fittings conforming to ANSI A21.53/AWWA C153 will be acceptable. Joints shall be furnished with ductile iron retaining glands. Retaining glands shall be Mega-lugs, series 1100, manufactured by EBBA Iron, or an approved equal. Glands using set screws will not be acceptable. Fittings shall be double cement-lined and seal- coated inside and out in accordance with ANSI A21.4/AWWA C104. Tees for hydrant branches and for stubs for future use shall have mechanical joints on the run with a

plain-end having an integral rotating gland on the branch (Anchor-tees). The gland will anchor mechanical joint pipe or valve ends to the plain end of the pipe.

MW4.2.2 All Ductile and Cast Iron Pipe and fittings shall be clean, sound, and without defects. The castings shall be smooth and free from pinholes, excess iron, etc. The coatings shall be continuous, smooth and neither brittle nor sticky.

MW4.3 Brass Water Service Fittings:

MW4.3.1 Mueller or McDonald fittings required with Compression Joint. Stops and Fittings furnished under these specifications shall be of the size and type specified, with all parts of brass, conforming to Alloy Number 4 A (ASTM Designation B 62) which has a nominal composition of 85% copper and 5% each of tin, lead, and zinc, plus or minus 1%. All stops, cocks, and fittings shall be full size openings, throughout, of the size specified.

All castings shall be smooth, free from burrs, scales, blisters, sand holes, and defects of every nature that would make them unfit for the use for which they are intended.

Nuts shall be smooth cast, with symmetrical, hexagonal wrench flats.

MW4.3.2 Fittings shall be designed for 200 psi working pressure and brass to brass parts shall be shipped prelubricated with a light, fluid lubricant between key and body.

MW4.3.3 Valves must be ball type with a full size opening with straight-through flow, Teflon coated, bronze ball with a minimum of .5 mil. thickness coating. The stop must be so constructed that it may be disassembled and the ball removed without special tools.

MW4.3.4 Corporation stops shall be "CC" tapered threads as required. They shall be designed to rotate about the axis of the flow passageway within a circle of rotation small enough to properly clear the inside of any standard tapping machine of appropriate size.

SECTION MW5 – VALVES AND VALVE BOXES

MW5.1 Resilient Seated Gate Valves:

MW5.1.1 Resilient seated gate valves shall be manufactured to meet or exceed the requirements to AWWA C-509 of the latest revision. Valves shall have an unobstructed water way when fully opened equal in diameter to at least ¼" greater than the nominal valve sizes. Valves shall have mechanical joint end.

MW5.1.2 All internal surfaces shall be coated with epoxy to a minimum thickness of 4 mils. Said coating shall be non- toxic, impart no taste to water and shall conform to AWWA C 550 of latest revision.

MW5.1.3 Valves shall be provided with two O-ring stem seals. Both O-rings shall be located above the thrust collar. The sealing mechanism shall provide a dual seal with zero leakage at the water working pressure when installed with the line flow in either direction, and shall consist of a cast iron gate having a vulcanized synthetic rubber coating with no rubber metal seams or edges in the water way when in the fully closed position.

MW5.1.4 All valves shall be seat tested at the rated working pressure in accordance with Section 6 of AWWA C-509. Valve shall be rated at 200 psi working pressure and 400 psi test pressure.

MW5.1.5 Valves shall operate open right.

MW5.2 Butterfly Valves:

MW5.2.1 All butterfly valves shall be of the rubber-seated, tight- closing type and shall meet or exceed AWWA Specification C-504-70, with latest revisions. Valves shall be designed for underground service.

MW5.2.2 Valves shall have mechanical joint ends. Standard M.J. accessories are also to be provided.

MW5.2.3 Valve shall be equipped with a 2" AWWA operating nut and shall open as specified below.

MW5.2.4 All valves shall be rated at 200 psi minimum working pressure and hydrostatically tested at 400 psi.

MW5.2.5 Valves shall have thermosetting epoxy coating on the interior and the vain. The coating shall meet all requirements of AWWA C-550 of the latest revision. All bodies and valves shall be factory coated prior to assembly and tested. All ferrous surfaces of the valve body waterway and vane shall receive an epoxy coating with a minimum dry film thickness of 8 mils. All exterior surfaces shall be coated with asphalt varnish.

MW5.2.6 Rubber seat shall be a full circle 360 degree seat not penetrated by the valve shaft. Rubber seat shall be mechanically retained in the valve body and shall be capable of being replaced. Seats vulcanized or bonded to the body are not accepted.

MW5.2.7 All valves shall use full AWWA C-504 Class 150-b valve shaft diameter. Valve shaft shall be one-piece. Shafts shall be made of stainless steel or hi-tensile steel. One piece valve shafts shall extend full size through the entire valve and operator with no neck down, keyways, or holes.

MW5.2.8 Valve shaft shall be sealed from waterway by means of stainless steel journals and "triple-seal" rubber packing designed for permanent duty in underground service. Valve disc shall be of the through shaft type made of high strength cast iron ASTM A-48 Class 40.

MW5.2.9 Valve operator shall be of the worm and gear or traveling- nut type

and shall use full AWWA C-504 Class 150-B torque rating throughout entire travel.

MW5.2.10 Valve operator shall be capable of withstanding an overload input torque of 450 ft.-lbs. at full-open or closed position without damage to the valve operator.

MW5.2.11 Valves shall open right.

MW5.3 Tapping Sleeve and Valve:

MW5.3.1 Tapping sleeve and valve shall be of the mechanical joint type for use on cast/ductile iron pipe with ductile iron outlet.

MW5.3.2 The mechanical joint sleeve shall have longitudinal compound rubber gaskets which shall fit against the rubber end gaskets which shall fit against the rubber end gaskets thus affecting a totally enclosed rubber water-tight seal.

MW5.3.3 Tapping sleeve shall have a flange with "O" ring seal and drilled to correspond to that of the tapping sleeve to insure proper alignment. The outlet side shall be mechanical joint.

MW5.3.4 Tapping sleeve shall meet or exceed provisions of AWWA C500 specifications

MW5.3.5 Tapping sleeve shall be designed for 200 psi working pressure and 400 psi test pressure and shall open left.

MW5.3.6 Tapping Valve shall be iron body, resilient seated gate valve with 2-inch operating nut.

MW5.4 Valve Boxes:

MW5.4.1 Valve boxes shall be furnished for all valves. Shop drawings will be required for approval before delivery.

MW5.4.2 Valve boxes shall be standard cast-iron, asphalt coated, and adjustable, sliding type, together with cast-iron covers with the word "Water" plainly cast in relief on the top surface.

MW5.4.3 The bottom section shall have a minimum I.D. of 5- ¼". The top section shall have a minimum diameter of 6-⅛". There shall be a minimum 6" overlap between sections.

MW5.4.4 The bottom section shall be 48" in length for all butterfly valves and 36" in length for all gate valves. The top section shall be at least 26" in length and have a plain bottom. No three piece combinations shall be acceptable.

MW5.4.5 Valve boxes shall be completely and thoroughly coated with bitumastic paint.

MW6 – FIRE HYDRANTS

MW6.1 General:

MW6.1.1 Hydrants shall conform to the requirements of AWWA C- 502, and be designed for 150 psi working pressure tested to 300 psi hydrostatic. Hydrants shall have 6-inch mechanical joint shoe with retaining gland, 5-¼-inch valve opening, and 6'0" bury, open right with two 2-½-inch hose nozzles and one 4-½-inch hose nozzles and one 4- ½ inch pumper connection, National Standard Threads, operating nut and nozzle cap with non-kink safety chains.

MW6.1.2 Hydrants shall be the compression type, closing with pressure. They shall be traffic model with safety flange and stem couplings.

MW6.1.3 Hydrants shall be able to be rotated 360 degrees. They shall have a positive closing, self-cleaning drain valve and drainage area shall be completely bronze or brass lined.

MW6.1.4 The District has standardized on Mueller, AVK, and Darling.

MW6.1.5 Hydrants shall be painted red to match the District's standard color.

MW7 – CONCRETE AND REINFORCING STEEL

MW8.1 Description:

This section covers materials for concrete and reinforcing steel used in water line construction.

MW8.2 Cement:

MW8.2.1 Cement shall be Portland Cement conforming to AASHTO Designation M85, Type 1. Type III cement high early strength, may be used if approved by the Engineer.

MW8.2.2 When concrete is mixed on the job site, cement shall be delivered in plainly marked paper sacks of not less than 94 pounds net weight.

MW8.3 Water:

Water used in mixing concrete and mortar shall be free from injurious amounts of acids, alkalies, oils, sewage, and vegetable matter. It shall be fit for drinking.

MW8.4 Composition and Strength:

MW8.4.1 Concrete shall be composed of Portland Cement, fine and coarse aggregate, and water proportioned in keeping with the following:

	Class "A"	Class "B"	Class "C"
Minimum sacks of cement per cubic	6	5	4
Consistency Range in Slump-in	2-4	2-4	2-4

MW8.4.2 Proportioning of concrete shall be by weight except that water may be measured by volume.

MW8.4.2.1 A one cubic foot sack of Portland Cement will be considered as 94 pounds in weight.

MW8.4.2.2 A gallon of water will be considered as weighing 8.33 pounds.

MW8.4.3 Class "A" concrete made with ordinary Portland Cement shall have a minimum compressive strength at 28 days of 3,000 psi. Class "B" concrete made with ordinary Portland Cement shall have a minimum compressive strength at 28 days of 2,500 psi. If made with high early strength cement, those strengths shall be attained at the age of 7 days. Class "C" concrete shall have 2,000 psi.

Class of concrete shall be shown on the plans in all locations where concrete is required.

SECTION MW8 – PIPE BEDDING AND BACKFILL

MW9.1 Description:

This section covers materials used for pipe bedding and backfilling. All water line bedding shall be Class "2" unless otherwise specified herein or shown on the plans. Class "1" bedding may be used for ductile or cast iron pipe only, unless approved by the Utility prior to construction.

MW9.2 Bedding:

MW9.2.1 Class "1" Bedding:

Class "1" bedding materials are materials on the site, earth bedding.

MW9.2.2 Class "2" Bedding:

Class "2" bedding materials shall be composed of gravel materials. Gravel bedding materials shall be pea gravel or washed gravel no larger than ½" diameter. Substitution of alternate bedding materials will be approved only in individual case and only at the specific request of the Engineer.

MW9.2.3 Class "3" and Class "4" Bedding:

Class "3" and Class "4" bedding materials shall be composed of concrete and reinforcing steel and shall meet with the requirements of Section MW9 – Concrete and Reinforcing Steel. All concrete used for Class "3" and Class "4" bedding shall be 2,000 lb. concrete.

MW9.3 Backfill:

Backfilling shall be done with good earth, sand or gravel and shall be free from large rocks or hard lumpy material, unless the rocks or lumps are not more than approximately four (4) inches in greatest diameter and are scattered in the soil. No material of a perishable, spongy, or otherwise unsuitable nature shall be used in backfilling.

MW9.4 Flowable Fill (CDF):

SECTION MW11 – TRACE WIRE

MW11.1 Trace wire or Magnetic Tape shall be laid with all non-metallic pipe as per standard details.

Trace shall be fourteen (14) gauge single strand plastic coated copper trace wire.

PART CW – CONSTRUCTION FOR WATER MAINS

SECTION CW1 – GENERAL

CW1.1 This part of the specification shall govern the construction procedures used in the installation of water line facilities under the jurisdiction of the District. Construction procedures other than those outlined in this specification shall meet with the approval of the District. Complete specifications covering any unusual or special construction procedure shall be submitted for approval and approval must be received prior to beginning any construction operations.

SECTION CW2 – EXCAVATION AND BACKFILL

CW2.1 Description:

This section covers the excavation and backfill of water lines, and appurtenances.

CW2.2 Trench Excavation:

CW2.2.1 The sides of the excavation shall be cut as such a slope that will prevent caving. In areas where soil conditions permit normal excavation of the trench, the sides shall be cut as nearly vertical as possible from the bottom of the trench to a point 12" above the top of the pipe when it is laid to grade. Maximum and minimum widths of the trench shall be as shown in the plans.

CW2.2.2 In caving ground or in wet, saturated, or flowing materials, the sides of the excavation shall be adequately sheeted and braced so as to maintain the excavation free from slides or cave-ins and safe for workmen. Sheeting and shoring shall not be removed until the excavation has been backfilled to a sufficient depth to prevent caving.

CW2.2.3 The trench width from the bottom of the trench to an elevation 12" above the top of the pipe shall not exceed the maximum width as specified in the plans.

CW2.3 Trench Bottom:

The entire length of the water line shall be founded on bedding specified in Section CW3 – Pipe and Bedding and in Section MW10 – Pipe Bedding and Backfill Materials.

CW2.4 Excavation for Fire Hydrants:

Excavation for fire hydrants shall be as specified in Section CW9 – Fire Hydrants.

CW2.5 Disposal of Excavated Materials:

Excavated material shall be piled adjacent to the work to be used for backfilling

as required. Excavated materials which are unsuitable for backfilling and excess material shall be disposed of in a manner approved by the Engineer.

CW2.6 Use of Explosives:

In the event the use of explosives is necessary for the efficient prosecution of the work, the Contractor shall be coordinated with the Sudbury Fire Department and the Engineer in advance of their use and shall exercise every precaution to prevent damage to adjoining improvements or property by reason of their use. Any damage to private property resulting from the use of explosives shall be the liability of the Contractor. In all cases where the explosives are necessary, a permit from the local government agency shall be obtained prior to their use.

CW2.7 Backfilling:

CW2.7.1Water Lines:

CW2.7.1.1 Backfilling of water lines shall include the refilling and consolidation of the fill in the excavation up to the surrounding ground surface or road grade at crossings. It is essential that the complete backfill be done in such a manner to minimize voids in the backfill.

CW2.7.1.2 Backfilling up to the point 12" above the top of the pipe shall be done with good earth, sand, or gravel and shall be free from large rocks or hard, lumpy materials. No materials of perishable, spongy or otherwise unsuitable nature shall be used in backfilling.

CW2.7.1.3 Backfill of Pipe:
Pipe shall be backfilled with select materials of the proper moisture content to obtain a support under the lower ½ of the pipe, compacted to a density of 90% AASHTO T-180 modified or better. The intent is to cradle the pipe so that the fill length of each joint is uniformly supported on firm bedding and the weight of pipe and fill is borne uniformly by the lower ½ of the pipe barrel. Tamping of fill below the spring line of the pipe may be by hand tamps provided the required density is obtained.

Where trenches are not under existing or proposed paved areas, backfill shall proceed with the same select materials hand placed to a point 12" over the top of the pipe. Backfill may then proceed by whatever commonly used construction methods as are consistent with the integrity of the pipeline. Backfill outside the existing or proposed paved areas shall be left slightly over full to allow for settlement.

Where trenches are under existing or proposed pave areas, the entire trench up to a point 2' below existing or proposed subgrade shall be backfilled with select materials and compacted to a density of 90% AASHTO T-180 modified or better. The remaining 2' shall be similarly backfilled, but the minimum compaction shall be 95% AASHTO T- 180 modified.

The backfill of materials in trenches under existing or proposed paved areas shall be compacted with mechanical devices

manufactured for that purpose form two feet above the top of the pipe to the top of the existing or proposed subgrade.

CW2.7.2 Fire Hydrants:

Backfilling of fire hydrants is specified in Section CW9 – Fire Hydrants.

SECTION CW3 – PIPE BEDDING

CW3.1 Description:

This section covers construction methods for pipe bedding. All pipes shall be laid on either Class "2", Class "3", or Class "4" bedding materials as specified in Section MW9 – Pipe Bedding Materials, except that cast or ductile iron pipe conforming to Sections MW2.3 or MW2 of these specifications may be bedded as specified for "type 1" laying conditions in ANSI A21.50, "Thickness Design of Ductile Pipe", latest revision, unless structural or foundation requirements indicate otherwise.

CW3.2 Class "1" Bedding:

CW3.2.1 Class "1" bedding shall be completed in accordance with details shown on the standard details and with these specifications.

CW3.2.2 The pipe shall be embedded in the bottom of the trench as shown on the standard details, with cuts made for the bells of the pipe.

CW3.3 Class "2" Bedding:

CW3.3.1 Class "2" bedding shall be completed in accordance with details shown on the standard details and with these specifications.

CW3.3.2 Excavation shall be carried to a depth of 0.40' below the bottom of the pipe. Where excavation is carried below this depth for any reason, the space shall be filled with Class "2" bedding material unless otherwise approved.

CW3.3.3 The pipe and joints shall be embedded in the gravel or sand bedding material to a depth of .10' of the outside diameter of the pipe or to a minimum depth of 0.2' as shown on the standard details.

CW3.4 Class "3" and Class "4" Bedding:

CW3.4.1 Class "3" and Class "4" bedding shall be completed in accordance with details shown on the standard details and with these specifications.

CW3.4.2 Excavation shall be carried to the bottom of the concrete as shown on the standard details. Where excavation is carried to a depth below the bottom of the concrete for any reason, the space may be filled with either Class "2", Class "3", or Class "4" bedding material unless otherwise approved.

CW3.4.3 Where Class "3" or Class "4" bedding is used, the pipe and pipe joints shall be embedded in the concrete as shown on the standard details.

CW3.4.4 Construction methods of placing concrete and reinforcing steel shall meet with the requirements stipulated above and as outlined in Section CW13 – Concrete and Reinforcing Steel.

CW3.5 Service Lines:

The bedding service lines shall meet with the requirements of Class "1" bedding set forth above.

SECTION CW4 – DEWATERING OF TRENCHES

CW4.1 Description:

This section covers the dewatering of trenches to the extent that bedding material and water pipe can be placed on dry, firm trench bottom.

CW4.2 Wellpointing:

Wellpointing where required to keep the excavation dry and the subgrade stable, shall be installed when the excavation is within a minimum of two (2) feet of the water table, except as hereinafter provided, and shall be in continuous operation until backfill is completed to this level. When construction equipment is to be operated in an area that has been excavated and wellpointing is required to keep trench excavation dry and the subgrade stable, the wellpoint shall be installed when the excavation is within a minimum of five (5) feet of the water table. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates when the pipe line crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work shall be prevented. Provision shall be made for the satisfactory disposal of surface water pumped so as to prevent damage to public or private property.

CW4.3 Trench Dewatering:

Dewatering of trenches other than by wellpointing shall be accomplished by whatever means elected by the Contractor, however, bedding material or pipe may not be placed in wet or unstable trenches. Soil that cannot be properly dewatered shall be excavated and dry material tamped in place to such a depth as may be required to provide a firm trench bottom.

CW4.4 Surface Runoff:

Surface runoff water shall be diverted away from the trenches. Such diversion shall be into existing drainage structures such as storm sewers, ditches or streams. Diversion of surface runoff shall be in such a manner to prevent flooding of streets or private property.

CW4.5 Disposition of Water from Dewatering:

All water removed from the trenches by well pointing or any other means shall be pumped, piped or drained into existing drainage structures, such as storm sewers, ditches or streams. The disposition of water from dewatering operations shall be accomplished in a manner that will prevent the flooding of public or private property.

SECTION CW5 – SHEETING AND SHORING

CW5.1 Description:

This section covers the sheeting and shoring to protect the safety of workers, provide suitable means for constructing the water line, and to protect public or private property, including existing utilities.

CW5.2 Cave-ins

Where trench cave-ins are a possibility, adequate sheeting and/or shoring shall be provided so as to maintain the trench free from slides or cave-ins and safe for workmen.

CW5.3 Existing Structures:

Where existing buildings, other utilities, streets, or other structures are in close proximity to the trench, adequate protection shall be provided by the use of sheeting and shoring to protect the structure from possible damage. In the case of streets or utilities, the Contractor may elect to remove the street or utility provided that the removal and subsequent replacement meets with the approval of the District, the utility owner, or whoever has jurisdiction of the structure. In all cases, it shall be the responsibility of the Contractor to protect public and private property and any person or person who might, as a result of the Contractor's work, be injured.

SECTION CW6 – PIPE LAYING

CW6.1 Description:

This section covers the laying of pipe for water lines. All material shall be in accordance with Part MW – Materials for Water Mains of these specifications.

CW6.2 Inspection:

Each joint of pipe shall be inspected carefully before being placed in the trench. Any joint found to be cracked or otherwise so damaged as to impair its usefulness shall be plainly marked in such a manner that the markings will not rub or wash off. Damaged joints shall be removed from the site as soon as feasible.

CW6.3 Pipe Laying:

CW6.3.1 All pipe and fittings shall be installed to the line and grade as detailed on the plans. Subject to the approval of the Engineer, other fittings may be added to or substituted for those shown on the plans, should the need arise during construction. This permissive stipulation in no way shall relieve the Contractor of the responsibility for furnishing and installing all fittings required for a complete and proper installation of main as detailed on the plans.

Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Full responsibility for the diversion of drainage and for dewatering of trenches during construction shall be borne by the Contractor.

All dirt and other foreign matter shall be removed from the inside of pipe and fittings before they are lowered into the trench. They shall be kept clean during and after laying, care shall be taken to keep dirt out of the jointing space.

Spigot and bells shall be cleaned thoroughly before the application of lubricant and attachment of the gasket shall be in strict accord with the joint.

At the end of each day's work, and when pipe laying is discontinued for an appreciable period, open ends of pipe shall be closed with a cast plug or cap firmly secured in place.

Pipe shall not be placed in the trench without excavating for bells so that the entire barrel of the pipe is uniformly supported on the pipe bedding.

Pipe shall be supported to proper line and grade, and secured against upheaval or floating during the placement of bedding.

All pipe and fittings shall be lowered carefully into the trench in such manner as to prevent damage to pipe, fittings, or linings. Neither pipe nor fittings shall be dropped or dumped into the trench.

Cutting of pipe, where needed, shall be done in a neat and workmanlike manner without damage to pipe or pipe lining.

Unless otherwise directed by the Engineer, pipe shall be laid with bell ends facing in the direction of laying. For lines on an appreciable slope, bells shall, at the direction of the Engineer, face upgrade. Wherever necessary to deflect pipe from a straight line in either the horizontal or vertical plane, to avoid obstructions, or for other allowable reasons, the degree of deflection at any joint shall not be greater than that which will provide adequate gasket space entirely around the spigot end of pipe. The joint opening shall be approximately ⅛ inch.

Deflections shall not exceed the maximum recommended by the pipe manufacturer.

All non-metallic pipes shall have trace wire meeting requirements of Section MW12, "Trace Wire" of these specifications as per standard details.

CW6.4 Service Lines:

CW6.4.1 Boring:

Boring may be done by whatever boring machine is designed for said purpose. Where casing is required, the bore shall be large enough to house to casing. Where encasement pipe is not required, the end of the pipe shall be plugged in such a manner as to keep pipe free from dirt and other foreign matter.

CW6.4.2 Water Service Pipe (Cu or PE):

CW6.4.2.1 Open Trench:

Trench bottom shall be free of rocks or sharp objects and should be compacted to prevent settlement. Depth of Service Line should be five (5) feet unless otherwise specified on plans or directed by the Engineer. Before installation, pipe should be inspected for cuts, punctures, or excessive abrasion.

CW6.4.2.2 Pipe should be blown out before final connections are made to

eliminate any dirt or sand that may have entered the pipe during installation. Pipe shall be pressure tested before being fully backfilled, (partial backfill to hold the pipe in place).

CW6.5 Early Warning Tape:

Early warning tape or wire shall be installed in trench, (18) inches below ground surface for all pipe.

SECTION CW7 – TAPS

CW7.1 Service Taps:

CW7.1.1 General:

Taps and/or tap assemblies of the specified size shall be installed in locations as detailed and indicated on the plans or as specified.

Taps: Taps for transmission of water or air from the main into system service accessories are defined as follows:

a. Standard internal pipe threaded holes in the wall of water mains; these taps may be either manufactured into the pipe or installed in the field.
b. Tap installations that are made by clamping a bronze service clamp equipped with a sealed threaded port on the periphery of the main then drilling through the pipe wall to complete each service port.
c. When a direct tap is made, pipe dope or Teflon tape shall be applied to the threaded part of the corporation stop.
d. Services will only be provided from dedicated easements, alley ad right-of-ways.
e. The District shall determine the location of taps.
f. Taps will be located in such a manner to provide the shortest distance and most direct line to the meter.

CW7.1.2 Tapping Asbestos-Cement Pipe:

Asbestos-cement pipe shall be tapped by the use of a tapping saddle made of bronze or stainless steel as in CW8.1.1b above.

CW7.1.3 Tapping Cast Iron Pipe;

Cast iron pipe four (4) inches in diameter and smaller shall be tapped by the use of a tapping saddle made of bronze or stainless steel as in CW8.1.1.b above.

CW7.1.4 Tapping Ductile Iron Pipe:

Ductile Iron Pipe shall be tapped the same as cast iron pipe, Section CW8.1.3 above.

CW7.1.5 Tapping PVC Pipe:

All PVC pipe, regardless of pipe size shall be tapped by use of a tapping saddle made of bronze or stainless steel as in CW8.1.3b above.

CW7.2 Main Taps:

CW7.2.1 Wet Taps:

Wet connections shall be used for all connections except where directed by the Engineer. Wet connections shall be made with a mechanical joint ductile iron full body tapping sleeve and valve conforming to MW5.3 "Tapping Valves and Sleeves" of these specifications. Either power driven or manual tapping machines may be used. The pipe to be tapped shall be cleaned thoroughly and wire brushed to remove rust and other foreign matter. The tapping sleeve shall be put on and tightened down securely. The valve shall be put on the sleeve and braced against movement. Then the tap shall be made.

CW7.2.2 Dry Taps:

Dry connections shall only be made when directed by the Engineer and/or when a fitting must be added to an existing line. For dry connections, the existing line must be shut off and drained. This should be done so that down time of the line shall be as short as possible. After line has been drained, the line shall be cut and the fitting put in and blocked. The section o line cut into shall be tested and disinfected as would a new line.

SECTION CW8 – ENCASEMENT PIPE

CW8.1 Open Cut:

Encasement Pipe installed by open cut shall be bedded as per Section CW3.2 – "Class '1' Bedding" of these specifications. Backfilling shall be as per Section CW2.7 –'Backfill of Rigid Pipe" of these specifications.

Pipe shall be pushed through encasement pipe and installed as per Section CW6 – "Pipe Laying" of these specifications.

CW8.2 Jacking and Boring:

CW8.2.1 Construction Requirements:

Where encasement or carrier pipe is required to be installed under railroad embankments or under highways, streets or other facilities by jacking or boring, construction shall be made in a manner that will not interfere with the operation of the railroad, highway or other facility, and will not weaken or damage any embankment or structure. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained, as directed by the Engineer, until such time as the backfill has been completed and then shall be removed from the site.

The drilling of pilot holes for the alignment of pipe prior to its installation by jacking, boring, or tunneling will not be a requirement but may be necessary to maintain grade.
The drilling of pilot holes will be considered as incidental work and the cost thereof shall be included in such contract pay items as are provided in the proposal and contract.

The Contractor shall take the proper precautions to avoid excavating earth

or rock or shattering rock beyond the limits of excavation needed to install the conduit. All damages by excavating and blasting, either to surface or subsurface structures, shall be repaired or replaced by the Contractor at this own cost and expense.

The removal of any obstruction that may be found to conflict with the placing of this pipe will not be measured for payment or paid for as a separate contract pay item. The removal of any such obstruction will be included in such contract pay items as are provided in the proposal and contract.

The Contractor shall dispose of all surplus materials at his own cost and expense at sites approved by the Engineer.

CW8.2.2 Construction by Jacking:

If the grade of the pipe at the jacking end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. This excavation shall not be carried to a greater depth than is required for placing of the guide and jacking timbers and no nearer the roadbed than the minimum distance shown on the plans.

At the other end of the pipe, an approach trench shall be excavated accurately to grade. All open trenches and pits shall be braced and shored in such a manner as will adequately prevent cave-ins or sliding of the walls into the open trench or pit.

Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating jacks, even pressure shall be applied to all jacks used. A suitable jacking head not less than 6 inches larger than the outside diameter of the pipe, usually of timber, and suitable bracing between jacks and jacking head shall be provided so that pressure will be applied at the jack. The jacking head shall be provided with an opening for the removal of excavated material as the jacking proceeds. A suitable jacking frame or backstop shall be provided. The pipe to be jacked shall be set on guides which are straight and securely braced together in such manner to support the section of the pipe and to direct it in the proper line and grade. All timber and other materials used in the construction of the jacking assembly will be of such quality and dimensions that they will withstand all stresses to which they are subjected in such a manner as to insure even pressures on the pipe during jacking operations. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe.

As jacking proceeds, the embankment materials shall be excavated slightly in advance of the pipe in such a manner to avoid making the excavation larger than the outside diameter of the pipe, with the excavated material being removed through the pipe. The excavation for the underside of the pipe, for at least one-third of the circumference of the pipe, shall conform to the contour and grade of the pipe. The excavation for the top half of the pipe shall conform closely to the outside diameter of the pipe and a clearance greater than 2 inches will not be permitted. All voids between the pipe and the earth will be filled with grout. Grout holes may be provided in

the pipe or grouting may be made through drill holes from the ground surface if practical. The grouting shall follow immediately upon completion of the jacking operation.

All carrier pipe installed by jacking shall be supported by quarter point cradle of 2000 psi concrete across the jacking pit and to the first joint in the ditch section on each end.

The distance that the excavation shall extend beyond the end of the pipe depends on the character of the material, but shall not exceed 2 feet in any case. The pipe, preferably, shall be jacked from the low or downstream end. Lateral or vertical variation in the final position of the pipe from the line and grade established by the Engineer will be permitted only to the extent of 1 inch per 10 feet, provided that such variation shall be regular and only in one direction and that the final grade of flow line shall be in the direction indicated on the plans.

When jacking of pipe is once begun, the operation shall be carried on without interruption, insofar as practicable to prevent the pipe from becoming firmly set in the embankment.

Any pipe damaged in jacking operations shall be repaired or removed and replaced by the Contractor at his entire expense.

The pits or trenches excavated to facilitate jacking operations shall be filled immediately after the jacking of the pipe has been completed unless an encasement only has been installed; in which case, the trenches and pits shall be left open until the carrier pipe has been laid through and manholes have been built if required. The pits or trenches will then be backfilled in accordance with the location and conditions as are covered elsewhere in these specifications.

If a carrier pipe is laid through an encasement pipe, the bedding of crushed rock, concrete, grout or granular material, if any, will be considered a part of the unit price of the jacking operation.

CW8.2.3 Construction by Boring;

The hole shall be bored mechanically with a suitable boring assembly designed to produce a smooth, straight shaft and so operated that the completed shaft will be at the established line and grade. The size of the bored hole shall be of such diameter to provide ample clearance for bells or other joints. All carrier pipe installed by boring shall be supported by quarter point cradle of 2000 psi concrete across the boring pit and to the first joint in the ditch section on each end.
All voids will be grouted and will be considered a part of the unit price of the boring operation.

In addition to the requirements stated above, the applicable provisions of Section CW11.2.2 – "Construction by Jacking", in regard to the construction of trench, tolerance in line and grade, method of operation, backfilling, etc., shall govern for construction by boring.

CW8.3 <u>Closing Encasement Pipe:</u>

After Water pipe has been installed in the encasement pipe, the ends of the

encasement pipe shall be closed with brick and mortar.

CW8.4 Joints:

When reinforced concrete pipe is used for encasement pipe, joints shall be sealed with mortar.

SECTION CW9 – CONCRETE AND REINFORCING STEEL

CW9.1 Description:

This section covers the construction methods for concrete and reinforcing steel. All materials shall conform to the requirements of Section MW8 – "Concrete and Reinforcing Steel".

CW9.2 Ready-Mixed Concrete:

All concrete for poured-in-place manholes and other structural applications shall be ready-mixed concrete. Ready-mixed concrete shall conform to the ASTM Standard D 94 and to applicable portions of these specifications for on-site mixing. The concrete shall be delivered and placed within one hour after all materials, including mixing water, shall have been placed in mixing drum.

CW9.3 Reinforcing Steel:

Steel reinforcement shall be free from rust, scale, and from mortar, dirt, or other objectionable coatings. It shall be placed accurately in accordance with details shown on the plans and properly secured in position.

CW9.4 Vibration:

All structural concrete must be vibrated as it is placed. The use of form vibrators is not acceptable. Internal vibrators shall be capable of transmitting vibration to the concrete at frequencies not less than 4,500 impulses per minute. Duration of vibration shall be limited to the time necessary to provide satisfactory consolidation without causing segregation. The vibrator shall not be inserted into the lower courses previously vibrated. Vibrators shall be applied in a substantially vertical position and at uniformly spaced point not further apart than the visible effectiveness of the vibrator. Vibration shall be supplemented by such spading and spudding as the Engineer may require. All concrete shall be vibrated except that the concrete in manhole bases and pipe foundations need not be vibrated if other methods produce satisfactory results.

CW9.5 Application of Structural Concrete Other than Manholes:

Utilization of reinforced or unreinforced concrete for structural uses other than poured-in-place manholes shall be subject to individual design and specification of the responsible Engineer to meet the specific needs of the project. Design and specification shall be in keeping with current engineering practice, applicable codes of practice, and subject to the review and approval of the District.

SECTION CW10 – PAVEMENT REPAIRS

CW10.1 Description:

This section covers the construction methods to be used in the repair of roads, streets, or other public rights-of-way.

CW10.2 Permanent Repairs:

CW10.2.1 Asphaltic concrete hot mix surface course construction shall meet with the current requirements of the Sudbury Department of Public Works (DPW) Specifications or the MassDOT Specifications for the construction of asphaltic concrete hot mix surface course or as otherwise approved.

CW10.2.2 Concrete pavement repairs shall meet with the current requirements of the MassDOT Specifications or the DPW Specifications for the construction of concrete rigid pavements.

CW10.2.3 Gravel surfacing shall meet with the current requirements of the MassDOT Specifications or the Sudbury DPW Specifications for the construction of crushed stone base courses.

CW10.2.4 All permanent repairs of streets, roads, or other public rights-of-way shall meet with the construction requirements of the District, DPW and MassDOT.

CW10.3 Temporary Surfacing:

Methods of temporary surfacing shall meet with the requirements of Paragraph CW14.2 or as otherwise approved to adequately maintain traffic and proper drainage.

SECTION CW11 – CONSTRUCTION WITHIN HIGHWAY RIGHT-OF-WAY

CW11.1 General:

Where proposed lines are in a highway right-of-way, the work shall not be started until the Contractor has the approval of the MassDOT or Sudbury DPW, received through the Engineer, and, in addition, until the Contractor has notified the Maintenance Foreman for the District and DPW that he is about to commence work. The Contractor shall provide and employ adequate warning signs, barricades, lights, watchmen, etc. to fully protect his workmen and the traveling public. When crossing of highway is permitted in open cut, the Contractor shall prosecute the work in such a manner that one-half of the traveled portion of the road is open to traffic at all times.

Highway crossings shall be bored and cased in accordance with Section CW11 of these specifications. However, in certain cases, where shown on the plans, the Contractor shall make the crossing in open cut.

No changes shall be made in location as shown on the plans with the limits of a highway right-of-way without prior authorization of the District, DPW and the Engineer.

CW11.2 Backfill:

The Contractor may, at his option, use MassDOT Specification Type I or Type II backfill above embedment except on crossings, in which Type I backfill must be used. Type I and Type II backfill are defined as follows:

a. Type I Backfill: This shall consist of compacted material obtained from suitable soil excavated from the trench or from sources outside the Highway

Right-of-Way which is free of rock, lumps, or clods that will not break down under compaction.

Type I Backfill Material shall be placed in the trench in layers not to exceed 4" in depth and compacted, with moisture being added to facilitate compaction.

Compaction shall be done with pneumatic tamps, mechanical tamps actuated by internal combustion and giving equal results to pneumatic tamps, tamping (sheep foot) rollers, pneumatic tired roller, or vibratory rollers. Hydro tamp will be allowed, but lift may not exceed 30 inches. Rollers may be used for compaction only if trench is wide enough to permit use of rollers and provided that use of roller is not believed detrimental to any Highway facility and that type of roller used is acceptable to the District. When rollers are employed, a pneumatic or mechanical tamp shall be used along the sides of the trench to compact any backfill that cannot be reached with rollers.

b. Type II Backfill (Granular Material): Granular backfill material for use in Highway Right-of-Way shall consist of sand or a combination of pit run sand or gravel, and shall be free of organic matter, hard lumps that will not consolidate readily, lumps of clay, and excessive amounts of clay. The Material shall be placed in the trench in uniform layers not to exceed two (2) feet. Each layer shall be dry rodded thoroughly and jetted with water to achieve maximum compaction. Where no pavements or driveways are involved, the top of granular backfill shall be sealed, as directed by the Engineer, with about 12 inches of suitable compacted excavated material to retard entry of water.

c. Where sodding is disturbed by excavation or backfilling operations, such areas shall be replaced by mulch sodding on all slopes of 2% or less. All slopes over 2% shall be replaced by block sodding. The cost of this work and material shall be included in the unit price bid per linear foot of various pipe sizes.

CW11.3 <u>Crossing Highway in Open Cut:</u>

The crossing shall be constructed by trenching across the highway in open cut; opening a trench to the minimum width necessary. Where pavement is concrete or concrete base with other wearing surface and is reinforced, the bars shall be cut on alternate sides of the trench and bent back. Upon laying the line, the pipe shall be covered with granular embedment to a level twelve (12) inches above the top of the pipe; the embedment to be deposited in four-inch layers and each layer thoroughly compacted. The remainder of the trench to the surface of the highway shall be backfilled with Class "B" concrete; the backfill to have a surface level with the top of the road surface pending the placing of concrete pavement (or the base). When ready to replace concrete pavement (or base), the surplus backfill shall be removed and the pavement shall be removed for an additional width of one foot on each side of the trench. The concrete pavement (or concrete base) shall then be replaced using Class "A" concrete. The replaced pavement or base shall be kept wet and barricaded for 48 hours. In the case of asphalt or brick wearing surface on concrete base, the wearing surface shall be installed as soon as the replaced

base has set up sufficiently.

Where pavement is flexible base and asphalt surface, the trench shall be backfilled as above. When ready to replace the base and wearing surface, the surplus backfill shall be removed and the base and asphalt surface shall be replaced the same as or equal to the original base and surface.

SECTION CW12 – CONSTRUCTION WITHIN TOWN RIGHT-OF-WAY

CW12.1 Town Streets: The District and DPW shall be notified prior to any street cuts. Pavement repairs shall be done according to the requirements of Section CW14 – "Pavement Repairs" of these specifications.

If town streets have to be closed, the appropriate Fire, Police and DPW shall be notified of closing. Proper barricades, warning signs, lights and watchmen shall be employed. Work shall be prosecuted in such a manner that one-half of the traveled portion of the road is open to traffic unless directed by the Engineer.

Right-of-way shall be left in a neat and orderly manner and left in as good or better shape than it was before construction. Town right-of-way shall be seeded or sodded according to the requirements of Section CW18 – "Grading, Sodding and Sprigging" of these specifications.

CW12.2 Easements: Easements shall be left in a neat and orderly manner. Easements shall be left in as good or better shape than that before construction. Easements shall be seeded and sodded according to the requirements of Section CW18- "Grading, Sodding, and Sprigging" of these specifications.

SECTION CW13 – EXISTING STRUCTURES

CW13.1 General: No trees or existing structures shall be removed unless directed to do so by the Engineer. All existing structures, improvements, and utilities shall be adequately protected, at the expense of the Contractor, from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures or utilities, or if it becomes necessary to move services, poles, guy wires, pipe lines, or other obstructions, the Contractor shall notify and cooperate with the utility or structure owner. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed by the District to be complete or accurate as to location and/or depth. The Contractor shall be liable for damage to any utilities resulting from his operation. During construction, all fire hydrants, valve boxes, fire or police call boxes, and other existing utility controls shall be left intact, unobstructed and accessible.

The removal and satisfactory disposal of all existing structures, either above, on the surface, or below the ground, which are to be abandoned or rebuilt and which interfere in any way with the new construction, shall be in accordance with the plans and these specifications.

The adjusting and replacement of all existing structures, either above, on the surface, or below the ground which are designated to be adjusted or replaced, shall be in accordance with the plans and these specifications.

CW13.2 Relocating or Replacing Utilities:

CW13.2.1 Unless noted on the plans that utilities are to be moved by others, any cost of temporarily or permanently relocating utilities shall be borne by the Contractor. The cost of these replacements shall be included in the Contractor's operations, the Contractor shall restore the structure or utility to its original condition and position without extra compensation.

CW13.2.2 Water Services:
Whenever water service connections are to be crossed, and the excavation is being done by machinery, it will be permitted, and the Engineer may require, that service lines be removed immediately ahead of excavation. Service lines so removed shall be reset immediately after passage of the excavating machine in order to achieve the least possible interruption of water service to the customer.

CW13.2.3 Interrupted Service:
Cuts or breaks in sewer mains and laterals, or service connections, shall be restored at the earliest practicable moment to give the least possible interruption in service. The Contractor shall be responsible for notifying customers of temporary interruption of service.

CW13.3 Removal and Replacement of Fence:

The Contractor shall do the necessary removing of fencing on the right-of-way, and shall rebuild same after the pipe line is completed. The fences shall be rebuilt of the same character of materials as that which was removed. All posts, wire and other material shall be sound, straight, equal to or better than the materials removed. Fences shall be built to line, posts well set, wires fastened with new staples and well stretched. All new posts used in the fencing shall be buried at least thirty inches (30") in the ground, and shall have a top diameter of not less than three and one-half inches (3 ½"). New corner posts shall have a minimum top diameter of not less than six inches (6"), set three feet (3') in the ground. Gates shall be replaced in a substantial manner, and all corner, gate and end posts well braced. Where fences are removed, the Contractor shall be responsible for the protection of livestock, etc.

CW13.4 Poles, Signs, Guy Wires, Etc.:

All utility poles and guy wires, private sign posts, signs and guy wires and similar private obstructions which are indicated on the plan or existing on the ground shall be removed and replaced by the Contractor at no additional cost to the Town. Any of the above installed after contract bids are submitted and after direction by the Engineer, the Contractor shall remove and replace or have moved to new permanent location by the owner thereof at the expense of the District. Any such item which the Contractor removes or causes to be moved for his convenience is at his own expense.

The Contractor shall be responsible for all damages to street sign posts and signs within the limits of his operations that remain in place or are removed and replaced. In even the street sign posts and signs are damaged or destroyed by the Contractor's operations, they shall be replaced by the Town at the Contractor's expense.

CW13.5 Other Utilities:

When it is necessary to remove or adjust a storm sewer, the DPW will be notified to decide method and work to be done. If the Contractor prefers to do the construction in order to facilitate the whole project, the Contractor may do the required construction in a manner satisfactory to the DPW, provided he first secures the written permission of the District, and further provided, that he shall initiate and perform such work at the Contractor's own expense other than items that may be provided in the contract for such work.

When it is necessary to remove or adjust another utility, a representative of that utility will be notified to decide method and work to be done. The Contractor shall make satisfactory arrangements with other utilities for the required cutting or adjustments at the Contractor's own expense other than items that may be provided in the contract for such work. No extra compensation will be paid due to delays caused by removal of public utility structures.

The Contractor will be held liable for any negligent or willful damage to any other utility and shall be expected to pay for the cost of all necessary repairs and any damages resulting to public or private property therefrom.

SECTION CW14 – GRADING, SODDING, AND PLANTINGS

CW14.1 Description:

This section covers methods to be used in replacing grass, preventing erosion and replacing removed trees, shrubs and other plants.

All areas in parks and parkways which have been disturbed during the construction operations and not requiring surfacing or paving, shall be brought to the designated grade with not less than 6" of top soil free of rock 1" and larger as shown on the plans or directed by the Engineer, due consideration being given to shrinkage and settlement.

All sod which does not show signs of living shall be replaced so that when the project is accepted by the District all areas which require sodding shall have thereon a well started growth.

CW14.2 Drainage:

All areas which have been disturbed during construction shall be left, when final grading is completed, so that the surfaces will drain. All existing drainage pipe systems shall be restored to a condition which will permit proper functioning.

CW14.3 Sodding:

All areas which have been disturbed by the construction operations, unless otherwise noted on the plans, shall be sodded with live grass strips or blocks. When areas have been approved by the Engineer as being in condition to receive the sod, the following procedure shall be followed in placing the sod:

a. All strips or blocks of sod shall be cut from a dense vigorous growth of grass in a soil which will withstand handling without dropping off or having the roots exposed. Generally, sod taken from a sandy soil will not be accepted and dried out sod will be rejected.

b. A continuous row of sod not less than five inches wide and two inches thick shall be placed around the boundary of each area. Commencing this row, other similar and parallel rows of sod shall be placed not more than two feet apart. Between rows of continuous sod strips there shall be placed two rows of tufts or blocks of sod not less than three inches square and two inches thick, set at eight inch centers so as to break space in adjacent rows.

c. All sod shall be set in trenches or depressions deep enough to permit at least one inch of cover after backfilling and spreading surplus materials over surface. All sod shall be tamped firmly but lightly into place.

CW14.4 Plant Replacement

Plants shall not be removed unless directed by the Engineer. When plants and/or trees are to be removed and replaced, the following steps shall be followed:

1. The hole shall be large enough for the plant being put in it.
2. The plant shall be carefully put in the hole, with care taken not to break or damage roots.
3. The hole shall be filled with good topsoil and tamped firmly but lightly into place.
4. The plant shall be watered.

CW14.5 Erosion Control:

Where the slope of the ground is two (2) percent or more, the ground shall be sodded and whatever means necessary taken to hold the sod in place.

SECTION CW15 – DISINFECTION

CW15.1 Description:

This section covers methods for disinfection of water lines and facilities. Before water lines are disinfected they must first be pressure tested according to the requirements of Part TW – "Testing of Water Mains" of these specifications. Water lines also must be flushed to remove dirt and other foreign matter.

CW15.2 Flushing:

A service tap must be put on one end of the water line to allow entry of flushing water and chlorine. The tap shall be done according to the requirements of CW8 – "Service Taps" of these specifications. Disinfection for 24 hours, flush to dichlorination tank.

Flushing shall be done with clean water from the District's water system until water leaving the other end of the main is clear.

CW15.3 Disinfection:

Chlorine shall be used to disinfect the pipe line by the following method:

The amount of chlorine applied shall be such as to provide a dosage of not less than fifty (50) parts per million. The chlorinating material shall be introduced to

the water lines and distribution system in a manner approved by the Engineer. After a contact period of not less than twenty four (24) hours, the system shall be flushed with clean water until the residual chlorine content is not greater than 0.2 parts per million. All valves in the lines being disinfected shall be opened and closed several times during the contact period.

CW15.3 De-chlorination

De-Chlorination shall be performed using the ANSI/AWWA C655-18 standard. The cost of furnishing the chemicals, labor, tools, equipment, and tests of chlorine content and bacteriological tests will be at the expense of the Contractor. No water mains shall be placed in service until a satisfactory test report has been received from an approved laboratory.

PART TW – TESTING OF WATER MAINS

SECTION TW1 – GENERAL

TW1.1 This part of the specifications stipulates test requirements for materials, construction methods, and leakage, pressure and bacteriological tests of the water lines. Testing for materials and construction methods shall be at the Developer's option except as stipulated herein. The District may require tests as outlined in these specifications for materials and construction procedures if, in the opinion of the District, the quality of materials and the construction procedures do not meet the requirements stipulated herein.

In all cases, leakage, pressure and bacteriological tests shall be performed on water lines as specified in these standard specifications.

SECTION TW2 – HYDROSTATIC TESTING

TW2.1 As soon as a continuous section of new water main has been installed, the Contractor shall proceed immediately to complete all testing and sterilizing, make all connections, and place those sections in service. The Contractor shall furnish all labor, materials, tools, and equipment necessary to bulkhead and seal off the line for testing, fill it with water, raise the filled line to test pressure and measure the amount of leakage over the test period.

Unless otherwise indicated, the pipeline shall be tested with a hydrostatic pressure of not less than two hundred (200) pounds per square inch maintained over a continuous period of not less than four (4) hours. After a successful continuous pressure period of four (4) hours has been completed, a test for the determination of amount of leakage shall be run at the same pressure as before for a duration of two (2) hours. If the tests indicate a leakage in excess of a rate equal to ten (10) gallons per inch of internal pipe diameter per mile of pipeline per twenty-four (24) hours, the Contractor will be required to find and eliminate the leak. All known leaks shall be stopped, regardless of this test requirement.

The cost of testing, finding, and repairing the leaks and retesting, shall be at the expense of the Contractor. The water required to fill the lines will be furnished by the Owner, without charge to the Contractor.

SECTION TW3 – BACKFILL DENSITY TESTS

TW3.1 Description:

This section covers the testing of backfill around water lines, valves, fire hydrants, and other structures to insure proper fill.

TW3.2 Requirements:

Backfill density requirements are specified in Part CW – "Construction Methods for Water Mains" of these specifications.

TW3.3 Methods of Testing

TW3.3.1 Moisture Density Relation:
The moisture density relation of material shall be determined in the laboratory in accordance with AASHTO Designation T-180 modified to use material passing a ¾" sieve.

TW3.3.2 Field Density:
Field density of backfill density shall be determined in accordance with AASHTO Designation T-147.

SECTION TW4 – BACTERIOLOGICAL TEST

TW4.1 After a section of water main has been disinfected and flushed according to Section CW19 – "Disinfection" of these specifications, the District shall be notified to pick up a sample.

A bacteriological test shall be run to determine whether coliform organisms are present. If coliform organisms are found the line will have to be redisinfected as per Section CW19 of these specifications.

The Contractor will be notified as to the results of the test. The test requires 48 hours to complete.

PART WMV – WATER METERS AND METER VAULTS

SECTION WMV1 – METERS

WMV1.1 Description:

This section covers water meters ⅝ inch to 2 inches. A special detail will be submitted for approval for meters larger than two inches.

WMV1.2 Meters must conform to AWWA Standard C-700, latest edition.

WMV1.3 Domestic meters will be a ⅝– ¾" Neptune T-10 with an encoder register. The bottom shall be of corrosion protector cast iron and will break clean across its diameter when subjected to freezing. The register shall be of the straight reading in gallons. The encoder shall have a cable connector consisting of no more than three screw type connectors. The receptacles shall have a cable connector consisting of a three screw terminal to receive a three wire cable connecting the encoder register on the water meter to the receptacle. The remote water meter system and components shall be as manufactured by Neptune Water Meter Company or approved equal and shall be known as the Neptune ARB system or equal.

WMV1.4 Larger meters must meet approval of the District.

SECTION WMV2 –CONCRETE METER VAULTS

WMV2.1 General:

1. Concrete Meter Vaults provided to the District or Installer shall be manufactured, tested, inspected, and delivered in full compliance with this Specification.
2. All vaults interior dimensions must allow a clear working space around the meters of at least 18-inches.
3. All vaults must be adequately reinforced to bear traffic and have an H-20 load rating per AASHTO HS-20-44.
4. All vaults shall be constructed with shiplap joints.
5. All vaults shall be watertight and sealed with butyl rubber gaskets as follows:
    a. Seal bell and spigot joints of vault sections with butyl rubber flexible rope-like gasket material.
    b. Butyl rubber flexible rope-like gasket material shall conform to ASTM C990.
    c. Butyl rubber flexible rope-like gasket material shall be produced from blends of butyl rubber, refined hydrocarbons, resins, and plasticized compounds reinforced with inert mineral filler and be solvent free.
    d. Each gasket shall have a self-adhesive nature.
    e. Each gasket shall be 1-inch diameter.
    f. Each gasket shall be furnished in coils.
6. All vaults shall have two (2) removable tops with lift rings made with ¾-inch galvanized rebar and have a 3-inch loop. The lift rings shall be located at the four (4) corners of each top piece.
7. All vaults shall have manhole rungs installed under each manhole opening.
8. Manhole rungs shall be made of reinforced steel, copolymer polypropylene, and 14-inch wide. Copolymer polypropylene shall conform to ASTM D4101 Classification PP0344 B33534 Z02. Steel reinforcing shall be 1/2-in diameter, conforming to ASTM A615, Grade 60 and shall be continuous throughout rung. Manhole rungs shall meet all OSHA requirements.
9. All vaults shall have manhole rungs installed 12-inches apart, so that the top foothold is within 12-inches of the manhole cover, the bottom foothold is within 12-inches of the vault floor, and the footholds are 7-inches from the vault wall.
10. All vaults shall have an adequate floor sump beneath one of the manhole openings. The sump shall be 12 through 14-inches diameter by 3-inches deep.
11. All vault floors shall be pitched to the drain.
12. Delivery shall be specified in terms of number of days from receipt of order.
13. The manufacturer/vendor/shipper must use care in preparing the above items for shipment and in handling during shipment and delivery, to insure that the above items are delivered without damage. Damaged items will not be accepted.
14. The manufacturer and/or vendor, on request, shall provide the purchaser with an affidavit for each and every delivery of an order, stating that the above items and all materials in its construction exactly conform to the applicable requirements of these specifications to include the applicable AWWA Standards. The Supplier shall provide references, on request, which shall list a minimum of three (3) Municipalities/Utilities that were, supplied this product, in the last two (2) years.

The listing is to include:

a. Name of Municipality/Utility
   Total amount of product bid on and amount delivered.
b. Reference person with address and desk top phone number whom the District has authorization to contact regarding the product

WMV2.2 Standard Concrete Meter Vault for Ductile Iron Water Service Pipe

1. Standard Concrete Meter Vaults for ductile iron water service pipes shall, as a minimum, meet all specifications as in Paragraphs WMV2.1 and the following:
2. Concrete Meter Vaults for 8-inch service pipe shall be provided with inside dimensions of 10-feet long, 6-feet wide, and 6.5-feet tall.
3. Knockouts for the pipe shall be provided on each end shall be tapered with the center at least 2-feet above the floor and 2-feet from the same wall.
4. The knockout diameter shall be at least 12-inches.
5. Two (2) 30-inch manhole openings shall be provided and each shall be located on the same side of the top at each end across from the knockouts
6. The walls, top, and bottom shall be 6-inches thick.

The Standard Concrete Meter Vaults shall be delivered in four (4) sections, as follows:

- Bottom riser with monolithic floor; 3-feet-9-inches high.
- Upper riser (without a top); 3-feet-3-inches high.
- Two-piece top; 6-inches high.

WMV2.3 Oversize Concrete Meter Vault for Ductile Iron Water Service Pipe

1. Oversize Concrete Meter Vaults for ductile iron water service pipes shall, as a minimum, meet all specifications as in Paragraphs WMV2.1 and the following:
2. Oversize Concrete Meter Vaults for ductile iron water service pipe shall be provided with inside dimensions of 11-feet, 2-inches long, 8-feet wide, and 6.5-feet tall.
3. Two (2) tapered knockouts for the pipes shall be provided on each end with the centers at least 2-feet above the floor and 2-feet from the outer walls of the pit.
4. The knockout diameter shall be at least 12-inches.
5. Two (2) 30-inch manhole openings shall be provided and each shall be located on the same side of the top at each end across from the knockouts.
6. The walls and bottom shall be 6-inches thick. The top shall be 8-inches thick.

The Oversize Concrete Meter Vaults shall be delivered in four (4) sections, as follows:

- Bottom riser with monolithic floor; 3-feet-9-inches high.
- Upper riser (without a top); 3-feet-3-inches high.
- Two-piece top; 8-inches high.

WMV2.4 Concrete Meter Vaults Makes and Models Approved for use by the District

The following products have been approved for use by the District. Any change in any component(s) of the product that does not allow for interchangeability of the component(s) shall result in the product no longer being approved and removed from

this list.

1. Standard Concrete Meter Vault:
   Arrow Concrete Products. – Standard 6-feet x 10-feet x 6.5-feet, or
   Equal provided the products are manufactured as per these specifications.
2. Oversize Concrete Meter Vault:
   Arrow Concrete Products. – Oversize 8-feet x 11.17-feet x 6.5-feet, or
   Equal provided the products are manufactured as per these specifications.

WMV2.5 MANHOLE FRAMES AND COVERS FOR WATER VAULTS

WMV2.5.1 General

1. Manhole frame and covers provided to the District or Installers shall be manufactured, tested, inspected, and delivered in full compliance with this Specification.
2. The manhole frame and cover shall be certified to meet American Association of State Highway and Transportation Officials (AASHTO) M 306 Drainage, Sewer, Utility, and Related Casting Specification and M 105 Class 35B strength of materials requirements.
3. Manhole frames and covers shall be strong, durable, even grained cast iron, ductile iron, or Fiber Reinforced Polymer smooth, free from scale, lumps, blisters, sand holes and defects of any kind.
   - An HS20 load rating is required.
     Cast iron shall conform to American Society of Testing and Materials (ASTM) A48, Class 35B.
   - Ductile iron shall conform to ASTM A 536 Grade 80-55-06.
     Fiberglass Reinforced Polymer shall conform to ASTM C 1028.
   - Manhole covers and frame seats shall be machined to a true surface so that the cover does not rock in the frame no matter the position of the cover.
4. The District requires that the Manhole Frame and Covers be subjected to proof load testing as follows:
   - Testing shall be in accordance with the National Institute of Standards Technology (NIST) standards.
   - The Manhole Frame and Covers shall show no detrimental deformation or cracks when a proof load of 40,000-pounds is concentrated on an 9-inch by 9-inch area at the center of the cover for a 1-minute period of time.
   - Permanent deformation shall not exceed 1/8-inch.
     All testing shall be at the supplier's expense.
5. Manhole covers shall have a diamond pattern cast on the top.
6. Manhole Frame and Cover shall be provided with individual permanent markings that are easily discernable and show the following:
   - Name of the producing foundry and country of manufacture preceded by the words "Made in", such as "Made in USA"
   - AASHTO designation or ASTM designation number
     Class by a number followed by a letter indicating the minimum tensile strength and size of test bar,

- Heat identification and cast date (MM/DD/YY),
- The above markings are required, but the District will allow some variation in how the above markings are provided on the finished product. The design and location of the markings must meet and be subject to the approval of the District's aesthetic judgment.

7. The product(s) shall have all parts cast and assembled in North America or meet the requirements of the American Iron & Steel (AIS), as follows;
    - North America shall mean the United States, Canada, and Mexico, Cast shall mean molten metals poured into a mold to create casting(s) for a finished product,
    - Manufactured shall mean raw material formed into a finished product, Incidental parts may be purchased/obtained from other counties to provide a finished product , in accordance with these Material Specifications, and Assembled shall mean castings and sourced parts are put together to build a finished product, or
    - The finished product shall meet all the requirements of the AIS language, and all guidance issued by the EPA. For any Massachusetts State Revolving Fund (SRF) project this requirement govern.
8. Delivery shall be specified in terms of number of days from receipt of order.
9. Delivery shall be made by truck in minimum truckload quantity to locations designated in the District's service area in Sudbury, Massachusetts. The low bidder shall notify the District of the quantity comprising a minimum truckload. The District reserves the right to mix depth of buries to reach a full truckload.
10. The manufacturer/vendor/shipper must use care in preparing products for shipment and in handling during shipment and delivery, to insure that the water meters are delivered without damage. Particular attention must be directed at protecting the protective coating from damage. Damaged manhole frame and covers will not be accepted.
11. The manufacturer and/or vendor, on request, shall provide the purchaser with an affidavit for each and every delivery of an order, stating that the manhole frame and cover and all materials in its construction exactly conform to the applicable requirements of these specifications to include the applicable AASHTO and ASTM Standards.