

**TOWN OF MILFORD
NEW HAMPSHIRE**

**WATER AND SEWER COMMISSION
WATER UTILITIES**

**STANDARD REGULATIONS AND
SPECIFICATIONS
FOR
DESIGN AND CONSTRUCTION
OF
WATER AND SEWER
INFRASTRUCTURE**

April 2007

DOCUMENT APPROVAL

The Town of Milford Water and Sewer Commissioners adopted the Standard Regulations and Specifications for the Design and Construction of Water and Sewer Infrastructure, dated April 2007.

Approved by:

Water and Sewer Commissioners

Date

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Supplementary Administration Material (available upon request)

- Application for the Start of Construction
- Water and Sewer Infrastructure Improvements Guarantee Worksheet
- Construction Monitoring Approach
- Construction Monitoring Time Schedule
- Construction Monitoring Cost Estimate Chart
- Entrance Fee Application
- Town of Milford Stormwater Management and Erosion Control Regulations

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PART A

General Construction Administration

A. GENERAL CONSTRUCTION ADMINISTRATION

1. Introduction

The specifications herein are compiled with the intent of providing the requirements of the Milford Water and Sewer Commission (the Commission) for sewer and water system design and construction in the Town of Milford, NH. The specifications in this document include those for sewer and water. Questions regarding other areas of construction should be directed as follows:

Questions regarding:

Road Repair and Road Opening Permit
Sewer Works
Water Distribution Systems
Traffic Control

Direct questions to:

Director of Public Works
Superintendent of Water Utilities
Superintendent of Water Utilities
Milford Police Department

2. Contact Lists

Listed below are town department contact names and telephone numbers. This contact list will be issued to all contractors/developers performing construction work in the Town of Milford. At the preconstruction meeting for a project, the developer and/or contractor shall provide a complete contact list of responsible personnel and emergency contact personnel with addresses, cell phone numbers, office telephone and fax numbers and home phone and fax numbers.

Town contacts are as follows:

Milford Water and Sewer Commission
c/o Milford Water Utilities
1 Union Square
Milford, NH 03055
Phone: 673-9441

Milford Department of Public Works
289 South Street
Milford, NH 03055
Phone: 673-1662
Fax: 673-2206

NHDOT, District 5 (for driveways and utilities in State Highway ROW)
485-9526

Milford Planning Department
Milford Town Hall
1 Union Square
Milford, NH 03055
Phone: 673-7964

3. Web Site

Additional Town information may be obtained from the Town web site located at:
www.milford.nh.gov.

4. Record Drawings

At the completion of the work, the Developer/Contractor/Builder shall submit a set of working drawings (red-lines) and record CAD mylar drawings to the Commission. The record drawings shall indicate any field adjustments, all buried structures, utilities and services. The record drawings shall be submitted to the appropriate department in triplicate hard copy, 24" x 36" size, and electronically in Autocad 2000 or more **recent version**.

5. Approved Plans

Prior to the start of construction, the Developer/Contractor/Builder must provide (6) six sets of approved plans. Site plans and subdivisions plans must be signed by the Planning Board, facility improvement plans must be approved by the Commission. An approved set of plans, signed by the planning board, shall be on-site at all times.

During the construction of the project, all changes relating to off-site improvements roadway construction and facilities construction in the Town R.O.W., or affecting the function of facilities within the town R.O.W., must be submitted in writing by the project design engineer for review and approval by the Water Utilities Superintendent or designated representative.

6. Project Completion Surety

All utility installation work within a town R.O.W. or off-site utility improvements must have an acceptable completion surety submitted to the Commission. An estimate of any proposed construction work requiring completion surety must be submitted to the Commission on the Water and Sewer Infrastructure Improvements Guarantee Worksheet included in the Supplementary Administration Documents section following Part A.

As work is completed on a project, the party named on the completion surety document may request a reduction of the surety amount. The request must be in writing. The party requesting the reduction in surety is responsible for all costs incurred by the Commission to review the reduction.

7. Construction Monitoring

Construction monitoring is required on all construction projects, including:

- Onsite utility work
- All off-site utility improvements

The Commission's intent is to have all water and sewer utility installation work monitored. Installation of utilities on private property will be monitored also. The Commission reserves the right to utilize a consultant for this work, if determined necessary by the Commission. The project contractor or developer will be responsible for the consultant construction monitoring costs incurred by the Commission.

All utility construction activity within the town's roadway R.O.W. or related easements shall have construction monitoring performed by a designated representative of the Commission.

The Developer or Contractor is responsible for all construction monitoring and administration costs incurred by the Commission at the noted rates. A detailed estimate of construction monitoring costs shall be provided by the Commission for each project.

The Designated Representative of the Commission shall be notified at least two (2) working days prior to the requested time of inspection. The scheduled inspection time shall be confirmed by the inspector. The requirements of this notification are as follows:

- Two (2) working days to not include holidays and weekends.
- Inspectors will be available between 8:00 am and 3:00 pm Monday through Friday.
- No inspections will be made on weekends or holidays.
- Cancellation of scheduled inspection: In cases where the Designated Representative of the Commission is not notified that an inspector's services are not required by 12:00 pm (noon) the day prior to the requested inspection, a minimum charge of three (3) hours will be assessed to the requesting person or company.

8. Construction Monitoring Escrow Account

Prior to the start of construction of a project required to have construction monitoring performed by a consultant of the Commission, the Developer or Contractor must provide funds to pay for construction monitoring to be placed in an escrow account with the Commission. The Water Utilities Superintendent shall determine the required initial escrow account deposit amount. After the initial deposit, the account must be replenished with funds when the account balance falls below \$5,000, within 7-days of notice by the Commission.

Any funds unused in the escrow account shall be returned to the depositor.

9. Water/Sewer Entrance Fee Application (Application included in this document)

An approved Town of Milford Water/Sewer Entrance Fee Application is required for all proposed new users that propose to connect to the existing water and/or sewer system. The application must be completed and submitted to the Water and Sewer Commission with the required payment prior to issuance of a certificate of occupancy for the property.

10. As-Built Plans

At the completion of the utility work, prior to obtaining substantial completion, the Developer/Contractor/Builder shall submit a set of working drawings (red-lines) and As-Built drawings. The As-Built drawings shall indicate any field adjustments, all buried structures, utilities and services. The As-Built drawings shall be submitted to the Commission in hard copy, 24" x 36" size, and electronically in the most recent version of AutoCAD. One copy of all As-Built drawings shall be submitted to the Commission for central filing.

11. Preconstruction Meeting

The Commission reserves the right to require a preconstruction meeting for any and all proposed construction projects that will affect the Town's or municipal facilities.

Representatives from each of the following must attend the preconstruction meeting:

- a. Milford Water and Sewer Commission Representative
- b. Milford Public Works
- c. Construction Monitoring Consultant
- d. Police Dept.

- e. Fire Dept.
- f. Ambulance Dept.
- g. Developer
- h. Design Engineer
- i. Contractor(s)

The following agenda items shall be discussed:

- Introductions
- Approved plans – overview by design engineer
- Design changes
- Construction schedule/approach
- Water and Sewer Commission's concerns
- Fire Dept. concerns
- Building Dept. concerns
- DPW concerns
- Planning Dept. concerns
- Police Dept. concerns
- Ambulance Dept. concerns
- Permits
 - Blasting
 - Road Opening Permit
- Commission construction standard compliance
- Construction monitoring
- Completion surety
- Construction monitoring escrow and charges

12. Utility Inspection Sign-Off Sheets

A utility inspection sign-off sheet will be issued by the Water and Sewer Commission for each project or phase of a project. One copy shall be maintained by the Developer and one copy by the designated representative of the Commission. As work is completed, the Developer must request sign-off of listed inspection milestone items by the designated project representative of the Commission.

13. Certificate of Substantial Completion of Utility Work

When the Developer for a project wishes to obtain Certificates of Occupancy for residences/buildings on any of the project water and/or sewer infrastructure, a Certificate of Substantial Completion for the project water and/or sewer systems must be issued and approved by the Water and Sewer Commission. The following must be complete prior to issuance of a Certificate of Substantial Completion:

- a. All buried utilities in place, tested and operational, with sign-off by the onsite representative
- b. Utility inspection sign-off sheet is up to date
- c. Required off-site utility improvements are complete
- d. A CAD as-built drawing has been submitted for the water and/or sewer utility showing as-built locations

14. Off-Site Utility Improvements Recommendation of Acceptance and Certificate of Final Completion of Utility Work

In advance of the Water and Sewer Commission accepting any new water and/or sewer infrastructure, the Developer must request acceptance of the new infrastructure, in writing, to the Commission. If it is determined by the Commission that the new utility work is acceptable, the Commission will vote for acceptance.

15. Town of Milford Stormwater Management and Erosion Control Standards.

END OF SECTION

PART B

General Construction Standards

EXCAVATING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Excavating topsoil and stockpiling topsoil for later use.
- B. Saw cutting pavement and excavating pavement.
- C. Excavating subsoil and stockpiling subsoil for later use.
- D. Excavating unsuitable material.
- E. Replacing ledge and boulder excavation and excavated unsuitable material with select fill material or common fill material.
- F. Placing select fill materials below utilities, tankage and concrete structures.
- G. Backfilling excavations with common fill materials.
- H. Placing common fill materials for bringing site to subgrade.
- I. Complying with compaction requirements.
- J. Removing and disposal of excess topsoil and subsoil, excavated unsuitable material, and excavated pavement, rock, boulders, solid rubble masonry and Portland cement concrete off site.
- K. Grading and rough contouring the site to the cut limits required for construction.
- L. Removing unsuitable material from excavated material and making the excavated material suitable for reuse.

1.02 REFERENCE STANDARDS

- A. ASTM C33 - Concrete Aggregates.
- B. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.
- C. ASTM D75 - Sampling Aggregates.
- D. ASTM D1557 - Tests for Moisture - Density Relations of Soils and Soil- Aggregate Mixtures, Using 10-lb Rammer and 18-inch Drop: (Modified Proctor).
- E. ASTM D2922 - Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. State of New Hampshire Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction (latest edition).

1.03 SAMPLES

- A. Samples shall be obtained in accordance with ASTM D75.
- B. Submit, 75-lb samples of each type of materials to be tested to the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION.

1.04 TESTING

- A. Tests and analysis of fill materials will be performed in accordance with the methods in ASTM C136.
- B. The DEVELOPER is responsible for payment of costs resulting from retesting of any soils.

1.05 PROJECT RECORD DOCUMENTS

- A. Accurately record location of utilities remaining, rerouted utilities, and new utilities by horizontal dimensions, elevations or inverts, and slope gradient.
- B. Provide records of utility locations to the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION prior to acceptance of the roadway.

PART 2 PRODUCTS

2.01 MATERIALS - GENERAL

- A. Screened Topsoil: Friable, fertile, 1" minus screened, natural, free-draining loam typical of the locality; free of subsoil, roots, grass, sticks, weeds, clay, sod lumps, debris and stones larger than one (1) inch in maximum dimension (screened). Soil shall not be excessively acid or alkaline, nor contain toxic material harmful to plant growth.
- B. Unsuitable Material: Cut or broken pavement, debris, concrete or other rubble, organic materials; muck, peat, silty soils or clayey soil; rock over six (6) inches in maximum dimension; or any material which in the opinion of the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION will not provide sufficient support or maintain the completed construction in a stable condition.

2.02 COMMON FILL MATERIALS

- A. Subsoil (suitable for reuse): Material excavated on site which is friable, natural soil composed of gravel, sand, or silty or clayey gravel and sand; free from debris, concrete or other rubble, organic matter, muck, peat, excavated rock and boulders over 6 inches in maximum dimension.
- B. Additional Fill: Imported material which is friable, natural soil composed of gravel, sand, or silty or clayey gravel and sand; free from debris, concrete or other rubble, organic matter, muck, peat, excavated rock and boulders over 6 inches in maximum dimension.

2.03 SELECT FILL MATERIALS

- A. Bank Run Gravel: Material excavated from a suitable gravel bank and consisting of stones, rock fragments and fine durable particles resulting from natural disintegration of rock; meeting the following limits, as noted in NHDOT standard specification Section 304, when tested in accordance with ASTM C136:

<u>Sieve Designation</u>	Percentage by Weight Passing Square Mesh Sieve <u>TOTAL SAMPLE</u>
(Maximum size - 6 inches)	
3-1/2-inch	95 - 100
No. 4	25 - 70
No. 200 (based on fraction passing the No. 4 sieve)	0 - 12

- B. Screened Sand: Clean mineral aggregate with the following particle size limits when tested in accordance with ASTM C136:

<u>Sieve Designation</u>	Percentage by Weight Passing Square Mesh Sieve <u>TOTAL SAMPLE</u>
No. 4	100
No. 100	0 - 30
No. 200	0 - 12

- C. Crushed Gravel (structural fill): Clean, hard crushed gravel; free from silt, topsoil, clay, and organic matter; uniformly graded from coarse to fine within the following limits, as noted in NHDOT standard specification Section 304, when tested in accordance with ASTM C136:

<u>Sieve Designation</u>	Percentage by Weight Passing Square Mesh Sieve <u>TOTAL SAMPLE</u>
3-inch	100
2-inch	95 - 100
1-inch	55 - 85
No. 4	27 - 52
No. 200 (based on fraction passing the No. 4 sieve)	0 - 12

- D. Crushed Stone: Clean mineral aggregate meeting the following limits when tested in accordance with ASTM C136:

<u>Sieve Designation</u>	Percentage by Weight Passing Square Mesh Sieve <u>TOTAL SAMPLE</u>
3/4-inch	100
No. 4	0 - 5

- E. Stone for Stone Fill: Hard, blasted angular rock other than serpentine rock containing the fibrous variety chrysotile (asbestos); reasonably well graded from smallest to maximum size stone so as to form a compact mass when in place: note NHDOT standard specification Section 585.

1. Class A - Approximately 50 percent of the mass having a minimum volume of 12 cubic feet, approximately 30 percent of the mass ranging from 12 and 3 cubic feet, approximately 10 percent of the mass ranging from 3 and 1 cubic feet, and the remainder of the mass composed of spalls.
2. Class B - Approximately 50 percent of the mass having a minimum volume of 3 cubic feet, approximately 40 percent of the mass ranging from 1 and 3 cubic feet, and the remainder of the mass composed of spalls.

3. Class C - Shall conform to the following gradation:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieve</u>	
	<u>TOTAL SAMPLE</u>	
12-inch	100	
4-inch	50 - 90	
1-1/2-inch	0 - 30	
3/4-inch	0 - 10	

4. Class D - Shall conform to the following gradation:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieve</u>	
	<u>TOTAL SAMPLE</u>	
2-inch	100	
1-1/2-inch	95 - 100	
3/4-inch	35 - 70	
3/8-inch	10 - 30	
No. 4	0 - 5	

2.04 FILTER FABRIC

- A. Filter fabric shall be Mirafi 140N. Substitution of a product equal or better quality, detail, function and performance may be proposed for substitution.

PART 3 EXECUTION

3.01 PREPARATION

- A. It is the responsibility of the DEVELOPER to verify all existing utilities within the project area.
- B. Identify required lines, levels, contours, and datum.
- C. Identify known underground utilities. Stake and flag locations.
- D. Identify and flag surface and aerial utilities.
- E. Notify utility companies to locate and temporarily support, remove, and/or relocate utilities.
- F. Notify DIG-SAFE (1-800-225-4977).

3.02 PROTECTION

- A. Protect trees, shrubs, lawns, and other features remaining as a portion of final landscaping.
- B. Protect bench marks, existing structures, fences, stone walls, sidewalks, paving, and curbs from equipment and vehicular traffic.
- C. Protect above and below grade utilities and structures which are to remain.
- D. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.
- E. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

- F. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

3.03 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, landscaped, or graded, and stockpile. Remove excess topsoil not being reused from site. Topsoil suitable for reuse shall be in conformance with paragraph 2.01 A. Stockpiled topsoil shall be protected from erosion.

3.04 PAVEMENT EXCAVATION

- A. All pavement shall be cut with saws or acceptable power tools prior to removal.
- B. Excavate pavement within the limits shown on the Drawings.
- C. Keep excavated pavement separate from topsoil and subsoil stockpiles.
- D. Remove and dispose of pavement excavated from site.

3.05 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be landscaped or graded to the limits shown on the Drawings.
- B. Excavate subsoil required for structures, utilities or yard piping and other work to the limits necessary or as shown on the Drawings.
- C. Stockpile excavated material to be reused and remove and dispose of unsuitable subsoil and excess subsoil not being reused, off site. Subsoil suitable for reuse shall be in conformance with paragraph 2.02 A. Stockpiled subsoil shall be protected from erosion.
- D. Remove all muck, peat and other unsuitable material within trench limits or where structures are to be located. Excavated unsuitable material shall be replaced with backfill material as specified.
- E. Notify the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION of unexpected subsurface conditions, discovery of unknown utilities or concealed conditions, and discontinue affected work in area until notified to resume work.
- F. Slope sides of excavation to satisfy OSHA requirements.
- G. Excavations shall not interfere with normal 45 degree bearing influence of any foundation.
- H. Grade top perimeter of excavations to prevent surface water run-off into excavation.
- I. When excavation through roots is necessary, cleanly cut roots.
- J. Maintain bottom of all excavations stable, dry and free of water on a continual basis.
- K. Remove boulders greater than six (6) inches in maximum dimension from sub-soil.

3.06 BACKFILLING PREPARATION

- A. Brace walls and slabs of structures to support surcharge forces and construction loads to be imposed by backfilling operations.
- B. Remove all water, snow, ice and debris from excavations and trenches before placing pipe bedding, foundation material under tankage or concrete structures or backfilling.
- C. Compact subgrade surfaces disturbed by construction operations to density requirements for backfill material. Do not place bedding, foundation material or backfill on porous, unstable or unsuitable subgrade.

3.07 BEDDING AND BACKFILLING

- A. Bedding and backfilling materials shall not contain frozen materials, ice or snow.
- B. Crushed stone shall be used beneath pipe where rock, boulders, or unsuitable bearing materials have been removed.
- C. Install pipe on shaped, undisturbed subgrade or on bedding material in accordance with paragraph 3.12 SCHEDULE OF BEDDING, BACKFILL AND COMPACTION.
- D. Support pipe during placement and compaction of bedding material.
- E. Filter fabric shall be placed to completely enclose crushed stone used for bedding material or for replacement material where rock, boulders or unsuitable material have been removed in pipe trenches unless authorized otherwise by the Designate Representative of the TOWN OF MILFORD. Under structures, where crushed stone is used, the filter fabric shall enclose the material on the sides and bottom, and on top, extend 2 feet under all edges of the proposed structure.
- F. Place and compact bedding for utilities and yard piping in accordance with the specifications and typical trench details shown on the Drawings.
- G. Backfill excavations and trenches to depths, contours and elevations required.
- H. Each layer of backfill shall be compacted to the specified density the same day it is placed.
- I. Maintain optimum moisture content of backfill materials to attain required compaction density.
- J. Fill that is too wet for proper compaction shall be disced, harrowed or otherwise dried to a proper moisture content for compacting to the required density. If the fill material cannot be dried within 48 hours of placement, it shall be removed and replaced with drier fill. This applies to both subsoil (suitable for reuse) and all imported select and/or common fills.
- K. Fill that is too dry for proper compaction shall be watered uniformly over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.
- L. Employ placement and compaction methods that will not disturb or damage Work or existing structures or utilities. Disturbed or damaged Work, structures or utilities shall be repaired.
- M. Do not backfill against unsupported foundation walls or before required concrete strength has been achieved. Backfill simultaneously on each side of unsupported foundation walls.

- N. Grade backfill to provide a smooth surface which will readily shed water and provide positive drainage. Areas to receive compacted fill shall be graded to prevent ponding of surface water runoff.

3.08 BACKFILLING TOLERANCES

- A. Top Surface of Backfilling or Subgrade: Plus or minus one inch.

3.09 COMPACTION

- A. The maximum density at optimum moisture content for bedding and backfill materials shall be determined in accordance with ASTM D1557 (Modified Proctor).
- B. All bedding and backfill materials shall be compacted to the density shown in paragraph 3.12 SCHEDULE OF BEDDING, BACKFILL AND COMPACTION.
- C. Testing density of soil in place (compaction) will be performed in accordance with ASTM D1556, ASTM D2167, or ASTM D2922. If tests indicate compacted bedding and/or backfill does not meet specified requirements, remove, replace and retest.

3.10 GRADING

- A. Grading Areas to be Loamed and Seeded:
 - 1. Perform all rough grading required to attain the elevations indicated on the Drawings or as required.
 - 2. Grade to elevations shown on the Drawings or as required for landscaping. Remove all material, including rock and boulders to a point at least 4 inches below the finished grade of landscaped areas to be loamed and seeded.
 - 3. Remove all ruts and other uneven surfaces by surface grading.
- B. Grading Areas to be Paved or Surfaced:
 - 1. Perform all rough grading, including shaping, sloping, and any work necessary to prepare the subgrades of all roadways, walks and parking areas. Subgrade shall be brought to the bottom elevation of the base course under paved or surfaced areas.
 - 2. Accomplish all grading within the slope and grade lines as indicated on the Drawings or as necessary to accomplish the Work, unless otherwise authorized in writing by the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION. The roadway shall be graded to full cross section width at subgrade before placing any type of subbase or pavement except that partial width construction may be permissible where necessary for the maintenance of traffic.
- C. Slope grade away from structure minimum 2 inches in 10 feet, unless noted otherwise.
- D. Make gradual changes in grade. Slopes shall transition gradually into level areas.
- E. Grade all areas completely and remove and dispose of all excess excavated, bedding and backfill materials from site.

- F. Backfill to original grade or as indicated herein or on the Drawings. Deviations and settlement shall be corrected.

3.11 FIELD QUALITY CONTROL

- A. All subgrades must be inspected and accepted by the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION prior to proceeding with Work. Sufficient time must be allowed for the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION to observe and to have any necessary tests performed on the subgrade.

3.12 SCHEDULE OF BEDDING, BACKFILL AND COMPACTION

- A. The following schedule identifies location; bedding and/or backfill materials to be used (identified from upper to lower fill type); loose thicknesses of each fill lift; and, compaction expressed as a percentage of maximum density and optimum moisture determined in accordance with ASTM D1557 (Modified Proctor).

<u>Location</u>	<u>Material/Thickness</u>	<u>Lifts (Loose) Compaction</u>
X Disturbed, Excavated Subgrade	Natural Subgrade/Existing.	Existing/95 percent or equal to average density of undisturbed material.
X Beneath SMH, Air Release MH Structures, etc.	Crushed Stone 6" min.	6" lifts
X Beneath Structures from which Rock, Boulders or Unsuitable Material has been Removed	Crushed Stone/12" min. Structural Fill/as req'd. to 12" below structure.	12" lifts 12" lifts/95 percent.
X Slabs-on-Grade	Crushed Gravel/4" min. on natural subgrade or structural fill. Structural Fill/as req'd.	4" min./95 percent. 12" lifts/95 percent.
X Around Structures	Common Fill/as req'd.	12" lifts to top of fill/95 percent.
X Around Structures with Foundation Perimeter Drainage	Structural Fill/as req'd.	12" lifts to top of fill/95 percent.
X Underground Tanks	Structural fill to top of fill. Structural Fill/to 2' above tank top. 12" lifts/95 percent.	12" lifts/95 percent. 12" lifts/95 percent.

Pipe Bedding

X	DI Water Pipe, DI Sewage Force Main, Copper Tubing and PVC Water Pipe	Sand/6" min. below pipe to springline of pipe.	Existing 95 percent or equal to average density of undisturbed material.
X	DI Gravity Sewer, PVC Gravity Sewer and PVC Sewage Force Main, High Density SPE Storm Drain	Crushed stone/6" min. below pipe to springline of pipe.	6" lifts/95 percent
X	RCP Storm Drain	Crushed Stone/6" min. below pipe to springline of pipe.	Existing 95 percent or equal to average density of undisturbed material.
X	All Pipe in Area of Rock Excavation	Crushed Stone/6" min. below pipe to springline of pipe.	6" lifts/95 percent.
X	All Pipe in Area of Unsuitable Material Excavation	Crushed Stone/As req'd, 6" min. from excavation limits below pipe to springline of pipe.	6" lifts/95 percent.

Pipe Blanket

X	DI & PVC Water Pipe, DI & PVC Gravity Sewer, DI & PVC, Sewage Force Main, Copper Tubing, and SPE Storm Drain	Screened Sand/from springline of pipe to 12" above pipe.	6" lifts/95 percent.
X	RCP Storm Drain, PVC Storm Drain	Crushed Stone/from springline of pipe to 12" above pipe.	6" lifts/95 percent.

Backfill

X	Under Grassed Areas	Common Fill/From subgrade or 12" above pipe to 4" below finished grade.	15" lifts/90 percent.
X	Under Landscaped Areas	Common Fill/From subgrade or 12" above pipe to 12" below finished grade.	15" lifts/90 percent.
X	Under Paved Areas	Common Fill/From subgrade or 12" above pipe to underside of subbase for paved areas	6" lifts/95 percent.

X	Under Paved Areas	Blasted Ledge/Rockfill to 5'-0" from finish grade.	2'-0" lifts/mechanical consolidation
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Subbase

X	Bituminous Pavement Subbase	Bank Run Gravel 12" min. Crushed Gravel 6" min.	6" lifts/95 percent.
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END OF SECTION

EXCAVATION SUPPORT

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Designing, furnishing, installing, maintaining and removing excavation support systems for the following:
 - 1. Excavation.
 - 2. Trench excavation.

1.02 REFERENCE STANDARDS

- A. ASTM A328 - Steel Sheet Piling.
- B. NFPA - National Forest Products Association.

1.03 SYSTEM DESCRIPTION

- A. The construction of the excavation support systems shall include soldier piles, lagging, trench boxes, wood sheeting and steel sheeting, including bracing members such as walers, struts, shores and tieback anchors and all other system members.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Wood: Tongue and groove; #3 common Douglas Fir or Hemlock; or Utility Grade Southern Pine; NFPA grading.
- B. Steel: ASTM A328.
- C. Trench Boxes: Fabricated steel.

PART 3 EXECUTION

3.01 EXECUTION

- A. The CONTRACTOR shall be totally responsible for the means and methods of excavation and for the design and construction of the excavation support systems.
- B. The support system shall be designed to support the maximum loads that will occur during construction.
- C. Excavation support systems shall be constructed so as to be able to support all vertical and lateral loads and other surcharge loads imposed on the system during construction including earth pressures, utility loads and other surcharges and construction loads in order to provide safe construction of the permanent structures and prevent movement and/or damage to adjacent soil, buildings, structures and utilities.

- D. Do not brace to concrete unless authorized by the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION, and then only if concrete has reached its design strength as determined by compressive test of representative concrete cylinders which have been cured on site for a period of at least 14 days.
- E. Do not embed any part or portion of excavation support system in the Work. Do not construct sleeves or openings in the structures to permit bracing through the structures unless authorized by the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION.
- F. The DEVELOPER shall not perform excavations in unstable earth. Stabilize all earth materials behind support walls before excavation is allowed to proceed.
- G. The DEVELOPER shall monitor all excavations and provide a means of determining movement of adjacent soil, buildings, structures and utilities.
- H. Where movement or damage is observed, the DEVELOPER shall immediately cease excavation operations and correct such deficiency in the excavation support system that allowed for movement or damage and repair all damage.
- I. The DEVELOPER shall be responsible for, and shall repair all damage resulting from his excavations.
- J. During construction, the DEVELOPER shall be responsible for meeting all requirements and standards of OSHA (Occupational Safety and Health Administration).

3.02 SHEETING LEFT-IN-PLACE

- A. Cut off all sheeting left-in-place at least three feet below the ground surface, whether such sheeting is ordered left in place by the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION or is left in place for the convenience of the DEVELOPER/CONTRACTOR.

END OF SECTION

DEWATERING

PART 1 GENERAL

1.01 SYSTEM PERFORMANCE REQUIREMENTS

- A. Dewatering shall include all necessary control and disposal of groundwater on a continual basis during construction.
- B. Dewatering shall include the lowering of the groundwater table to relieve any hydrostatic head that could cause a decrease in the stability of the excavated subgrade. It shall also include the intercepting of seepage which could otherwise emerge from the slope or sides of excavations which could cause a decrease in the stability of the excavated subgrade or the slopes or sides of the excavations.
- C. Dewatering shall be performed during construction to temporarily protect against the following:
 - 1. The loss of any material beneath the excavated subgrade or from the slopes or sides of the excavations or the movement of any fine particle materials from the soil.
 - 2. Any increased vertical or lateral loads on the excavation support systems.
 - 3. Any disturbance, rupture, instability, boiling or heaving of the bottom of excavated subgrade during:
 - a. Excavation.
 - b. Placement of foundation or bedding materials.
 - c. Construction of slabs, footings, pipes, conduits, under-drains and any other structures.
 - d. Backfilling operations.

1.02 ADDITIONAL PROVISIONS

- A. Provide, operate and maintain any dewatering system required to lower and control groundwater levels and groundwater hydrostatic pressure during the construction of the Work as required by these specifications. The DEVELOPER shall assume full responsibility and expense for the adequacy of the dewatering system with no additional time for performance.
- B. Remove and dispose of water resulting from activities described in paragraph 1.02 A. Provide siltation settling basins for all discharges from dewatering systems. Submit plan of settling basins and discharge facilities for review by the Town prior to dewatering system installation.
- C. Remove dewatering systems and equipment when no longer required.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 EXECUTION

- A. The dewatering system shall be capable of developing an excavated subgrade relieved of any hydrostatic pressure that could cause a decrease in the stability of the excavated subgrade and which will provide the necessary groundwater control for the proper performance required for completion of the Work.
- B. The dewatering system shall not cause damage to newly constructed or existing properties, buildings, utilities and other work due to the loss of support from incompletely drained soils or from removal of soil particles resulting from the dewatering system operation.
- C. Dewatering facilities shall be located where they will not cause interference with work performed by others.
- D. If the dewatering system utilized by the DEVELOPER causes or threatens to cause damage to new or existing facilities, the dewatering system shall be modified. The DEVELOPER shall be responsible for, and shall repair all damage caused by the dewatering system operation.
- E. Dispose of subsurface water collected in a manner which conforms to all applicable local and state ordinances, statutes and laws.
- F. Maintain continual and complete effectiveness of the dewatering system operation to provide a firm, stable, excavated subgrade at all times as required for proper performance of the Work.
- G. Provide dewatering necessary to maintain the groundwater table a minimum of two (2) feet below the bottom of excavated subgrade at all times.

3.02 JOB CONDITIONS

- A. Erosion Control: Provide adequate protection from erosion from any of the dewatering operations utilized during the course of the construction. Any damage, disruption or interference to newly constructed work or existing properties, buildings, structures, utilities and/or other work resulting directly or indirectly from dewatering operations conducted by the DEVELOPER shall be remedied.
- B. Treatment of Dewatering Operations Discharges: Provide such additional treatment devices as may be required. This may include the construction of sumps and/or settling basins, stone rip-rap, silt fences or other requirements. The treatment devices shall be later removed and/or filled in with acceptable backfill material, and restored to original conditions once they are no longer needed.

END OF SECTION

RESTORATION OF GROWTH - CLASS A (LAWN)

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Finishing, loaming, grading, fertilizing, seeding and maintaining all seeded areas as shown on the Drawings and/or specified herein, and any other areas disturbed by the DEVELOPER'S operations.
 - 1. Class A growth restoration shall apply to all lawn or park type areas disturbed during construction.
 - 2. Restore growth in all areas to a condition at least fully equal to that prevailing prior to the construction.

1.02 QUALITY ASSURANCE

- A. Employ trained personnel experienced in this type of work.

1.03 PRODUCT DELIVERY AND STORAGE

- A. Fertilizer shall be delivered to the site in the original unopened containers each showing the manufacturer's guaranteed analysis, and stored so that, when used, it shall be dry and free flowing.
- B. Lime shall be delivered and maintained in a dry, free flowing condition until used.
- C. Seed shall be delivered in sealed containers bearing the dealer's guaranteed analysis and stored in a dry, protected place.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Screened topsoil shall be friable, fertile, 1" minus, screened, natural free-draining loam, typical of the locality; free of subsoil, roots, grass, sticks, weeds, clay, sod lumps, debris and stones larger than 1-inch in maximum dimension (screened). Soil shall not be excessively acid or alkaline, nor contain toxic material harmful to plant growth.
- B. Fertilizer shall be a complete commercial fertilizer, 10-20-20 grade.
- C. Lime shall be ground limestone containing not less than 95% calcium and magnesium carbonates.
- D. Seed shall be from the same or previous year's crop and shall have not more than 1% weed content. Seed shall also meet the following requirements:
 - 1. Grass seed of the specified mixtures shall be furnished in fully labeled, standard, sealed containers.

2. Percentage and germination of each seed type in the mixture, purity and weed seed content of the mixture shall be clearly stated on the label.
3. The weight of pure live seed (PLS) is computed by the labeled purity percent times the labeled germination percent times the weight.
4. To illustrate the method of computing to PLS from the tag basis, the following example is given:

Required: 20 lbs PLS of a particular variety.

Stock Available: 99.41% pure and 92% germination.

$$\frac{20 \text{ lbs}}{(0.9941 \times 0.92)} = 21.87 \text{ lbs to be obtained}$$

- E. Class A shall normally be used on loam areas. This seed shall conform to the following and shall be furnished on a pure live seed (PLS) basis.

CLASS A

<u>Kind of seed</u>	<u>PLS per Acre, lbs</u>
Red Fescue (creeping)	21
Kentucky Bluegrass	21
Redtop	21
Perennial Ryegrass (Manhattan)	<u>21</u>
TOTAL	84

- F. Hay mulch shall consist of mowed and properly cured grass or legume mowings, reasonably free from swamp grass, weeds, twigs, debris or other deleterious material. It shall be free from rot or mold.
- G. Mulch Anchoring: When mulch must be held in place, one of the following mulch anchoring materials shall be used:
1. Mulch Netting (paper, twine, plastic, or plastic and wood fiber).

PART 3 EXECUTION

3.01 GENERAL

- A. Rake the subgrade of all areas to be loamed for seed or ground cover and remove all rubbish, sticks, roots, and stones larger than 1 inch in maximum dimension. Spread and lightly compact the loam to finished grade as shown on the Drawings. When finished grades are not indicated, they shall be uniform between the points for which finished grades are given, or from such points to existing grades, except that the top and bottom of slopes shall be rounded. Compacted loam shall not be less than the depth specified. No loam shall be spread in water or while frozen or muddy.
- B. After the loam is placed and before it is raked to true lines and rolled, spread lime evenly over loam surface and thoroughly incorporate into the loam by heavy raking to at least one-half the depth of the loam.

- C. Uniformly spread fertilizer and immediately mix with the upper 2 inches of loam.
- D. Immediately following this preparation, uniformly apply the seed evenly in two (2) intersecting directions and lightly rake the seed into the surface. Lightly roll the surface and water with a fine spray.
- E. Seed shall be sown in a favorable season, as approved by the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION, typically between September 15 and October 15 and between April 15 and June 1. Seeding shall not be done during windy weather when ground is frozen, excessively wet or otherwise untillable.
- F. Promptly thereafter or within 24 hours after the seeding operation, lightly and uniformly mulch the area with hay. Spread hay by hand or with machine.
- G. Anchor mulch on all slopes exceeding 5% and other areas as required using one of the following methods:

Mulch Netting: Spread over loose mulch and pin to the soil in accordance with the manufacturer's instructions.
- H. Protect against washouts by an approved method. Any washout which occurs shall be regraded and reseeded.

3.02 APPLICATION RATES

- A. Place loam to a minimum depth of 4 inches compacted, or as shown on the drawings.
- B. Apply lime at the rate of 75 to 100 lbs per 1,000 square feet.
- C. Apply fertilizer at the rate of 30 lbs per 1,000 square feet.
- D. Apply seed at a rate of at least 84 lbs per acre or 2 lbs per 1,000 square feet.
- E. Apply mulch at the rate of 90 lbs per 1,000 square feet.

3.03 MAINTENANCE

- A. Keep all seeded areas watered and in good condition, reseeding if and when necessary until a good, healthy, uniform growth is established over the entire area seeded. Maintain these areas in an approved condition until final acceptance of growth by the REPRESENTATIVE OF THE MILFORD WATER AND SEWER COMMISSION. The maintenance shall include repairs for damage caused by erosion.

END OF SECTION

GENERAL PUMP STATION TECHNICAL REQUIREMENTS

PART 1 GENERAL

- A. The intent of this section is to provide general design criteria and technical requirements which are common to both for proposed sewer pump stations and water booster pump stations. Additional technical requirements specific to sewer pump stations is included in Part C of this Specification.
All pump stations must comply with the latest NHDES regulations.

PART 2 PUMP STATION SUBMITTALS

- A. The DEVELOPER must submit the Pump Station Plans to the WATER AND SEWER COMMISSION for review, the submittal package must include the following:
 - Plans designed and stamped by a Professional Engineer
 - Design flow data
 - Plans and Specifications
 - Pump curves and system head curves with calculations.
- B. The Pump Station design submittal must include the following:
 - Two pumps
 - Emergency power supply
 - Lead - lag pump controls
 - Dehumidification in below ground chambers
 - Ventilation
 - Flow meter
 - Manlifts - Approval by N.H. Dept. of Labor
- C. Prior to the start of construction, the developer must submit Pump Station Equipment shop drawings for the following:
 - Pumps
 - Piping
 - Pump Station and structure
 - Electrical
 - Controls/SCADA systems
 - Level control/Indicator System
 - Emergency generator
 - Concrete and/or precast concrete
 - Doors and Hardware
 - Miscellaneous metals
 - Reinforcing steel
 - Paint system
 - Fencing

PART 3 STAND-BY GENERATOR

- A. All pump stations shall be equipped with a stand-by electrical generator, capable of powering all pumps, lights, blowers, sump pumps, compressors, controls, telemetry/SCADA systems, and other electrical devices associated with the pump station.
- B. Stand-by generator shall be enclosed in a building, minimum dimension 8' x 10', with doorway opening adequate to permit complete replacement of unit. In wetwell/drywell stations with above ground building, the generator building may be constructed within the pump station building.

- C. Alternate Enclosure: Drop over style, weatherproof enclosure will consist of a roof, two (2) side walls, and two (2) end walls, of prepainted maintenance free aluminum stressed-skin semi-monocoque construction as built by Pritchard & Brown, specification 9920.
1. Roof:
 - a. One piece cambered roof panel .040" thick aluminum with .125" extruded aluminum side and end rails, 6063-T6 alloy.
 - b. Corner casting: Aluminum.
 - c. Roof bows: Extruded aluminum "I" beams 1-1/2" deep of 6063-T6 alloy. Roof reinforced to carry required muffler load.
 - d. Engine exhaust hole(s) with rain collar(s) shipped loose unless otherwise specified.
 2. Side and end walls:
 - a. Posts: 1/8" x 1-1/2" extruded aluminum "Z" section - 6063-T6 alloy.
 - b. Panels: .040" thick aluminum sheet, mill-prepainted (see color chart for color selection).
 - c. Corner posts: Extruded aluminum, 6063-T6 alloy - .125" x .625" radius.
 3. Access doors: Fabricated .040" prepainted aluminum reinforced for rigidity, and including locking hardware and aluminum hinges with stainless steel pins.
 4. Door frames: Welded aluminum frame consisting of extruded "Z" sections of aluminum 6063-T6, riveted to side panels.
 5. Louvers: Fixed or punched louvers as dictated by engine air flow. Fixed louver will be of all-aluminum construction and hinged to an aluminized steel frame incorporating an internal locking pin for security. Punched louvers will be punched in door and wall panels as required.
 6. Radiator discharge: Radiator air exhaust is through an expanded aluminum screen, .080" thick x 5/8" open, size as required.
 7. Lift eyes: Lift eyes for handling enclosures will be provided on each side wall.
 8. Tie down frame: Aluminum perimeter mounting channel, 2" x 2" x .125" thick will be provided for mounting onto concrete pad.
 9. Requirements:
 - a. Muffler supports and brackets for external exhaust.
 - b. Gravity operable discharge damper.
 - c. 6" diameter radiator access fill cap.
 - d. Exhaust pipe rain collar and rain shield.
 - e. Perforated mill finished aluminum interior liner.
 - f. Stainless steel door hardware.
- D. Generators shall be powered by propane or natural gas, if available.
- E. Generator shall be equipped with exerciser to permit regular timed operation of the generator. The generator must have a critical grade muffler with a maximum noise level of 65 dBA. Exerciser must be adjustable for length between exercise cycles and length of exercise, and will cause lock out of power demand during exercise phase.

- F. Generator shall be equipped with a control panel where all control switching and instrumentation shall be located. All generator functions shall be controlled and monitored from the panel and shall include override start-up or shut-down, test or other required operations. Start-up and shut-down switching (including manual override) shall include, respectively, automatic electrical load ramp-up and thermal cool-down phases to permit safe start-up and shut-down of generator.

Control panel shall be equipped with sensors, indicators and automatic shut-down of generator in the event of:

- motor overtemperature
 - motor overspeed
 - low oil pressure
 - overcrank (failure to start)
- G. For reasons of standardization, the standby generator set (motor and generator) shall be manufactured by Caterpillar Power Systems (No Substitutions).

PART 4 PUMP STATION CONTROLS

- A. Coordinate New and Existing Control Systems: Proposed new pump station control systems and remote transmitting units (RTU) must be compatible with existing MILFORD WATER UTILITIES systems. Remote transmitting units shall be radio signal systems compatible with existing equipment. Controls and RTU equipment shall be manufactured by Allen Bradley. Alarm conditions requiring notification of maintenance or security personnel shall be capable of identifying the actual alarm condition at the receiving location. A study must be performed to verify that new RTU equipment will operate as required without signal path obstructions or radio interference.
- B. Alarm Conditions: All pump stations shall be equipped with all sensing, control and annunciation equipment to accommodate alarm conditions as defined.
1. Local Alarm: Local alarm condition shall be signaled by flashing exterior dome light, visible outside site fence, and shall be identified on annunciation panel at the site. Local alarm conditions are defined below.
 2. RTU Alarm: RTU alarm conditions are those conditions which must be signaled via radio system (RTU) to security personnel, and are defined below.
 3. Alarm Conditions: The following are alarm conditions and are defined as local alarm (LA) and RTU alarm (RTU):
 - pump failure (LA, RTU)
 - pump station low/high ambient temperature (LA)
 - loss of one or more phases of power supply (LA, RTU)
 - high water in pump room sump (wetwell/drywell pump stations only) (LA, RTU)
 - loss of RTU signal (LA, RTU)
 - generator running (LA)
 - generator failure (LA, RTU)
 - intrusion alarm (LA,RTU)
- D. The RTU system shall be connected to existing dialer system from Honeywell Security of Manchester, NH, and shall utilize a dedicated telephone connection. The system shall also be connected to an existing telephone dialer system to notify the TOWN OF MILFORD Dispatcher.
- E. RTU Systems: All pump stations shall be equipped with a system to signal RTU Alarm condition. The power source for the RTU alarm system shall be an independent battery with continuous charge.

- F. All pump stations shall be equipped with main breaker and independent circuit breakers for each pump.
- G. All pump station controls shall include hand-off-automatic switching, to permit complete override operation of all pumps. Automatic switching shall be run off wetwell level, and shall include lead/lag alternation with manual lead/lag override systems.
- H. Each pump shall have an independent hour meter, to record total length of pump operation.
- I. All pump stations shall be equipped with flow meter and totalizer calibrated in gallons. Flow meter shall be magnetic type meter or similar approved device.

PART 5 MATERIALS OF CONSTRUCTION

5.01 GENERAL

- A. All below grade pump station structures shall be constructed of reinforced concrete with a minimum of #5 rebar at 12" o.c. in the frost walls and footings. Stations made of steel, fiberglass or other materials will not be accepted. All concrete work, materials shall be in accordance with A.C.I. 301 standards.
- B. All fittings, clamps, anchors, hatches, ladders, grating, and appurtenant parts of wetwell shall be made of stainless steel or aluminum.
- C. All piping shall be a minimum of CL 53 flanged ductile iron pipe with 150 lb. cast iron flanged fittings. Isolation valves shall be minimum 150 lb. flanged cast iron Dezurik plug valves or equal complete with NRS operators.
- D. Pump station building may be constructed of split face block with insulation, precast concrete with insulation or block and brick, and should blend with local architectural style, as determined by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION. Building must have steel doors large enough to permit removal of the largest equipment in the station. Windows are not allowed.
- E. Pump stations shall be equipped with Bilco "SS" type hatches, or equal, equipped with thru-hatch safety handrails.
- F. The heating system must be an efficient system with redundant backup.
- G. The station must include interior lighting and exterior lighting controlled by a switch or electric eye.

5.02 PAINT SYSTEMS

- A. Provide the following paint systems for the various substrate, as indicated. All dry film thicknesses (DFT) are called for as total mils per coat specified and are considered minimums. REPRESENTATIVE OF THE WATER AND SEWER COMMISSION to select colors.
- B. Exterior:
 - 1. Miscellaneous ferrous metal items:
 - Surface Preparation: SSPC-SP6 Commercial Blast-Cleaning
 - 1st Coat: Series 90-1K97 Tneme-Zinc on unpainted metal or touchup (2.5-3.5 mil DFT)

2nd Coat: Series N69 Hi-Build Epoxoline II (4.0 – 6.0 mil DFT)

3rd Coat: Series 73 Endura-shield (2.0 – 3.0 mil DFT)

2. Ferrous metals, submerged (potable water):

Surface Preparation: SSPC-SP10 Near White Metal Blast Cleaning

1st Coat: Series 91 H₂O Hydrozinc (touchup and primer) (3.0 - 3.5 mil DFT)

2nd Coat: Series N140 Pota-Pox Plus (4.0-6.0 mil DFT)

3rd Coat: Series N140 Pota-Pox Plus (4.0-6.0 mil DFT)

Note: All materials to be NSF approved for use with potable water.

3. Ferrous Metals submerged (non-potable water):

Surface Preparation: SSPC-SP10 Near White Metal Blast Cleaning

1st Coat: Series 1 Omnithane (2.5-3.5 mil DFT)

2nd Coat: Series N69 Hi-Build Epoxoline II (4.0-6.0 mil DFT)

3rd Coat: Series N69 Hi-Build Epoxoline II (4.0-6.0 mil DFT)

4. Galvanized metal:

Surface Preparation: Solvent Cleaned and SSPC-SP7 Brush off Blast Cleaning.

1st Coat: 66 Hi-Build Epoxoline (Primer) (4.0 mil DFT)

2nd Coat: 73 Endura-shield (2 - 2.5 mil DFT)

5. Concrete, concrete block masonry:

Surface Preparation: Wire brush and wipe.

1 coat Silicon Sealer

6. Asphalt and asphaltic cement (zone marking):

Traffic Marking Paint

7. Exposed PVC (vents, etc.)

Surface Preparation: Sand thoroughly to obtain a uniform profile and solvent clean to remove surface contamination and residue.

1st coat: Series N69 Hi-Build Epoxoline II (2.0-4.0 mil DFT)

2nd coat: 73 Endurashield (2.0-3.0 mil DFT)

C. Interior:

1. Interior concrete walls, ceilings and concrete masonry:

Surface Preparation: Per manufacturer's recommendation, shall include brush blasting.

1st Coat: Block Filler, Series 130 Envirofill (80 to 100 s.f./gal.)

2nd Coat: Series N69 Hi-Build Epoxoline II (4.0 to 6.0 mil DFT)

3rd Coat: Series N69 Hi-Build Epoxoline II (4.0 to 6.0 mil DFT)

Note: Spray, then roll each coat.

2. Interior concrete floors:

Surface Preparation: SSPC-SP7 Brush off Blast Cleaning (no acid etch).

1st Coat: Series 201 Epoxoprime (8 mil DFT)

2nd Coat: Series 282 Tneme-Glaze (8 mil DFT)

3rd Coat: Series 282 Tneme-Glaze (8 mil DFT)

Spread aluminum oxide aggregate over second coat prior to curing to create a non-slip surface.

3. All interior metals, including structural steel, piping, railings, equipment and stairs:

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

1st Coat: Series 90-97 Tneme-Zinc (2.5-3.5 mil DFT)

2nd Coat: Series N69 Hi-Build Epoxoline II (4.0-6.0 mil DFT)

3rd Coat: Series N69 Hi-Build Epoxoline II (4.0-6.0 mil DFT)

4. Submerged Ferrous Metals (potable water):

Surface Preparation: SSPC-SP10 Near White Metal Blast Cleaning.

1st Coat: Series 91 H₂O Hydrozinc on unpainted metal or touchup (3 - 3.5 mil DFT)

2nd Coat: Series N140 Pota-Pox Plus (6.0-8.0 mil DFT)

3rd Coat: Series N140 Pota-Pox Plus (6.0 - 8.0 mil DFT)

Note: All materials to be NSF approved for use with potable water.

5. Submerged Ferrous Metals (non-potable water):

Surface Preparation: SSPC-SP10 Near White Metal Blast Cleaning

1st Coat: Series 1 Omnithane (2.5-3.5 mil DFT)

2nd Coat: Series N69 Hi-Build Epoxoline II (4.0-6.0 mil DFT)

3rd Coat: Series N69 Hi-Build Epoxoline II (4.0-6.0 mil DFT)

6. PVC piping:

Surface Preparation: Sand thoroughly to obtain a uniform profile and solvent clean to remove surface contamination and residue.

1st Coat: N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)

2nd Coat: N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)

7. Copper and bronze piping:

Surface Preparation: Sand thoroughly to obtain a uniform profile and solvent clean to remove surface contamination and residue.

1st Coat: Series N69 Hi-Build Epoxoline II (3.0-4.0 mil DFT)

2nd Coat: Series N69 Hi-Build Epoxoline II (3.0-4.0 mil DFT)

8. Galvanized metals and aluminum:

Surface Preparation: Solvent Cleaned and SPC-SP7 Brush off Blast Cleaning.

1st Coat: Series V27 Typoxy (2.0-3.0 mil DFT)

2nd Coat: Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)

9. Previously primed and existing painted surfaces - steel, CMU, drywall, piping, etc.

Please contact Tnemec representative for recommendation based on substrate and conditions (800-533-3003)

10. Painted woodwork:

1st Coat: Series 151 (1.0-1.5 mil DFT)

2nd Coat: Series 29 (2.0-3.0 mil DFT)

3rd Coat: Series 29 (2.0-3.0 mil DFT)

11. Canvas and cotton insulation coverings:

1st Coat: 51-792 PVA sealer (1.0-2.0 mil DFT)

2nd Coat: Series 113 Hi-Build Tnemec-Tufcoat Water-Based Epoxy
(4.0-6.0 mil DFT)

12. Plywood Walls:

Primer: Series 51-792 PVA sealer

1st Coat: Series 113 H.B. Tnemec-Tufcoat (3.0-4.0 mil DFT)

2nd Coat: Series 113 H.B. Tnemec-Tufcoat (3.0-4.0 mil DFT)

13. Exterior Woodwork:

Primer: Series 151 Elasto-Grip (1.0-1.5 mil DFT)

1st Coat: Series 6 Tneme-Cryl (2.0-3.0 mil DFT)

2nd Coat: Series 6 Tneme-Cryl (2.0-3.0 mil DFT)

14. Drywall and Plaster:

Primer: Series 51-792 PVA sealer

1st Coat: Series 113 H.B.Tneme - Tufcoat (4.0-6.0 mil DFT)

2nd Coat: Series 113 H.B.Tneme - Tufcoat (4.0-6.0 mil DFT)

15. Exterior Wood Trim/Siding:

1st Coat: Cabot acrylic stain

2nd Coat: Cabot acrylic stain

16. Tankage:

- Concrete Wastewater Tanks - If sufficient ventilation exists.

Surface Preparation: Verify dryness by testing for moisture with a "plastic tapedown test." Shot-blast or mechanically abrade the concrete to remove laitance, curing compounds, hardeners, scalers, coatings and other contaminants and to provide a surface profile (ref. ICRI CSP:3-5).

1st Coat: Series 218 Mortar clad (resurfacing material) min 1/16"

2nd Coat: Series 446 Perma Thane (7.0-9.0 mil DFT)

3rd Coat: Series 446 Perma Thane (7.0-9.0 mil DFT)

- Concrete Wastewater Tanks - Stagnant - High probability of corrosive H₂S conditions:

1st Coat: Series 435 Perma Thane (15.0-20.0 mil DFT)

2nd Coat: Series 435 Perma Thane (15.0-20.0 mil DFT)

17. Chemical Containment Areas:

Chemical containment areas shall be coated with a high solids, two-component, cold-applied liquid, chemical resistant asphalt extended urethane elastomer which cures to a durable abrasion resistant film. The coating shall form a flexible, impermeable membrane. The material shall be applied in accordance with manufacturer's recommendations. The material shall be CIM1000 or equivalent TNE MEC, Elastoshield.

18. Seamless Flooring

- a. Seamless flooring shall be a seamless epoxy quartz chemically resistant flooring matching the flooring as provided in other areas of the facility. The flooring shall be installed with a four (4) inch cove base at the perimeter of the flooring wall surfaces. The flooring shall be manufactured by Hallemite, Inc., of Warwick, RI (401) 941-0600. The following Tnemec system is acceptable:

1st Coat: Series 201 Epoxoprime (6.0 – 8.0 mil)

2nd Coat: Series 222 Decotread (1/8" DFT)

3rd Coat: Series 284 Deco-clear (8.0 -10.0 mil DFT)

- b. The flooring shall be installed by flooring specialists, as approved by the flooring manufacturer. A letter from the manufacturer certifying to their approval of the installer shall be provided prior to the start of flooring installation.
- c. Flooring preparation shall be in strict accordance with the manufacturer's instructions, but shall include as a minimum, sand or shot blasting of the flooring and cove base surfaces. The flooring installer shall examine and approve the flooring substrate prior to installation of the flooring. All cracks, holes, eroded or damaged areas, etc. shall be patched prior to flooring installation. The installer, by proceeding with the installation of the flooring, shall have agreed to the suitability of the substrate surfaces.
- d. Materials
 - i. Epoxy: 100% clear solid combination of one (1) part hardener to two (2) parts resin.
 - ii. Ceramic colored quartz: Angular, translucent quartz with a ceramic coating for color and texture. Ceramic colored quartz shall have a moisture hardness of not less than 6.5 and shall be a #28 grade.
- e. Installation
 - i. The flooring shall be installed in strict accordance with the manufacturer's instructions.
 - ii. The flooring finishing operation, including grinding and sealing, shall be conducted in such a manner to provide a non-skid finish.
 - iii. After completion of the flooring installation any area, materials, equipment, and other surfaces not specifically required to receive seamless flooring shall be cleaned free of any flooring material residue.

19. Preparation And Priming

- a. Condition of Surfaces: Painting shall start only after complete assembly of equipment components unless otherwise permitted by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION in writing. Examine all surfaces to be painted for conditions that will adversely affect the work and which cannot be put into an acceptable condition as hereinafter specified under "Preparation". Do not proceed with surface preparation or the application of coatings until conditions are suitable.
- b. Preparation: Remove all rust and scale, oil and other items that may adversely affect paint film adhesion. Preparation shall include sandblasting.

- i. Exterior and Interior Ferrous Metals: The following surface preparation specifications of Steel Structures Painting Council are required for exterior and interior ferrous metals for use in connection with treatment operations and service areas including basins, chambers, clarifiers and interior service areas; non- submersible exposure shall require SSPC-SP-6, Commercial Blast Cleaning; submersible exposure shall require SSPC-SP-10, Near-White Blast Cleaning. Prime coat specified shall be applied within 8 hours after preparation.
- ii. Galvanized and Aluminum Metal Surfaces: Surfaces shall be solvent cleaned and wiped dry with clean, dry cloths immediately prior to the application of special pre-treatment and primers as hereinafter specified.

20. Piping Identification

- a. All piping shall be color coded as follows except as directed by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION.

<u>Item to be Painted</u>	<u>Color</u>
2.01 Process piping & potable water lines	Safety Blue
2.02 Raw water lines	Olive Green
2.03 Chlorine lines	Safety Yellow
2.04 Caustic lines	Light Yellow w/ Green Bands
2.05 Phosphate lines	Light Green w/ Red Bands
2.06 Sewer lines	Dark Gray
2.07 Drain lines	Light Gray
2.08 Gas (LP or natural gas) lines	Safety Red
2.09 Wall, floor, & ceiling	OWNER to choose
2.10 Doors, windows, & frames	OWNER to choose
2.11 Raw sludge line	Brown w/ Black Bands
2.12 Sludge recirculation suction line	Brown w/ Yellow Bands
2.13 Sludge draw off line	Brown w/ Orange Bands
2.14 Sludge recirculation discharge line	Brown
2.15 Sludge gas line	Orange (or Red)
2.16 Nonpotable water line	Blue w/ Black Bands
2.17 Sulfur Dioxide	Yellow w/ Red Bands
2.18 Sewage (wastewater) line	Gray
2.19 Compressed air line	Green
2.20 Water lines for heating digesters or buildings	Blue w/6" (150 mm) Red Bands spaced 30" (760 mm) apart

- b. After painting, piping shall be identified by self-adhesive pipe markers as manufactured by W. H. Brady Company, Seton Nameplate Corporation or approved equal. Markers shall be of wording and color as selected by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION. The markers shall be 2-1/4 inches high for pipe 3 inches in diameter or larger, and 1-1/8 inches high for smaller pipe. Markers shall be placed no more than 20 feet apart with at least one marker on every straight run, and additional markers at turns and where pipe passes through walls. An arrow indicating flow direction shall be placed adjacent to each marker.

PART 6 SITE REQUIREMENTS

- A. All pump station sites shall include the following:
1. Site shall be enclosed by an 6-foot-high galvanized chain-link fence with 12-foot-wide lockable gate. The Water and Sewer Superintendent must approve the proposed configuration of the site gate on a case by case basis.
 2. Site shall have a paved access road. All pavement shall be adequate to accommodate heavy vehicular traffic, and shall be a minimum 3 inches thick (2" base and 1" finish), with a 6" compacted crushed gravel base, and a 12" compacted gravel subbase. Other areas within the fenced area shall have a minimum of 4" crushed stone underlain by Mirafi 140N geotextile.
 3. Full size yard hydrant shall be included, hydrant type to be as specified in the water distribution section of this document with two 2-1/2" threaded nozzle and 4" pumper nozzle, open right.
 4. Yard light, 150 watt high pressure sodium bulb, dawn to dusk light sensor, minimum 10 foot high.
 5. All yard fixtures shall be so designed as to accommodate winter maintenance (plowing).
 6. Weather-proof dual 120V electric GFI outlet, outside of building.
 7. Water service to the pump station.

PART 7 OPERATION AND MAINTENANCE MANUALS

Thirty (30) days prior to start-up of the pump station, the CONTRACTOR must submit Operation and Maintenance manuals for all major equipment including process, power supply, HVAC, instrumentation and controls, etc.)

PART 8 CHAIN LINK FENCE

A. WORK INCLUDED

1. Furnishing fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete footings for posts and center drop for gates.
4. Furnishing sliding gates and related hardware.
5. Installation.

B. MATERIALS

1. All steel pipe, wire and accessories shall be galvanized. Galvanized steel pipe shall conform to ASTM A120.

C. CONCRETE MIX

1. Concrete: ASTM C94; Portland Cement Type II; minimum compressive strength 3500 psi at 28 days.

D. COMPONENTS

1. Line Posts: Nominal 2.38-inch diameter steel pipe.
2. Corner and Terminal Posts: Nominal 3.5-inch diameter steel pipe.
3. Gate Posts: Nominal 6.63-inch diameter steel pipe.
4. Top and Brace Rail: Nominal 1.66-inch diameter, plain end, sleeve coupled steel pipe.
5. Gate Frame: 1.66-inch diameter steel pipe for fittings and truss rod fabrication.
6. Fabric: 2-inch diamond mesh steel wire, interwoven, 9-gauge wire, top selvage twisted tight, bottom selvage knuckle end closed.
7. Caps: Cast steel or malleable iron, sized to post dimension, set screw retained.
8. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings shall be steel.
9. Tension Wire: 6-gauge steel, single strand.
10. Extension Arms: Cast steel, to accommodate two (2) strands of barbed wire, single arm sloped to 45 degrees on fence, single arm installed vertically on gates.
11. Barbed Wire: 12-gauge wire, 3 strands, 4 points at 5 inches oc aluminum coated steel conforming to ASTM A585 or zinc-coated steel.

E. FINISHES

1. Galvanized: ASTM A123; 2.0 oz/sq ft coating.
2. Aluminum Coating: ASTM A428; 0.40 oz/sq ft.
3. Accessories: Same finish as framing.

F. INSTALLATION

1. Install framework, fabric, accessories and gates in accordance with ASTM F567.
2. Space line posts at intervals not exceeding 10 feet.
3. Set terminal gate and line posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff. Footing depth below finish grade: 36 inches for line posts, 48 inches for corner, terminal, and gate posts.
4. Provide top rail through line post tops and splice with 7-inch-long rail sleeves.
5. Brace each gate and corner post back to adjacent line post with horizontal center brace rail and diagonal bracing. Install brace rail, one bay from end and gate posts.
6. Install center and bottom brace rail on corner and gate leaves.
7. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
8. Position bottom of fabric 2 inches above finished grade.
9. Fasten fabric to top rail, line posts, braces, and bottom tension wire with wire ties maximum 15 inches on centers.

10. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
11. Install bottom tension wire stretched taut between terminal posts.
12. Install barbed wire support arm sloped outward and attach barbed wire; tension and secure.
13. Install gates with fabric and barbed wire overhang to match fence. Install three (3) hinges per leaf, latch, catches, drop bolt, retainer and locking clamp.
14. After erection of fence, apply two (2) coats of zinc-rich paint to any galvanized parts or fittings that have been abraded so that the base metal is exposed.

END OF SECTION

AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnishing automatic transfer switch for use on sewer pump stations and water booster pump stations.
- B. Installation.

1.02 REFERENCE STANDARDS

- A. UL 1008 - Standard for Automatic Transfer Switches.

1.03 SYSTEM DESCRIPTION

- A. The transfer switch shall be mounted as shown on the Drawings.

1.04 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Division 1, General Requirements.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Automatic transfer switch:
 - 1. Automatic Switch Company (ASCO).
 - 2. Russelectric.
 - 3. Zenith (General Electric).
- B. Substitutions: Items of equal quality, function and performance may be proposed for substitution by following the procedures outlined in Division 1, General Requirements.

2.02 AUTOMATIC LOAD TRANSFER CONTROL

- A. The automatic load transfer control shall be rated as indicated on the Drawings, 3-pole for 480 volts, 3 phase, 4 wire power provided with accessories specified herein. The automatic transfer switch shall be listed per Underwriter's Laboratories Standard No. 1008 as a recognized component for emergency systems and rated for all classes of loads when installed in a non-ventilated enclosure. The short circuit withstand rating shall be 30,000 RMS symmetrical amperes minimum.
- B. Transfer switch mechanism shall be electrically-operated by a single solenoid and mechanically held. Locking shall be accomplished without the use of latching solenoids, toggle mechanisms or gear arrangements. Operation shall be inherently double-throw with normal and emergency contacts moving simultaneously. Transfer switch contacts shall not stop in a neutral position between generator and utility. Operating transfer time shall not exceed one-half of one second.
- C. Main switch contacts shall be segmented and the configuration shall be designed such that fault currents provide increased main contact pressure. Separate arcing contacts are required and visual inspection and replacement of main and separate arcing contacts, both stationary and movable, shall be possible from the front of the switch without any disassembly of operating linkages or power conductors. Main contacts consisting of adapted devices, such as

subassemblies or contactors, not originally designed for transfer switch application are not acceptable.

D. The transfer switch shall be equipped with the following accessories:

1. Adjustable time delay to override momentary dips in normal source, 0-10 seconds.
2. Full phase voltage relay supervision of the normal source (65- 70% dropout and 92-95% pickup) with at least one close differential relay (83-85% dropout and 92-95% pickup) to detect "brownout" conditions.
3. Voltage/frequency lockout relay (90% pickup, nominal) to prevent premature transfer to emergency source.
4. System test switch, momentary type.
5. Gold plated engine starting control contacts for 2-wire control.
6. Auxiliary pilot contacts rated 10 amperes at 120 VAC, two closed on normal and one closed on emergency.
7. Adjustable (2-25 minutes nominal) time delay on retransfer to normal.
8. Adjustable time delay (5 to 15 minutes, nominal) on shutdown of engine-generator after retransfer of the load to normal.
9. Automatic engine exerciser with load/no load selector switch and 7-day clock with adjustments for time, day and duration of generator exercise period.
10. Pilot lights mounted on exterior of enclosure doors: Green (normal) and red (emergency).
11. Complete AL-CU lugs (UL listed) shall be provided for normal, emergency and load positions. Full rated neutral bar with lugs shall be provided.
12. Pre-transfer and post-transfer load disconnect contacts for control of selected loads before transfer switch operates in either direction.
13. In-phase monitor to transfer motor loads, without any intentional off time, to prevent in-rush currents from exceeding normal starting levels and to keep motors operating during transfer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall be made in complete accordance with the manufacturer's recommendations.
- B. The transfer switch shall be mounted in a motor control center as shown on the Drawings.

END OF SECTION

PART C

Sewer System

SANITARY SEWERS

PART 1 SCOPE

- 1.01 The CONTRACTOR/DEVELOPER shall furnish all sanitary sewer pipe and fittings, jointing materials, labor, tools, and equipment necessary to lay and joint the pipe in accordance with the specifications herein. All sewer design and construction shall comply with all NHDES and EPA requirements.

PART 2 MATERIALS

2.01 GENERAL

Materials for new sanitary sewers shall be of new and unused material and shall conform to the requirements specified herein.

2.02 PLASTIC PIPE SPECIFICATIONS (SMALL DIAMETER 4" TO 27")

- A. Plastic sewer pipe and fittings (PVC) shall conform to ASTM D-3034, SDR 35 only, polymer compounding and classification shall be accordance with ASTM D-1784 (Class 1254B).
1. Pipe stiffness, measured in accordance with ASTM D2412, shall be a minimum of 45 psi at 5% deflection.
 2. Joints shall be push-on, bell, and spigot-type.
 3. Joint seals, for PVC pipe, shall be oil resistant compression rings of elastomeric material conforming to ASTM D-3212.
 4. PVC fittings shall SDR-35 rated.

2.03 LARGE DIAMETER PLASTIC PIPE SPECIFICATION (LARGE DIAMETER 27" TO 36")

- A. Large diameter ribbed gravity sewer pipe - Pipe shall conform to ASTM F-794.
1. Pipe stiffness shall be 46 psi for Series 46 pipe when tested in accordance with ASTM D2412.
 2. Joints shall be push-on, bell and spigot type.
 3. Joint seals, for large diameter PVC pipe shall be oil resistant compression rings of elastomeric material conforming to ASTM D-3212.

2.04 DUCTILE IRON PIPE, FITTINGS AND JOINTS

- A. Ductile iron pipe and fittings shall be Class 52, unless noted otherwise on the drawings, and shall conform to the following Standards of the United States of America Standards Institute:
- A21.4 Cement mortar lining for cast iron and ductile iron pipe and fittings for water
- A21.10 Gray iron and ductile iron fittings, 3 inches through 48 inches for water or other liquids
- A21.50 Thickness design of ductile iron pipe

B. Joints

1. Joints and gaskets shall be any of the following types:

- a. mechanical with GRIP RING joint restraint
- b. push-on
- c. ball and socket

2. Joints and gaskets shall be oil resistant and shall conform to:

A21.11 Rubber gasket joints for cast iron and ductile iron pressure pipe and fittings (mechanical and push-on types). Ball and socket joints shall be boltless Usiflex Flexible Joint Pipe and manufactured by U.S. Pipe, Snap-Lok River Crossing Pipe or an approved equal.

PART 3 INSTALLATION OF PIPE

3.01 PIPE HANDLING

- A. The CONTRACTOR shall arrange for the delivery of the pipe sections at approved locations in the vicinity of that portion of the sewer line in which the pipe sections are to be laid. To this end, he shall do such work as is necessary for access and for delivery of the pipe. Pipes shall be stored in an approved, orderly manner so that there will be a minimum of rehandling from the storage area to the final position in the trench and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that the progress of the work is at no time delayed and also so that large quantities of pipe shall not be stored for excessive lengths of time in crowded locations or in locations where large storage areas might be considered objectionable. Storage of pipe will be restricted to approved or permitted areas.
- B. Each pipe section shall be handled into its position in the trench in such a manner and by such means as the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION approved as satisfactory, and these operations will be restricted to those considered safe for the workmen and such as to cause no injury to the pipe or to any property.
- C. The CONTRACTOR shall be required to furnish slings, straps, and/or approved devices to provide satisfactory support of the pipe when it is lifted. Transportation from delivery areas to the trench shall be restricted to operations which can cause no injury to the pipe units.
- D. The pipe shall not be dropped from trench or into the trench.
- E. The CONTRACTOR shall have on the job site with each pipe laying crew, all the proper tools to handle and cut the pipe. The use of hammer and chisel, or any other method which results in rough edges, chips, and damage pipe, shall be prohibited.
- F. Damaged pipe coating and/or lining shall be restored before installation as approved or directed by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION.

3.02 CONTROL OF ALIGNMENT AND GRADE

- A. The CONTRACTOR will establish the location of the pipe, manholes and other appurtenances, and will establish benchmarks along the route of the pipeline at convenient intervals for his own reference in checking the pipe and manhole invert and other elevations throughout the project.
- B. The CONTRACTOR may elect to use this information to set lines and use a level or transit to set grade.

- C. The CONTRACTOR shall use a pipe laser beam to assist in setting the pipe provided he can demonstrate satisfactory skill in its use.
- D. The use of string levels, hand levels, carpenters levels, or other relatively crude devices for transferring grade or setting pipe will not be permitted.
- E. During construction, the CONTRACTOR shall provide the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION, at his request, all reasonable and necessary materials, opportunities, and assistance for setting stakes and making measurements including the furnishing of one or two rodmen or chainmen as needed at intermittent times. He shall not proceed until he has made timely demand upon the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION for, and has received from him, such controls and instructions as may be necessary as the work progresses. The work shall be done in strict conformity with such controls and instructions. The CONTRACTOR shall carefully preserve benchmarks, reference points and stakes, and in case of willful or careless destruction by his own men, he will be charged with the resulting expenses and shall be responsible for any mistakes or delay that may be caused by their unnecessary loss or disturbance.
- F. The minimum slope for gravity sewers shall comply with New Hampshire Code of Administrative Rules. The following table is an excerpt from Env-Wq 704.04:

Nominal Pipe Diameter (Inches)	Minimum Slope (feet/foot)
8	0.0040
10	0.0028
12	0.0022
14	0.0017
15	0.0015
16	0.0014
18	0.0012
21	0.0010
24	0.0008
27	0.0007
30	0.0006
36	0.0005

3.03 PREPARATION OF BED

- A. As soon as excavation has been completed to proper depth as shown on the Standard Trench Section, a layer of bedding material shall be placed and compacted to the elevation necessary to bring the pipe to grade.
- B. The compacted bed shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly for the full length of the barrel. Suitable holes for bells or couplings shall be dug around the pipe joints to provide ample space for making tight joints.
- C. It shall be the CONTRACTOR's responsibility to control any water in the trench below the pipe invert and shall place concrete, clay or other impermeable material in the bedding at intervals to prevent horizontal movement of the groundwater which might induce settling of the bed, or make it difficult to handle water in the trench as approved by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION.

3.04 LAYING PIPE

- A. Each pipe length shall be inspected for cracks, defects in coating or lining, and any other evidences of unsuitability. Before lowering in place, the pipe shall be struck with a suitable tool to verify its soundness.
- B. Pipe shall be laid in the dry and at no time shall water in the trench be permitted to flow into the sewer.
- C. The pipe shall then be laid on the trench bedding as shown in the Standard Trench Cross-Section, and the spigot pushed home. Jointing shall be in accordance with the manufacturer's instructions and appropriate ASTM Standards and the CONTRACTOR shall have on hand for each pipelaying crew, the necessary tools, gauges, pipe cutters, etc. necessary to install the pipe in a workmanlike manner. Pipe laying shall proceed upgrade with spigot ends pointing in the direction of the flow.
- D. Blocking under the pipe will not be permitted except where a concrete cradle is proposed in which case precast concrete blocks shall be used.
- E. After the pipe has been set to grade, additional bedding material shall be placed in 6-inch layers up to the spring line of the pipe. Tamping bars shall be carefully employed to assure compaction of the bedding under the lower quadrants of the pipe.
- F. After this, the screened sand blanket shall be carefully placed in 6-inch layers to a depth of 12 inches over the crown of the pipe. Each layer shall be thoroughly compacted with mechanical equipment. Care shall be taken so that the equipment does not damage the pipe.
- G. At this point, the pipe shall be checked for line and grade and any debris, tools, etc. shall be removed.
- H. If inspection of the pipe is satisfactory, the CONTRACTOR may then refill or backfill the remainder of the trench in accordance with the Standard Trench Section and the Excavating, Backfilling, and Compacting Specification included in this document.
- I. Manholes shall be installed on sewer gravity mains at intervals of not more than 300 feet and at any change of direction.
- J. At any time that work is not in progress, the end of the pipe shall be suitably closed to prevent the entry of animals, earth, etc.
- K. Clean outs shall be installed on sewer force mains at intervals of not more than 500 feet and at any change of direction in accordance with the Force Main Cleanout Detail.
- L. Clean outs shall be installed on sewer gravity mains at every sewer service in accordance with the Typical Sewer Service Detail.
- M. Clean outs in paved areas will be protected and made accessible by the use of a typical cast iron water valve box with diameter 2 inches greater than the installed clean out. A blank cover or the word "water" will be removed by means satisfactory to the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION. Valve box will be installed flush to finish surface. See detail in this section.
- N. At the end of each day's work or at intervals of not more than 200 feet of pipe, the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION, with the CONTRACTOR, will inspect the pipe for alignment with lamps or mirrors. Unsatisfactory work shall be dug up and reinstalled to the satisfaction of the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION.

3.05 BACKFILLING

- A. Bedding for polyvinyl chloride and ductile iron pipe shall consist of crushed stone placed to a depth of at least 6 inches below the bottom of the pipe and to the springline.
- B. Bedding and cover for insulated pipe shall be sand.
- C. Cover ductile iron pipe to 12 inches over crown with sand blanket.
- D. Cover polyvinyl chloride pipe to 12 inches over crown with sand blanket.

3.06 LEAKAGE TESTS

A. General

- 1. At intervals along the sewer work not to exceed 1000 feet, all portions of all sewers shall be subjected to leakage tests under the direction of the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION and witnessed by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION. The CONTRACTOR shall have on hand, all plugs, pumps, weirs, water trucks, etc. necessary to conduct the tests. Allowable leakage shall be limited to not more than 50 gallons per inch of diameter per mile of pipe per day. Should the work fail the leakage test, corrective action shall be taken by the CONTRACTOR in a manner approved by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION. If directed by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION, all portions of the section that failed the test shall be dug up and relayed.
- 2. In general, the use of sealants, applied from the inside of the pipe, will not be approved.
- 3. All piping systems must be flushed with water and effectively cleaned to the satisfaction of the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION prior to testing.
- 4. Testing forms which indicate all testing information and results shall be submitted to the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION.

B. Air Test

- 1. All gravity sewer shall be air tested using the following testing criteria, unless other methods have been approved by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION.

The maximum allowable pressure drop from the test pressure shall be 1.0 psig during the minimum holding time. Test pressure shall be calculated using the following equation:

$$P = 3.5 + \frac{H}{2.31} \text{ (psig)}$$

P = Test pressure, maximum of nine (9) psi.

H = Height of groundwater above invert (H = depth of pipe in the absence of any groundwater level data).

- 2. Minimum holding time required for a 1.0 psig maximum pressure drop shall be calculated using the following chart:

Pipe Dia. (in.)	Min. Time (min: sec)	Length For Min. Time (ft)	Time For Longer Length (sec)	Time (min:sec) for Length (L) Shown					
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29

C. Sewer Force Mains

1. Water to be furnished by CONTRACTOR.
2. Test Duration: Two (2) hours.
3. Test Pressure: One hundred and fifty percent (150%) of maximum operating pressure as determined by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION, or 100 psi minimum, whichever is greater.
4. Allowable Pressure Loss: Pressure shall not vary more than 5 psi for the duration of the pressure test.
5. Allowable Leakage: Allowable leakage shall be determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200}$$

L = allowable leakage, in gallons per hour.

S = length of pipe tested, in feet.

D = nominal pipe diameter, in inches.

P = average test pressure, in psi (gauge).

6. Allowable leakage, in gallons per hour, per 1000 feet of pipe line can be determined from the following chart:

Avg. Test Pressure psi	Nominal Pipe Diameter-in.										
	3	4	6	8	10	12	14	16	18	20	24
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80

D. Deflection Test

1. All PVC gravity sewers shall be deflection tested. The deflection test shall be performed after the trench has been completely backfilled and adequate time has passed to allow for any settlement. Adequate time shall be considered to be a minimum of 30 days. The maximum allowable pipe deflection shall be five percent (5%). Testing shall be performed in the presence of the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION using a properly sized, "GO-NO-GO" mandrel with the following dimensions:

Nominal Pipe Diameter (Inches)	Minimum Mandrel Length (Inches)	ASTM 3034 – SDR 35 Mandrel Dia. (Inches)	ASTM 3034 – SDR 26 Mandrel Dia. (Inches)
4	4	3.78	3.70
6	6	5.62	5.50
8	8	7.52	7.37
10	10	9.40	9.21
12	12	11.19	10.96
15	15	13.70	13.42
18	18	--	--
21	21	--	--
24	24	--	--
27	27	--	--

The minimum mandrel diameter was determined by the following formula:

$$0.95 \times (\text{Ave. O.D.} - 2 \times \text{min. wall thickness})$$

E. New Sewer Main Television Inspection

1. After the installation of the new sewer mains and the 30-day settlement period, and within 90 days after installation and prior to base paving, every new sewer main run shall be cleaned and inspected by television camera in the presence of the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION. The intent of this inspection will be to check the sewer main installation for conformance with the specification requirements. A copy of the television inspection video must be submitted to the Town. If sewers were not

cleaned adequately as determined by the Town's sewer superintendent or REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION, then the sewers will be re-cleaned and re-inspected by television camera.

3.07 PIPE INSULATION

- A. When sewer mains, services, or force mains are less than 5'-0" deep or are within 5'-0" of culverts, catch basins or other sources of below-freezing temperatures insulation shall be installed according to insulation details.
- B. Isolated short sections requiring insulation (such as culvert crossings) may be insulated with 2" rigid board insulation.
- C. Sections with inadequate depth for extended lengths shall be protected with preformed 2" thick rigid pipe insulation and 0.020" thick PVC jacket.

3.08 IMPERVIOUS TRENCH DAMS

- A. For sewers with slopes exceeding eight percent (8%), impervious trench dams with underdrain discharge piping (SDR 35 PVC) shall be constructed at 200 feet maximum intervals to prevent migration of groundwater through sewer bedding material.
- B. Within 20 feet downstream of brook or river crossings, impervious trench dams shall be constructed; underdrain discharge piping is not required at these locations.
- C. Impervious trench dams shall be constructed of well compacted clay in contact with existing soils of the trench bottom and sides. The trench dam shall be a minimum of 3-ft long and extend 1'-6" above the top of sewer pipes; crushed stone bedding and sand cover will be omitted at trench dams. Groundwater flow interrupted by the trench dam must be conveyed into underdrains, storm water catch basins, or open ditches. The interrupted groundwater flow must not be allowed to surcharge the trench area and undermine roadway stability.

PART 4 HOUSE SERVICES, WYE BRANCHES, AND CHIMNEYS

4.01 SCOPE

- A. All existing buildings, vacant lots and buildings under construction which require sanitary, or as directed by the MILFORD WATER AND SEWER COMMISSION shall be connected to the sewer collection system using services, wye branches, chimneys, and all necessary appurtenances.
- B. The location of wyes, chimneys, and building services shall be approved by the New Hampshire Department of Environmental Services (NHDES).
- C. When a house ties into the municipal sewer system, the abandoned septic tank must be pumped out and either removed or filled with sand.
- D. All sewer service lines shall be 6" dia. P.V.C., SDR 35, from the sewer main to the property line.
- E. All sewer services shall have a cleanout located on the property line.

4.02 MATERIALS

- A. Materials for house services, wye branches, and chimneys shall be of the same material and quality as that for the fittings specified in Part 2 of this section or as specified on the "House Sewer Details" Standard Sheet.

4.03 INSTALLATION

- A. Installation shall be as shown on the "Typical Sewer Service Detail" in the manual. House services shall not, in general, be connected directly to manholes. The opening of the house service, wye branch, or chimney shall be suitably plugged with a watertight cap or plug.
- B. Before backfilling, the CONTRACTOR shall notify the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION so that he may make the necessary measurements to locate the opening later. In addition, an approved ferrous rod or pipe shall be placed over the plugged opening, extending to within 3 inches of the final ground surface.

PART 5 CONNECTIONS TO EXISTING SEWERS AND MANHOLES

5.01 GENERAL

- A. The CONTRACTOR shall make all connections to the existing facilities as indicated on the drawings and as herein specified, or as directed.
- B. The CONTRACTOR shall furnish all pipe, fittings, and appurtenances. The CONTRACTOR shall do all excavations and backfill as required.
- C. Existing pipeline damaged by the CONTRACTOR shall be replaced by the CONTRACTOR at his own expense in a manner approved by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION.

5.02 INTERFERENCE

- A. The CONTRACTOR shall develop a program for the construction and placing in service of the new work subject to the approval of the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION. All work involving cutting into and connecting to the existing facilities shall be planned so as to interfere with operation of the existing facilities for the shortest possible time and when the demands on the system best permit such interference even to the extent of working outside of normal working hours to meet these requirements.
- B. The CONTRACTOR shall have all possible preparatory work done and shall provide all labor, tools, material and equipment required to do the work in one continuous operations.

5.03 NORMAL JOINT CONNECTIONS

- A. The CONTRACTOR shall make joint connections similar to those on the existing pipe or adaptable to such pipe unless specifically otherwise shown on the drawings or directed by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION.

5.04 CONNECTION TO EXISTING SEWERS AND MANHOLES

- A. Public Sewers
 - 1. Where new construction is intended to connect to an existing sewer, a new manhole shall be installed at the connection unless waived by the REPRESENTATIVE of the Milford Water and Sewer Commission. Special care shall be taken to insure a tight joint between the new and existing sewers.

B. Service Connections

1. Service connections constructed where there is no connection fitting, or where the fitting has been damaged by, or cannot be located by the CONTRACTOR shall be constructed of plastic or pvc saddles. Service connections made on existing reinforced concrete sewer pipes shall use a Kor-N-Seal type boot, installed after tapping the hole.
2. Existing sewers shall be tapped by mechanical tapping machines specifically designed for such work. Tapping by use of hammer and chisel shall not be allowed except if specifically authorized in writing by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION.

C. Manholes

1. Where new construction is intended to connect to an existing brick or block manhole, the existing manhole shall be replaced at no expense to the Town or the Water and Sewer Commission. If the existing manhole is of concrete or precast concrete, and in satisfactory condition as determined by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION, this requirement may be waived by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION. For connections to existing concrete or precast concrete manholes, a hole shall be mechanically cored and a Kor-N-Seal type rubber boot installed, to provide a watertight connection.

PART 6 PROTECTION OF WATER SUPPLIES

- A. There shall be no physical connection between a public or private potable water supply system and a sewer, or sewer appurtenance which would permit the passage of any sewage or polluted water into the potable supply. No water pipe shall pass through or come in contact with any part of a sewer manhole.
- B. Sewers shall be located outside a 400 feet radius centered at a municipal well; 200 feet radius centered at a small public well, and 75 feet radius centered at a private well.
- C. Sewers shall be located during design, at least 10 feet, horizontally, from any existing or proposed water main, except that a deviation from this separation to avoid subsurface structures, including telecommunication chambers, interference of building foundations shall be allowed provided that the sewer is constructed as follows:
1. Sewer pipe shall be class 52 ductile iron for a maximum distance of 75 feet each side of the obstruction.
 2. Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1-1/2 times working pressure for force mains.
- D. Whenever sewers must cross water mains, the sewer shall be constructed as follows:
1. Sewer pipe shall be class 52 ductile iron for a minimum distance of 9 feet each side of the crossing.
 2. Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1-1/2 times working pressure for force mains and joints shall not be located within 9 feet of the crossing.
 3. Vertical separation of the sewer and water main shall not be less than 18" and the sewer shall be installed below the water main.

PART 7 CONCRETE CRADLE

- 7.01 Where indicated on the drawings, or as directed by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION or by the Town, sewer pipe shall be covered by a concrete arch encasement.

PART 8 SEWER FORCE MAINS

8.01 SCOPE

- A. The CONTRACTOR shall furnish all pipe, valves, valve boxes, fittings, couplings, labor, tools and equipment necessary to lay and join all pipe in accordance with the specifications herein.

8.02 MATERIALS - GENERAL

- A. Materials for new sewer force mains shall be of new and unused materials.
- B. Forced service lines must have an in-line check valve for each sewer user installed in an accessible location. The valve shall be a single union ball check valve, shall have PVC body construction, with an elastomeric uniseat/seal, and shall be rated at 150 psi at 120NF, as manufactured by ASAHI/AMERICA or approved equal.
- C. Force mains less than 4" in diameter shall be DR 26 or DR 21 PVC pipe and shall conform to the requirements specified herein.
- D. Force mains 4" in diameter and greater shall be Class 52 ductile iron pipe. All pipe, fittings, and appurtenances shall conform to the requirements specified herein.
- E. All force mains must have clean-out manholes installed every 500 feet or less. Install in accordance with the Force Main Cleanout Detail included in this section.

8.03 P.V.C. PIPE AND FITTINGS

- A. Pipe: P.V.C. pipe used for force mains shall conform to ASTM D-2241 and D1784 (Class 1254-B). A safety factor of 2.5 shall be used for pressure rating determination with a standard dimension ratio no higher than 21. DR 21 PVC pipe is acceptable.
- B. Fittings: Fittings to be used on P.V.C. pipe force mains shall be push-on joints with oil resistant compression rings of elastomeric material conforming to ASTM D-3212. All bends and tees must have a poured concrete thrust block. The size of the thrust block shall conform to the Thrust Block Detail Requirements.

8.04 DUCTILE IRON PIPE AND FITTINGS

- A. Pipe:
1. The ductile iron pipe shall be Class 52 (150 psi) modified and conforming to AWWA Specifications C151-76. The bell for this type of joint shall be cast with a shouldered gasket groove of a shape which will prevent the gasket from being blown or forced out of the joint. Rubber gasket joints shall be used per ANSI/AWWA specification C11/A21.11-85.
- B. Fittings:
1. Fittings shall be ductile iron, 350 psi pressure rating. Ductile or cast iron fittings shall conform to ANSI A21.10/AWWA C110 with mechanical joints. Joints and gaskets shall conform to ANSI A21.11 AWWA C111. Joints shall be furnished with GRIP-RINGS joint

restraints. Fittings shall be double cement-lined and seal-coated inside and out in accordance with ANSI A21.4/AWWA C104.

C. Lining and Coating:

1. The inside of ductile iron pipe and fittings shall be given a double cement lining and bituminous seal coat in accordance with AWWA Specifications C104.
2. The outside of ductile iron pipe and fittings shall be coated with bituminous varnish as required in AWWA Specification C151-76.
3. Machined surfaces shall be cleaned and coated with a suitable rust-preventive coating at the shop immediately after being machined.

D. Ductile Iron Ford FC1 Coupling (2" to 12")

Coupling shall be for plain end cast iron or ductile iron pipe made of ductile iron with grade 27 rubber gaskets and black, steel, track head bolts with nuts, as manufactured by Ford Meter Box Co., Wabash, Indiana.

E. Mechanical Joint Ductile Iron Solid Sleeve

The pipe coupling shall be of the mechanical type, with ductile iron body; minimum body length of 12 inches. The pitting pressure rating shall be 350 psi and shall conform to ANSI/AWWA A21.10/C100. The fitting shall be cement lined with interior and exterior seal coating in accordance with ANSI/AWWA A21.2/C104.

8.05 VALVES AND APPURTENANCES

A. Gate Valves

1. All gate valves shall conform to AWWA C-509 specifications for resilient seated gate valves. The wedge must be totally encapsulated in rubber and have molded delrin guide insert locked into gate slots. The valve body shall be ductile iron and the valve shall have a minimum of 10 mils of epoxy coating on all surfaces of the body and bonnet inside and out.
2. Gate valves shall open left. For reasons of standardization, the valves shall be a U.S. Pipe Metroseal or a Waterous series 500 gate valve.
3. All gate valves shall be mechanical joint with GRIP RING joint restraints or approved equal.

B. Valve Boxes

1. Unless otherwise specified or required, each buried valve shall be provided with a valve box. Valve boxes shall be of tough even grain cast iron and of the adjustable, slip, heavy pattern type. They shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valve. Valve boxes shall be manufactured in the U.S.A. by Tyler, Bibby LaPearle, or approved equal.
2. The upper or sliding section of the box shall be provided with a flange having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve. The boxes shall be adjustable trough at least 6 inches vertically without reduction of the lap between sections to less than 4 inches.

3. The inside diameter of boxes shall be at least 4.2 inches and the lengths shall be as necessary for the depth of the valves with which the boxes are to be used.
4. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. An arrow and the word "OPEN" to indicate the direction of turning to open the valve shall be cast in the top of the cover. Covers shall not have the word "WATER" cast in.

C. Wrenches for Buried Valves

1. The CONTRACTOR shall furnish two(2) tee handle wrenches of sufficient length to permit operation of all buried valves, regardless of depth, by the operators of average height working in normal positions.

D. Painting

1. Interior surfaces of all valves, and exterior surfaces of valves shall be fusion-bonded epoxy and miscellaneous piping appurtenances shall be given a shop finish of Omnithane and N69 Hi-Build Epoxoline supplied by Tnemec, or approved equal that meets the requirements of AWWA Specification C500.
2. Parts customarily finished at the shop shall be given coats of paint filler and enamel or other approved treatment customary with the manufacturer.
3. After thorough cleaning exterior surfaces of various parts of valves and miscellaneous piping appurtenances exposed within structures shall be given one shop coat of an approved rust inhibitive primer compatible with the field coats and applied in accordance with the instructions of the paint manufacturer.
4. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust resistant coating.

8.06 INSTALLATION

A. Pipe and fittings

1. Laying pipe and fittings: Gasket-type joints shall be made up by first inserting the gasket into the groove of the bell and applying a thin film of special non-toxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot end of the pipe. Both push-on joint and mechanical joint gasket must be lubricate prior to use. The end of the plain pipe shall be chamfered to facilitate assembly. The end shall be inserted into the gasket and then forced past it until it seats against the bottom of the socket. All fittings shall be mechanical joint with GRIP-RING joint restraints or approved equal.
2. Pipe Supports: The CONTRACTOR shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the drawings or specified.
3. All bends, tees, and other fittings shall be backed up with concrete thrust blocks placed against undisturbed earth as shown on the Standard Thrust Block Details and Notes Detail. If the soil does not provide firm support, then suitable bridle rods, GRIP-RING joint restraints, and accessories to brace the fitting properly shall be provided in conjunction with the required thrust blocks. Such bridle rods, etc. shall be coated thoroughly and heavily with an approved bituminous paint after assembly or, if necessary, before assembly.
4. Handling and Cutting Pipe: The CONTRACTOR's attention is directed to the fact that ductile iron pipe and the cement lining are brittle. Every care shall be taken in handling and laying

pipe and fittings to avoid damaging the pipe or lining, scratching or marring machined surfaces, and abrasion of the pipe coating or lining.

5. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
6. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by and at the expense of the CONTRACTOR before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack.
7. Excavation, bedding, backfill and compaction for sewer force mains and appurtenances shall conform to the Excavation, Backfill, and Compaction Specification and the typical sewer detail sheets.

B. Valves and Appurtenances

1. Setting Valves: Valves and valve boxes shall be set plumb and centered with the valve box directly over the valve. Backfill around the valves shall be as specified under the Excavation, Backfill, and Compaction Specification and the typical sewer detail sheets.
2. All valves shall be carefully erected and supported in their respective positions free from all distortion and strain. Care shall be taken to prevent damage or injury to the valves or appurtenances during handling and installation.
3. All material shall be carefully inspected for defects in workmanship and materials, all debris and foreign material cleaned out of valve openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced at no expense to the Town or to the WATER AND SEWER COMMISSION.

8.07 FORCE MAIN TESTING

A. Field Testing

1. The ductile iron pipe shall be given pressure and leakage tests in sections of approved length. For these tests, the Town may supply a water meter to record water consumption. The CONTRACTOR shall furnish and install a suitable temporary testing plug or cap for the pipeline; all necessary pressure gauges, pumps, pipe connections, and other similar equipment; and all labor required. The meter and gauge shall be installed by the CONTRACTOR in such a manner that all water entering the section under test will be measured and the pressure in the section indicated, and they shall be kept in use during both tests.
2. The scheduling of pressure and leakage tests shall be as directed by the REPRESENTATIVE of the MILFORD WATER AND SEWER COMMISSION and NHDES, in accordance with Section 3.06 of this specification.
3. The section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe. If blowoffs or air releases are not available at high points for releasing air, the necessary excavation, taps, and plugging and backfilling of said holes after completion of the test with brass or bronze plugs shall be completed at no expense to the Town or WATER AND SEWER COMMISSION.

4. For the pressure test, the CONTRACTOR shall, by pumping, raise the water pressure (based on the elevation at the lowest point of the section under test and corrected to the gauge location) to a pressure in pounds per square inch numerically equal to the class rating of the pipe. If the CONTRACTOR cannot achieve the specified pressure and maintain it for a period of one hour, the section under test shall be considered as having failed to pass the pressure test.
5. Following a successful pressure test, the CONTRACTOR shall make a leakage test by metering the flow of water into the pipe while maintaining in the section being tested, a pressure equal to the average pressure to which the pipe will be subjected under normal conditions of service. This shall be done by placing the section under system pressure or by pumping.
6. The amount of leakage which will be permitted shall be in accordance with Section 3.06 of this specification.
7. If the section shall fail to pass the pressure test, the leakage test, or both, the CONTRACTOR shall do everything necessary to locate, uncover, even to the extent of uncovering the entire section, and repair or replace the defective pipe, fitting, or joint, all at his own expense.

PART 9 GREASE TRAPS

9.01 SCOPE

- A. All food service and preparation establishments shall have an adequate grease trap installed between establishment and town sanitary sewer service connection point. Said grease trap is to be located on establishment property. Grease trap shall not be allowed on town property or in close approximation of the same.
- B. All sizing shall be per latest edition of N.H.W.S.P.C.D. or at a minimum 2.5 gallons for each patron served at one meal. Minimum size allowable shall be 500 gallons.

9.02 MATERIALS GENERAL

- A. Materials for grease traps shall be of new and unused material.
- B. Grease traps shall be constructed of 4000 p.s.i. concrete designed for H-20 loading.
- C. The grease trap shall be accessible from both ends. Access frames and covers shall be provided at same.
- D. Grease traps shall generally conform to a rectangular shape of which the width shall be approximately one-half the length.
- E. Outlet baffle shall extend to within 8 inches of bottom of grease trap bottom. Inlet baffle shall extend to a minimum of 1 foot below full level and no greater than 1-1/2 feet below the same.
- F. Grease trap shall generally conform to detail provided in this section.
- G. The exterior of the grease trap tank shall be asphalt coated.

PART 10 OIL AND GRIT TRAPS

10.01 SCOPE

All establishments with floor drains in vehicle storage and or service areas or any use which may generate any material classified as oil and grit shall install an adequate oil and grit trap.

Said oil and grit trap shall be located on establishment property. Oil and grit trap shall not be allowed on town property or close approximate to same.

10.02 MATERIALS GENERAL

- A. Materials for oil and grease trap shall be of new and unused material.
- B. Oil and grit traps shall be constructed of 4000 p.s.i. concrete designed for H-20 loading.
- C. Oil and grit trap shall be accessible through a minimum 30 inch diameter standard manhole frame and cover.
- D. Inlet piping shall be provided with adequate fume venting.

END OF SECTION

SANITARY MANHOLES

PART 1 GENERAL

1.01 SCOPE

- A. The work covered by this section includes the furnishing of all parts, labor, equipment, appliances and materials, and performing all operations in connection with the satisfactory installation of sanitary manholes and all incidental work, complete, in strict accordance with the specifications and applicable drawings and standard details, and conditions of the contract.
- B. The CONTRACTOR shall provide the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION with shop drawings of all precast material and a description of all methods of jointing he proposes to use on this portion of the contract.
- C. It is the intention of these specifications and the desire of the Commission that the manholes, including all component parts, have adequate space, strength and leakproof qualities considered necessary and configurations shall be as shown on the drawing. Manholes and catch basins may be an assembly of precast sections with or without steel reinforcement, with approved jointing, or concrete cast monolithically in place with or without reinforcement. In any approved manhole, the complete structure shall be of such material and quality as to withstand loads of 8 tons (H2O loading) without failure and prevent leakage in excess of one gallon per day per vertical foot of manhole, continuously for the life of the structure. A period generally in excess of 25 years is to be understood in both cases. It is further intended that any pointing of joints shall be accomplished after leakage tests have been satisfactory completed except as noted in sub-part 3.04, "Leakage Tests".

1.02 DESCRIPTION

- A. Manholes shall be constructed at the locations, to the elevations, and in accordance with notes and details shown on the drawings as well as the standard details.
- B. Manholes shall be as shown on the standard details and of the types following:
 - 1. Barrels and cone sections shall be precast reinforced or non-reinforced concrete, or poured-in-place reinforced or non-reinforced concrete.
 - 2. Base sections shall be monolithic to a point 6 inches above the crown of the incoming pipe, and shall be precast reinforced concrete or precast non-reinforced concrete.
 - 3. Horizontal joints between sections of precast concrete barrels shall be of a type approved by the Commission, which type shall, in general, depend for watertightness upon an elastomeric or mastic-like sealant.
 - 4. Pipe to manhole joints shall be only as approved by the Commission and, in general, will depend for watertightness upon either an approved non-shrinking mortar or elastomeric sealant.
 - 5. Cone sections shall be eccentric - see standard detail.
 - 6. All precast sections and bases shall have the date of manufacture and the name or trademark of the manufacturer impressed or indelibly marked on the inside wall.
 - 7. All precast sanitary sewer manhole must be asphalt coated on exterior surfaces.
 - 8. All new sewer connections made to new or existing sewer manholes shall have a rubber boot connection.

- C. The following diameter manholes shall be used with the appropriate size diameter pipe:
 - 1. 4'-0" diameter for 24 inch diameter pipe or less.
 - 2. 5'-0" diameter manhole for greater than 24 inch diameter pipe up to and including 36 inch diameter pipe.
 - 3. 5'-0" diameter for 18 feet or deeper excavations.
 - 4. Diameter of manhole for inside drop manholes as noted on inside drop manhole detail sheet.
- D. Force main manholes shall be placed at intervals of no more than 500 feet and shall conform to detail provided in this section.
- E. Force main cleanout manholes shall conform to detail provided in this section.

PART 2 MATERIALS

2.01 MANHOLES

- A. Concrete for poured-in-place bases for complete manholes shall conform to the requirements for Class A concrete in Section 520 of the latest edition of the State of New Hampshire Department of Transportation Standard Specifications for Road and Bridge Construction.
- B. Reinforcing steel for poured-in-place concrete shall conform to the requirements of the New Hampshire Department of Public Works and Highways Standard Specifications for Billet-Steel Bars or Welded Steel Wire Fabric.
- C. Precast concrete barrel sections, cones, and bases shall conform to ASTM C478 except as may be otherwise shown on the Standard Details.
- D. Manhole steps are required and shall conform to detail provided in this section.
- E. In lieu of a cone section, when manhole depth is less than 6 feet, a reinforced concrete slab cover may be used having an eccentric entrance opening and capable of supporting H-20 loads.
- F. Drop inlets shall be provided as specified on the Standard Details Sheet.
- G. All end manholes are required to have a 3' stub of the same pipe diameter and completed shelf at terminated end of sewer main.
- H. Sewer manholes with prefabricated fiberglass inverts are not acceptable.

2.02 MANHOLE FRAMES AND COVERS

- A. Manhole frames and covers shall conform to the details on the Standard Sheets.
- B. Manhole frame and cover shall provide 30 inch diameter clear opening. The cover shall have the letter "S" or the word "SEWER" in 3 inch letters cast into the top surface.
- C. The castings shall be of good quality, strong, tough, evengrained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined at the foundry, before shipment to prevent rocking of covers in any orientation.
- D. All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

- E. Castings shall be at least Class 30 conforming to the ASTM Standard Specifications for Gray Iron Castings, Designation A48.
- F. Before being shipped from the foundry, castings shall be sandblasted and given two coats of a coal tar pitch varnish, applied in a satisfactory manner so as to make a smooth coating, tough, tenacious and not brittle or with any tendency to scale off. Coatings damaged in transit or handling shall be repaired by the CONTRACTOR to the satisfaction of the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION.

2.03 WATERTIGHT MANHOLE COVERS

- A. Watertight manhole covers shall conform to the requirements of Paragraph 2.02 above, and shall have a round rubber gasket seal with a bolted lid. The lid shall be bolted with at least 4 bolts. Two (2) keys shall be supplied if bolt heads are pentagonal shaped. Watertight covers shall be used when indicated on the drawings or ordered by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION.

2.04 BEDDING MATERIALS

- A. Bedding materials shall consist of crushed stone and shall conform to the Excavation, Backfilling, and Compacting specification and the Sewer Manhole Standard Detail provided in this specification.
- B. Where ordered by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION to stabilize the base, screened gravel or crushed stone 1.5 inches to ½ inches shall be used

2.05 BRICK MASONRY

- A. This section applies to brick masonry, for the shelf, invert, and grade adjustment.
- B. The brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of dense/impervious texture, and satisfactory to the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION. Brick shall comply with the ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade SS, hard brick.
- C. Rejected brick shall be immediately removed from the job site by the CONTRACTOR at his own expense.
- D. The mortar shall be composed of portland cement, hydrated lime and sand, in the proportions of one part cement to 1 part lime to 3 parts sand (by volume). The proportion of cement to lime may vary from 1:1/4 for hard brick to 1:3/4 for softer brick, but in no case shall the volume of sand exceed three times the sum of the volume of cement and lime.
- E. Cement shall be Type II Portland Cement conforming to ASTM Standard Specifications for Portland Cement.
- F. The hydrated lime shall be Type S conforming to the ASTM Standard Specifications for Hydrated Lime for Masonry Purposes, Designated C207.

- G. The sand shall consist of inert natural sand conforming to the ASTM Standard Specifications for Concrete (Fine) Aggregates, Designation C33 as follows:

Sieve	Percent Passing by weight
3/8"	100%
#4	95 - 100%
#8	80 - 100%
#16	50 - 85%
#50	10 - 30%
#100	2 - 10%

Fineness Modulus 2.3 - 3.1

- H. Only clean bricks shall be used in brickwork for manholes. The brick shall be moistened by suitable means, as directed, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.
- I. Each brick shall be laid in full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded as directed. A 3/8" mortar joint shall be used.
- J. Brick masonry shall be protected from too rapid drying by the use of burlap kept moist, or by other approved means and shall be protected from the weather and frost, all as required.

2.06 CONCRETE STRUCTURE SEALER

- A. All interior surfaces of manholes and the exterior of the brick cover adjustment shall be thoroughly coated with a penetrating water-based silane sealer. The sealer shall penetrate concrete surfaces, exceed water absorption resistance test requirements of ASTM C 642-84, exceed chloride ion penetration resistance requirements of AASHTO T259 and T260, and comply with VOC requirements of the Clean Air Act.
- B. Concrete structure sealer shall be two coats of Series 435 Perma Thane, manufactured by Tnemec or approved equal.

PART 3 EXECUTION

3.01 EXCAVATION AND BACKFILLING

- A. Excavation, backfilling and compacting shall be performed in accordance with Excavation, Backfilling and Compacting specification.

3.02 INSTALLATION OF MANHOLE BASES AND SECTION

- A. Precast bases shall be placed on a 6 inch layer of compacted bedding material as described in PART 2. The excavation shall be properly dewatered while placing bedding materials and setting the base or pouring concrete. Waterstops shall be used at the horizontal joint of poured-in-place manholes.
- B. Inlet and outlet stubs shall be connected and sealed in accordance with the manufacturer's recommended procedure, and as shown on the Standard Details, or cast integrally with the poured base.

- C. Barrel section and cones of the appropriate combination of heights shall then be placed, using manufacturer's recommended procedure for sealing the horizontal joints, and as shown on the Standard Details or the remaining barrel of the manhole shall be cast above the base.

Horizontal joints and hydraulic lift holes shall be filled with mortar and coated with asphalt water-proofing.

- D. A leakage test shall then be made as described in PART 3.04 of this section.
- E. Following satisfactory completion of the leakage test, the frame and cover shall be placed on the top or some other means of preventing accidental entry by unauthorized persons, children, animals, etc., until the CONTRACTOR is ready to make final adjustment to grade.

3.03 SETTING FRAMES, COVERS, AND GRATES

- A. Frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the drawings. Frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of manhole masonry and the bottom flange shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

The exterior of the brickwork raising the sewer manhole frame to grade must be parged with mortar and finished smooth.

Manhole covers shall be left in place in the frame on completion of other work at the manholes.

3.04 LEAKAGE TESTS FOR SEWER MANHOLES

- A. Leakage tests shall be made and observed by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION on each manhole. The test shall be a vacuum test according to New Hampshire Water Supply and Pollution Control Division Guidelines as described below.
- B. After the manhole has been assembled in place, all lifting holes and all joints shall be filled and pointed with an approved non-shrinking mortar. After mortar has set up at lift holes and joints, apply an asphalt coating which is compatible with the manhole factory coating. The test shall be made prior to placing the shelf and invert and before filling and pointing the horizontal joints. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blowout.

- C. Vacuum test:

The vacuum test may be performed on manholes, completely constructed, with inlet and outlet pipes in place. Any material around the base section shall be removed to expose the entire side of the manhole. Plug pinholes and horizontal seams with a non-shrinking concrete grout.

Brace the inlet and outlet pipes/plugs to prevent movement during the test. Use air inflated plugs in good condition.

The vacuum test shall be performed using equipment acceptable to the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION. The equipment shall be in good operating condition. All gauges shall not have any broken glass or other visible abnormalities. The test shall be performed by trained personnel familiar with the equipment and the test.

The test shall have a minimum duration of two minutes. The vacuum shall be pumped down to 10 inches of mercury on an acceptable gauge, and held. At the time the removal of air is stopped, the test time shall begin.

Any manhole that has a vacuum drop to nine inches of mercury or less, within the following time intervals, shall have failed the test.

0 - 10 ft. deep:	less than 2 minutes.
10 - 15 ft. deep:	less than 2-1/2 minutes.
15 - 20 ft. deep:	less than 3 minutes.
over 20 ft. deep:	less than T.

Calculations for manholes deeper than 20 feet:

$$T = 0.085 [DK/Q]$$

T = Time of pressure drop in seconds.

K = 0.000419 DL; but not less than 1.0.

Q = 0.0015 ft³/min/ft⁵ of area.

D = Nominal manhole diameter in inches.

L = Depth of manhole in feet.

- D. The test must be conducted after backfilling around the manhole. If a given test should fail, it shall be incumbent upon the CONTRACTOR to determine the reason for any failure of the test, make the necessary repairs, and perform a successful re-test. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc., i.e., it will be assumed that all leakage during the test is a result of leaks through the concrete.

Furthermore, the CONTRACTOR shall take any steps necessary to assure the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION that the water table is below the bottom of the manhole throughout the test.

END OF SECTION

SEWER PUMP STATION TECHNICAL REQUIREMENTS

PART 1 GENERAL

- A. The intent of this section is to provide design criteria specific to sewer pump stations that is in addition to the general pump station technical requirements included in Part B of this Specification.
- B. All Milford Sewer Department technical standards supplement the latest edition of the New Hampshire Department of Environmental Services, Standards for Design and Construction for Sewer and Wastewater Treatment Facilities, Part Env-Wq 705. In either case, the most stringent standard(s) shall dictate.
- C. Pump Station Type:
 - 1. Wetwell/Drywell Stations: Pump stations designed to accommodate 10,000 gpd or more average daily flow, or equipped with 10 hp or greater pumps shall be wetwell/drywell stations. Suction lift type pump stations will be acceptable.
 - 2. Submersible Pump Stations: Pump stations designed to accommodate less than 10,000 gpd with less than 10 hp pumps may be submersible type pump stations.
 - 3. Pneumatic Ejector Stations: Pneumatic ejector stations are unacceptable.

PART 2 PUMP STATION SUBMITTALS

- A. In addition to the general pump station submittal requirements included in Part B of this Specification, the DEVELOPER must also submit the Sewer Pump Station Plans to the WATER AND SEWER COMMISSION for review, the submittal package for sewer pump stations must also include the following:
 - Plans and Profile Views for the force main
 - Wet well detention calculations
 - Buoyancy calculations.
- B. In addition to the general pump station requirements included in Part B of this Specification, the Sewer Pump Station design submittal must also include the following:
 - Two pumps
 - 3" solids handling, 2 1/2" with grinder pump
 - High water alarm
 - Emergency power or surcharge storage
 - Lead - lag pump controls
 - Explosion proof wiring and pumps in wet well
 - Pumps protected by screen or rack
 - Self-priming pumps TDSL <28 - NPSHR
 - Vacuum prime pumps limited to 100 gpm
 - Submersible pumps limited to 25 hp, 500 gpm
 - Submersible - Valves in exterior valve pit
 - On/Off bubbler control, 2 compressors or
 - Float switches for submersible or suction lift
 - Division wall in wet well over 200 gpm
 - Wet well capacity less than 10 min. at ADF
 - Gravity for submersible & suction lift
 - Wet well 30/hr int. or 12/hr continuous
 - Dry well 6/hr occupied or 3/hr not occupied
 - Access door warning

Flow meter when over 500 gpm
Manlifts - Approval by N.H. Dept. of Labor

PART 3 WETWELL/DRYWELL PUMP STATIONS

- A. Wetwell/Drywell type stations shall be constructed of two completely separate chambers including a drywell to house pumps, motors, piping and valving systems, electrical power and control systems and any appurtenant equipment. Wetwell shall store wastewater for cyclic or constant level (variable speed) pumping, and shall contain screening or comminution device for control of large solids.
- B. Wetwell/drywell pump stations have a two level drywell with all controls, indicators, compressors and electrical equipment on the upper level. The upper level may be constructed as either a below ground structure or as an above-ground building. The pumps, valves, and associated hardware shall be placed in the lower level.
- C. Pumps shall be vertical close coupled, non-clog type, capable of passing 3-inch solids, with 460 volt, 3 phase electric motor. Discharge elbow shall be cast iron, with clean-out fitting. Mechanical seals shall be double carbon ceramic seals.
- D. Sewer inlet shall be equipped with comminutor.
- E. Drywells shall be provided with lifting eyes in roof of station to enable removal of pumps. Lifting eyes shall be directly over each pump with a minimum of 36" clearance over the pump motor, to permit operating a lifting device.
- F. Pump stations ladders shall be equipped with safety rails which extend through the hatch opening. Large or deep pump stations may be required to install "ship type" ladders for safety.

PART 4 SUBMERSIBLE PUMP STATIONS

- A. Submersible pump stations shall have a separate wetwell, drywell valve pit, and above-ground generator building.
- B. Pumps shall be of the submersible non-clog type capable of passing 3-inch solids complete with 460 volt, 3 phase electric motors, slip flange cast iron base plate assembly, and rail system for pump removal.
- C. Pump control panel, compressors, indicators and annunciators shall be housed within generator building.
- D. Pump controls and power cables shall be connected at a junction box placed outside of the wetwell.
- E. All electrical equipment inside pump station shall comply with the National Electric Code.
- F. Removal of pumps shall not require personnel to enter the wetwell.
- G. Pump stations shall be equipped with davits, winches or other approved device for removal of pumps from station.

PART 5 PUMP STATION CONTROLS

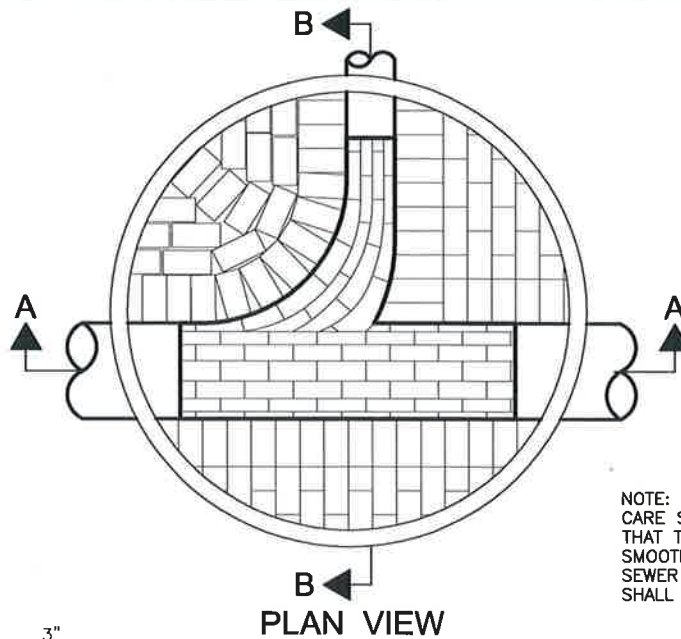
- A. Level Control: All wetwell/drywell pump stations shall be controlled by means of a bubbler level control system, with duplex compressor units and duplicate bubbler air feed lines. Bubble lines must be installed in sealed P.V.C. conduit. Submersible pump stations may be controlled by mercury-float type switches.
- B. Alarm Conditions: All pump stations shall be equipped with all sensing, control and annunciation equipment to accommodate alarm conditions as defined.
1. Local Alarm: Local alarm condition shall be signaled by flashing exterior dome light, visible outside site fence, and shall be identified on annunciation panel at the site. Local alarm conditions are defined below.
 2. RTU Alarm: RTU alarm conditions are those conditions which must be signaled via radio system (RTU) to security personnel, and are defined below.
 3. Alarm Conditions: The following are alarm conditions specific to sewer pump stations in addition to the other general pump station requirements and are defined as local alarm (LA) and RTU alarm (RTU):
 - high/low water in wetwell (LA, RTU)
 - H₂S or methane alarm (LA, RTU)
- C. High water alarms shall be detected by a separate float type switch, independent of the bubbler system. RTU system shall be connected to existing dialer system from Honeywell Security of Manchester, NH, and shall utilize a dedicated telephone connection. The system shall also be connected to an existing telephone dialer system to notify the TOWN OF MILFORD Dispatcher.

PART 6 ODOR CONTROL

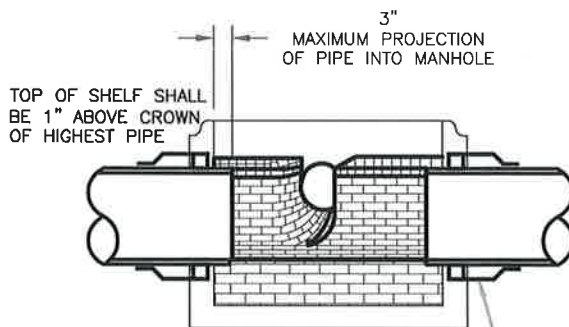
All pump stations shall be equipped with provisions to allow installation of odor control equipment. Station design submittals shall address odor control and indicate system type and design materials. Implementation of odor control shall be determined on a case-by-case basis.

END OF SECTION

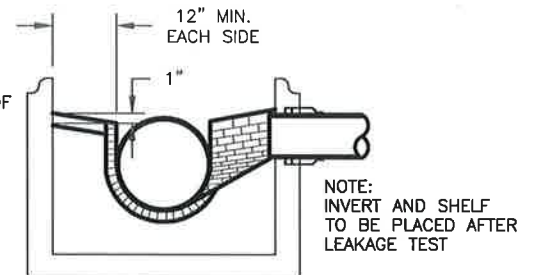
SEWER CONSTRUCTION DESIGN DETAILS



NOTE:
CARE SHALL BE TAKEN TO ENSURE
THAT THE BRICK INVERT IS A
SMOOTH CONTINUATION OF THE
SEWER INVERT. INVERT BRICKS
SHALL BE LAID ON EDGE.



SEE SEWER MANHOLE
JOINT DETAIL



NOTES:

1. IT IS REQUIRED THAT THE MANHOLE, INCLUDING ALL COMPONENT PARTS, HAVE ADEQUATE SPACE, STRENGTH, AND LEAKPROOF QUALITIES CONSIDERED NECESSARY BY THE COMMISSION FOR THE INTENDED SERVICE. SPACE REQUIREMENTS AND CONFIGURATIONS SHALL BE AS SHOWN ON THE DRAWING. MANHOLES MAY BE AN ASSEMBLY OF PRECAST SECTIONS, WITH OR WITHOUT STEEL REINFORCEMENT, WITH ADEQUATE JOINTING, OR CONCRETE CAST MONOLITHICALLY IN PLACE WITH OR WITHOUT REINFORCEMENT. IN ANY APPROVED MANHOLE, THE COMPLETE STRUCTURE SHALL BE OF SUCH MATERIAL AND QUALITY AS TO WITHSTAND H-20 LOADING WITHOUT FAILURE AND PREVENT LEAKAGE IN EXCESS OF ONE GALLON PER DAY PER VERTICAL FOOT OF MANHOLE, CONTINUOUSLY FOR THE LIFE OF THE STRUCTURE, A PERIOD GENERALLY IN EXCESS OF 25 YEARS IS TO BE UNDERSTOOD IN BOTH CASES.
2. BARRELS AND CONE SECTIONS SHALL BE PRECAST REINFORCED OR NON-REINFORCED CONCRETE, OR POURED IN PLACE REINFORCED OR NON-REINFORCED CONCRETE.
3. PRECAST CONCRETE BARREL SECTIONS, CONES, AND BASES SHALL CONFORM TO ASTM C478.
4. LEAKAGE TESTS SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS.
5. INVERTS AND SHELVES: MANHOLES SHALL HAVE A BRICK PAVED SHELF AND INVERT, CONSTRUCTED TO CONFORM TO THE SIZE OF PIPE AND FLOW AT CHANGES IN DIRECTION. INVERTS SHALL BE LAID OUT IN CURVES OF THE LONGEST RADIUS POSSIBLE TANGENT TO THE CENTER LINE OF THE SEWER PIPES. SHELVES SHALL BE CONSTRUCTED TO THE ELEVATION OF THE HIGHEST PIPE CROWN AND SLOPE TO DRAIN TOWARD THE FLOWING THROUGH CHANNEL. UNDERLAYMENT OF INVERT SHELF SHALL CONSIST OF BRICK MASONRY.
6. MANHOLE FRAMES AND COVERS SHALL BE OF HEAVY DUTY DESIGN AND PROVIDE A 30" CLEAR OPENING. A 3" (MINIMUM HEIGHT) LETTER "S" FOR SEWERS OR "D" FOR DRAIN SHALL BE PLAINLY CAST INTO THE CENTER OF EACH COVER. MANHOLE COVERS SHALL HAVE NO PENETRATING PICK HOLES.
7. BEDDING: SCREENED GRAVEL AND/OR CRUSHED STONE FREE FROM CLAY, LOAM, ORGANIC MATTER AND MEETING ASTM C33

100% PASSING 1 INCH SCREEN	0-10% PASSING 4 SIEVE
90-100% PASSING 3/4 INCH SCREEN	0-5% PASSING 8 SIEVE
20-55% PASSING 3/8 INCH SCREEN	0% PASSING #2 SIEVE

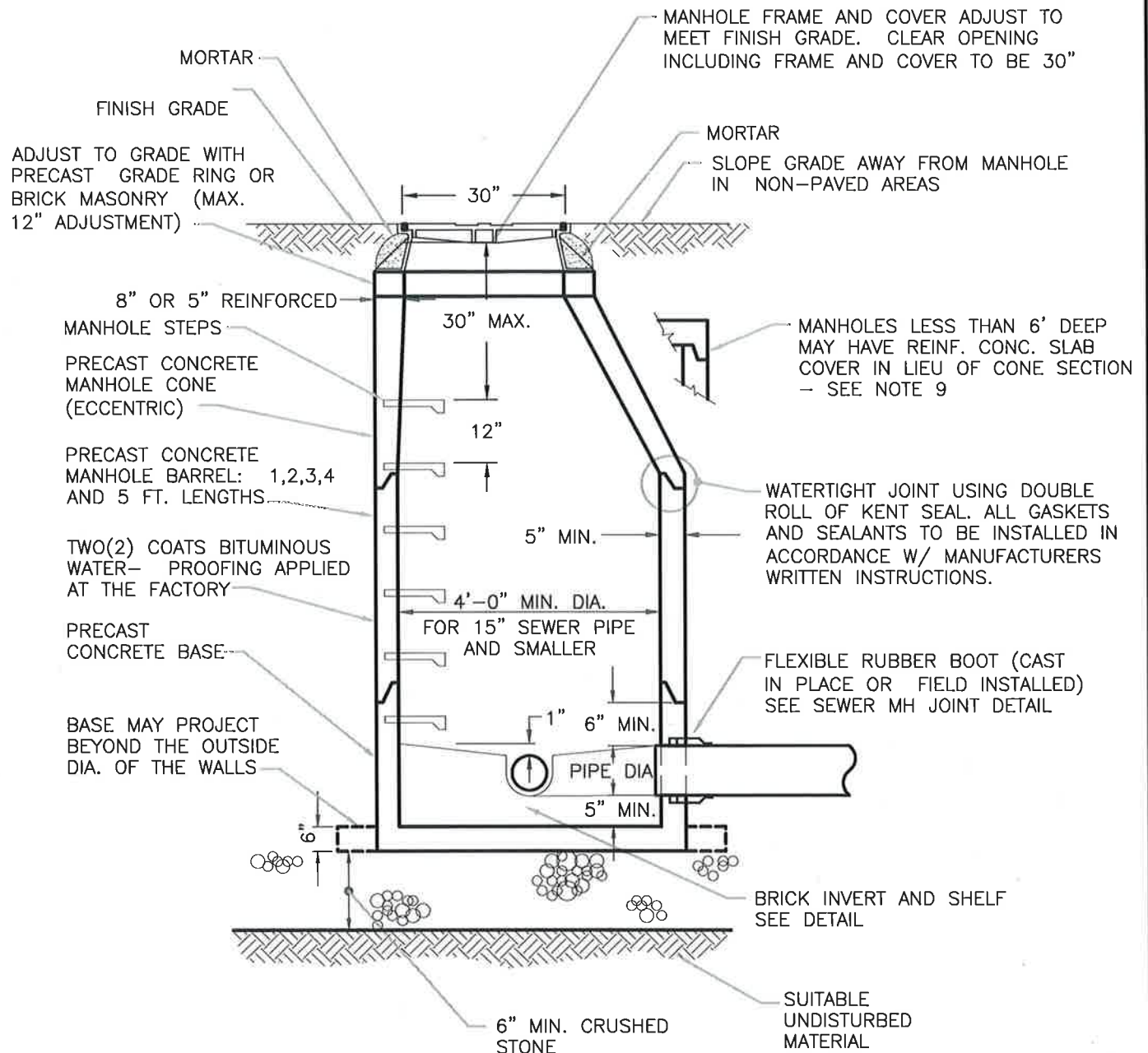
WHERE ORDERED BY THE ENGINEER TO STABILIZE THE BASE SCREENED GRAVEL OR CRUSHED STONE 1 1/2 INCH CRUSHED STONE SHALL BE USED.
8. IN LIEU OF A CONE SECTION, WHEN MANHOLE DEPTH IS LESS THAN 6 FEET, A REINFORCED CONCRETE SLAB COVER MAY BE USED HAVING AN ECCENTRIC ENTRANCE OPENING AND CAPABLE OF SUPPORTING H-20 LOADS.

DRAWN BY:	D.K.P.
CHECKED BY:	R.L.
APPROVED BY:	R.L.
SCALE:	AS SHOWN
DATE:	NOVEMBER 2003

**TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS**

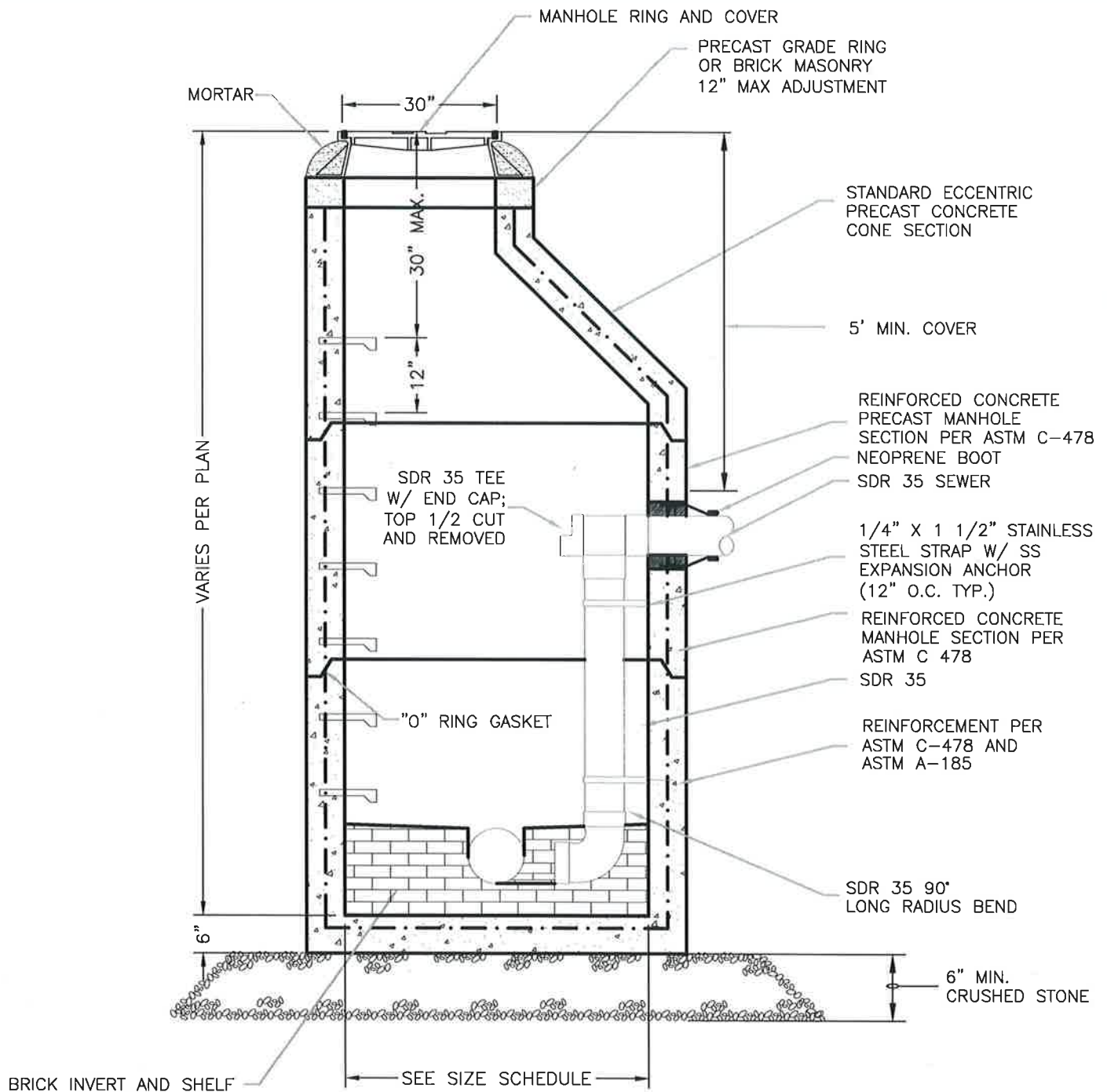
**SEWER MANHOLE
INVERT AND SHELF DETAILS**

REV.	DESCRIPTION	DATE					
FIGURE:	S-1	A					



NOTE: MANHOLE STRUCTURE TO BE CAPABLE OF SUPPORTING AASHTO H-20 LOADING

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CHECKED BY: R.L.						
APPROVED BY: R.L.						
SCALE: AS SHOWN				REV.	DESCRIPTION	DATE
DATE: NOVEMBER 2003				FIGURE:	S-2	A



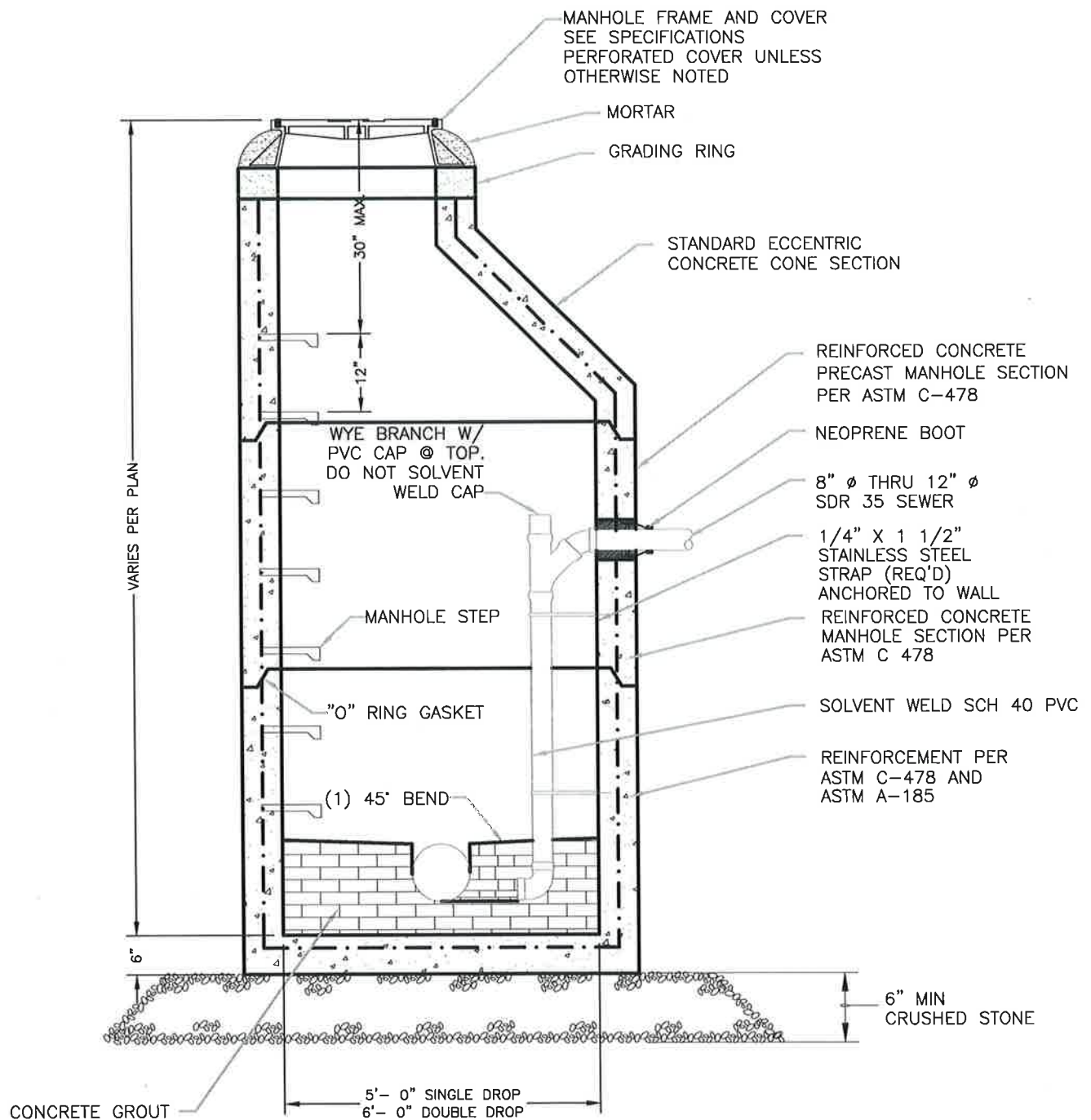
MANHOLE DIAMETER SIZE GUIDE

- 1 - 8" OR 10" DROP - 4 FT. DIA. MH
 1 - 12" OR 15" DROP - 5 FT. DIA. MH

NOTE:

1. MANHOLE STRUCTURE TO BE CAPABLE OF SUPPORTING AASHTO H-20 LOADING
2. SEE ALSO, SEWER MANHOLE STANDARD DETAIL.

DRAWN BY: D.K.P.	TOWN OF MILFORD, NEW HAMPSHIRE DESIGN SPECIFICATIONS SEWER MANHOLE INTERNAL DROP DETAIL					
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APPROVED BY: R.L.						
SCALE: AS SHOWN				REV.	DESCRIPTION	DATE
DATE: NOVEMBER 2003				FIGURE:	S-3	A

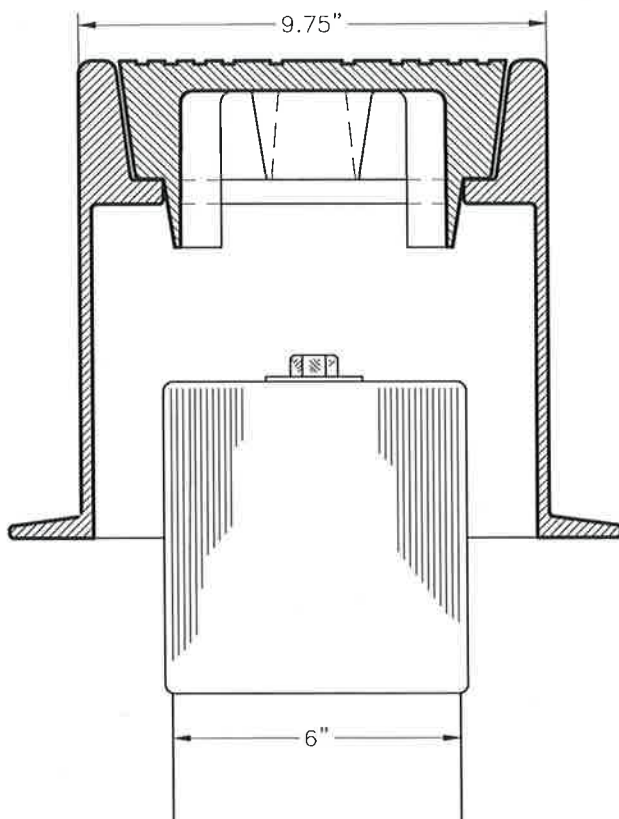
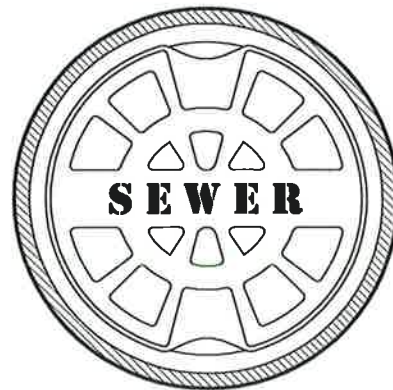


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APPROVED BY:	R.L.
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DATE:	NOVEMBER 2003

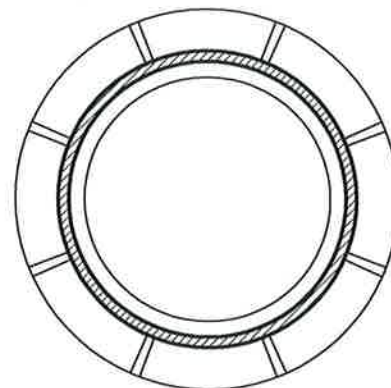
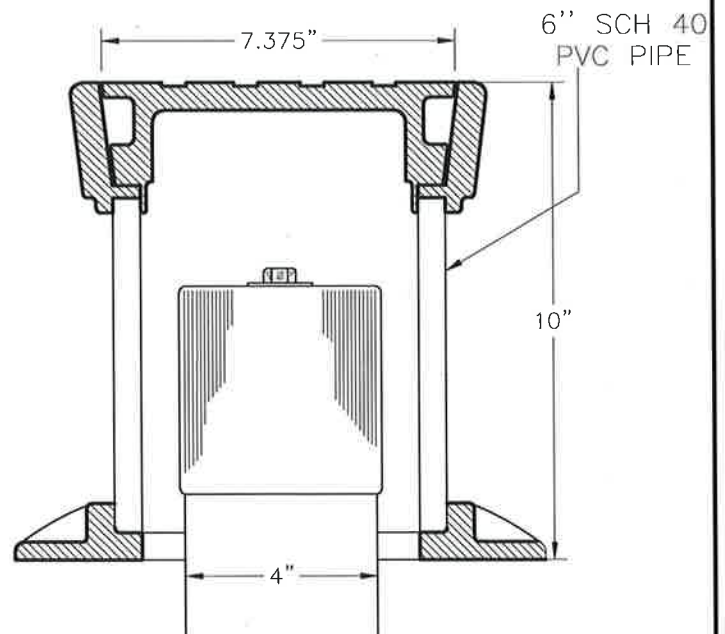
TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS

SEWER MANHOLE FORCE MAIN INTERNAL DROP DETAIL

REV.	DESCRIPTION	DATE
FIGURE:	S-4	A



4" OR 6" IN PAVED AREAS



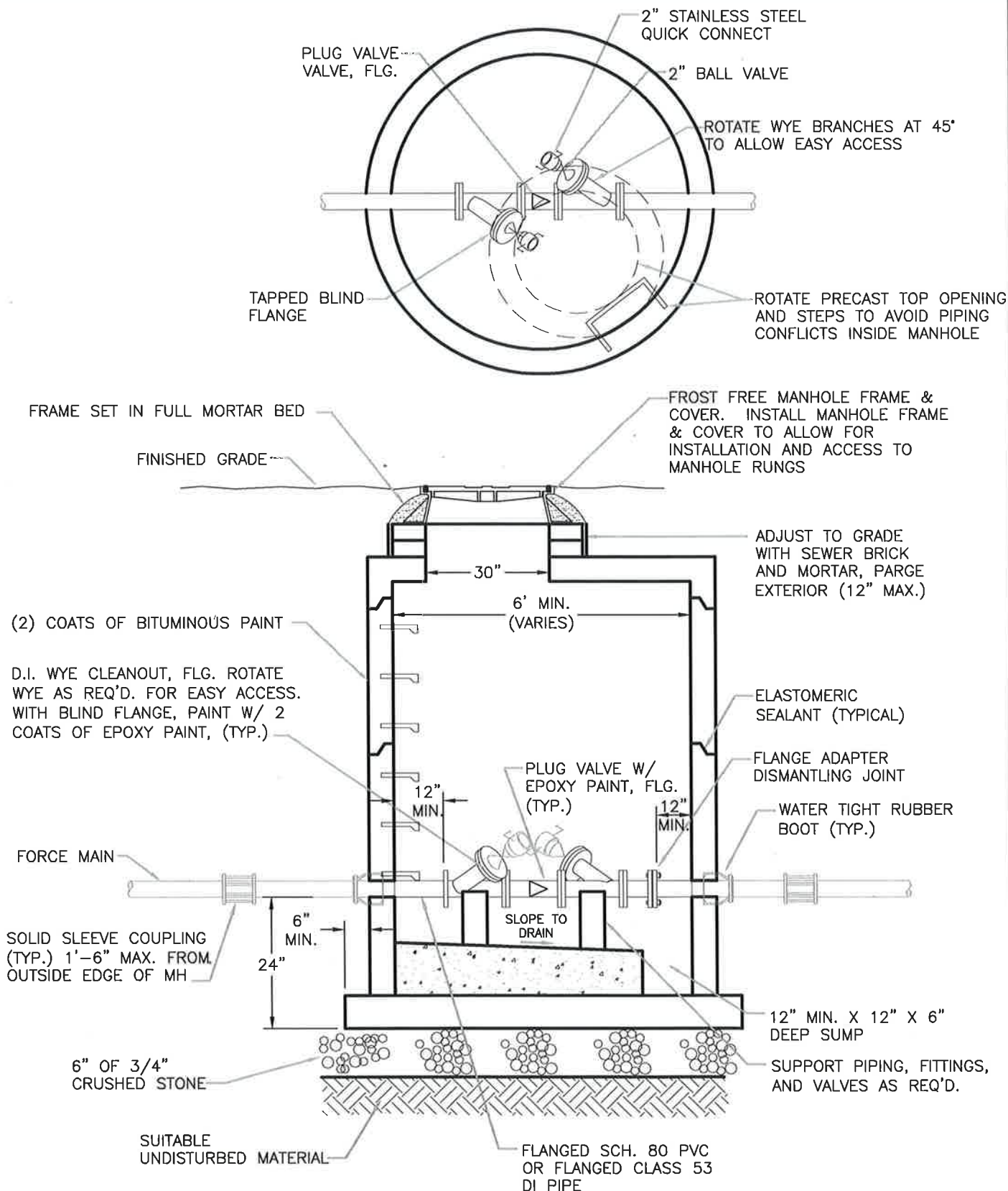
LAWN AREA STYLE

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CHECKED BY:	R.L.
APPROVED BY:	R.L.
SCALE:	AS SHOWN
DATE:	NOVEMBER 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS

SEWER CLEANOUT COVERS

REV.	DESCRIPTION	DATE
FIGURE:	S-5	A



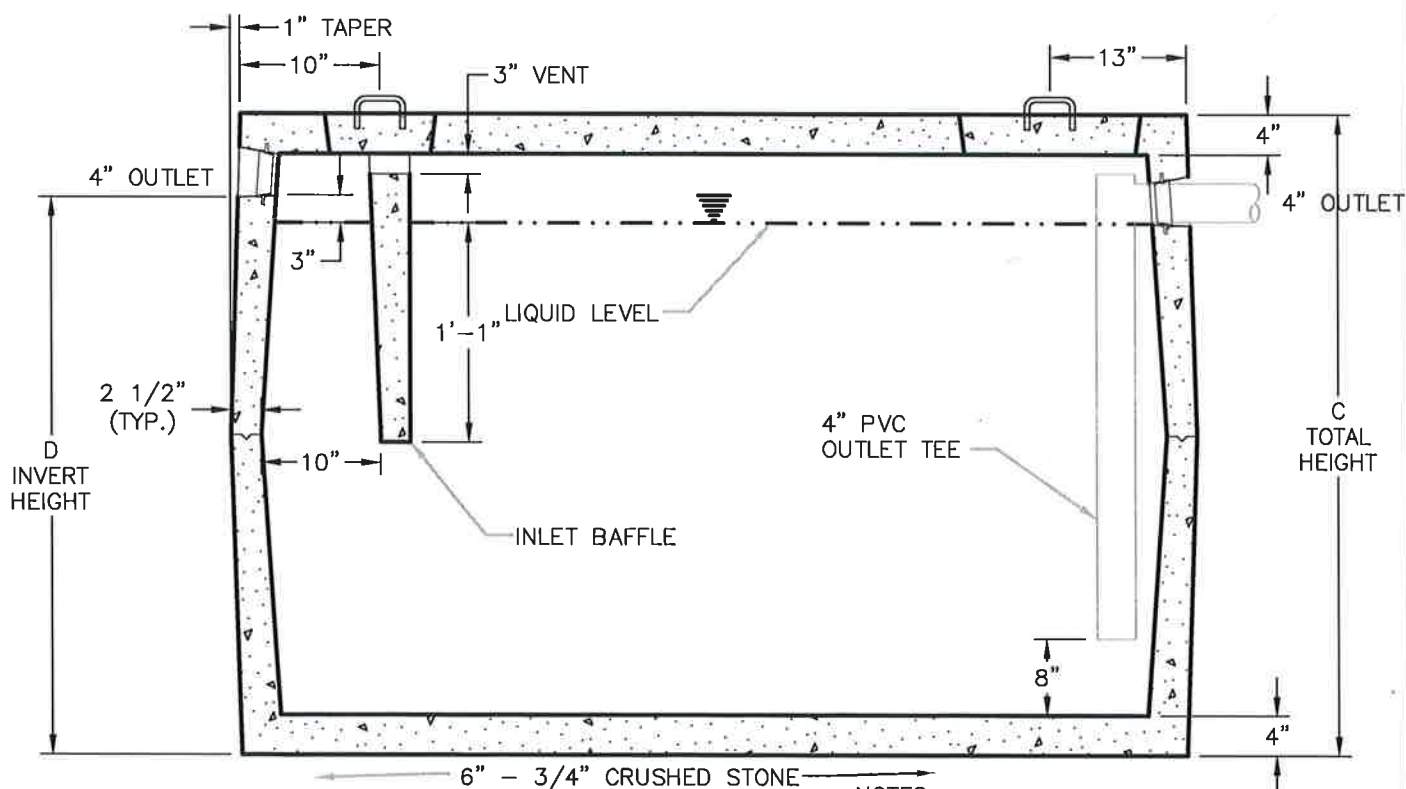
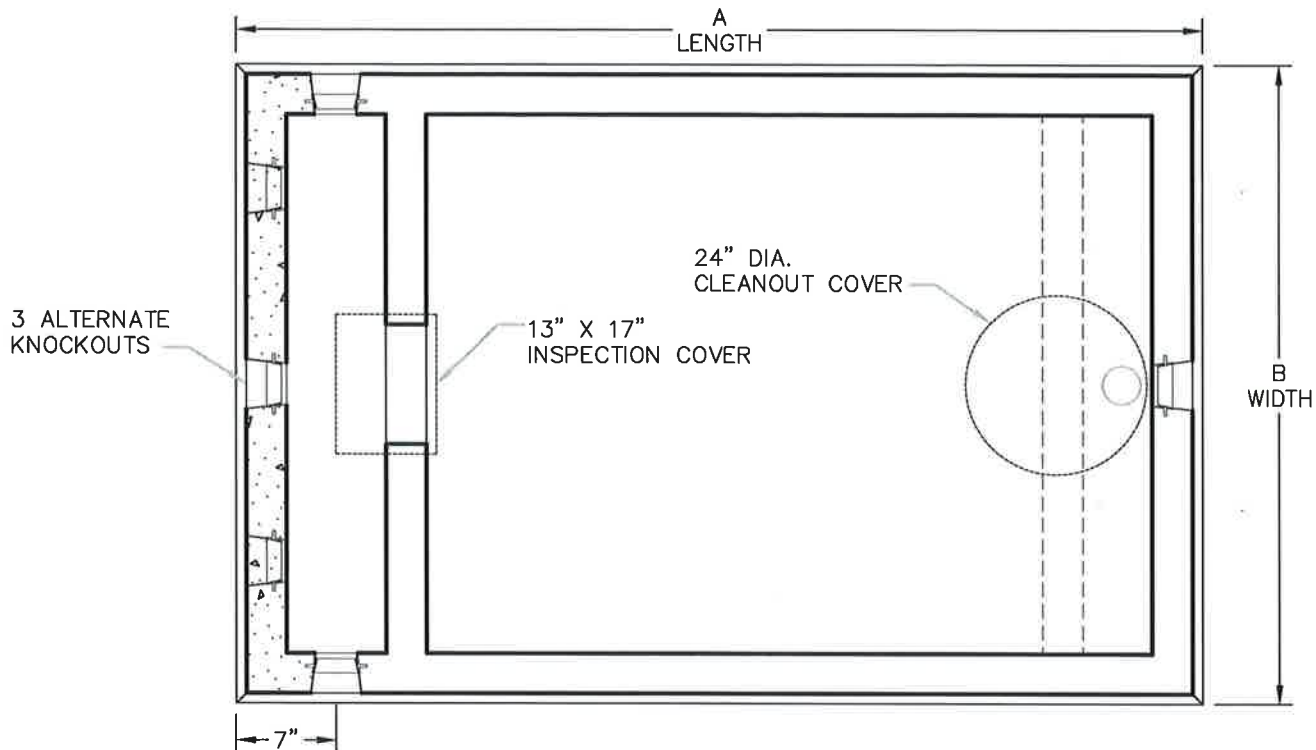
NOTE:

1. SEE SEWER MANHOLE STANDARD DETAIL FOR ADDITIONAL REQUIREMENTS.

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APPROVED BY:	R.L.
SCALE:	AS SHOWN
DATE:	NOVEMBER 2003

**TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS
FORCE MAIN CLEANOUT DETAIL**

REV.	DESCRIPTION	DATE
FIGURE:	S-6	A



LIQUID CAPACITY	A LENGTH	B WIDTH	C HEIGHT	D INVERT
500	8'-0"	4'-0"	4'-0"	3'-2 1/2"
750	8'-0"	4'-0"	5'-4"	4'-6 1/2"
1000	8'-0"	5'-1"	5'-4"	4'-6 1/2"
1500	10'-6"	6'-4"	5'-4"	4'-5"
2000	10'-6"	6'-4"	6'-2"	5'-3"

NOTES:

1. CONCRETE 4,000 PSI AFTER 28 DAYS
2. REINFORCING 6X6-W1.4XW1.4
3. H.D. SEPTIC TANK TOPS REINFORCED WITH #5's @ 12" O.C.E.W.
4. KEYED JOINT SEALED WITH ASPHALTIC CEMENT OR EQUIVILANT
5. TANK TO WITHSTAND H-20 LOADING

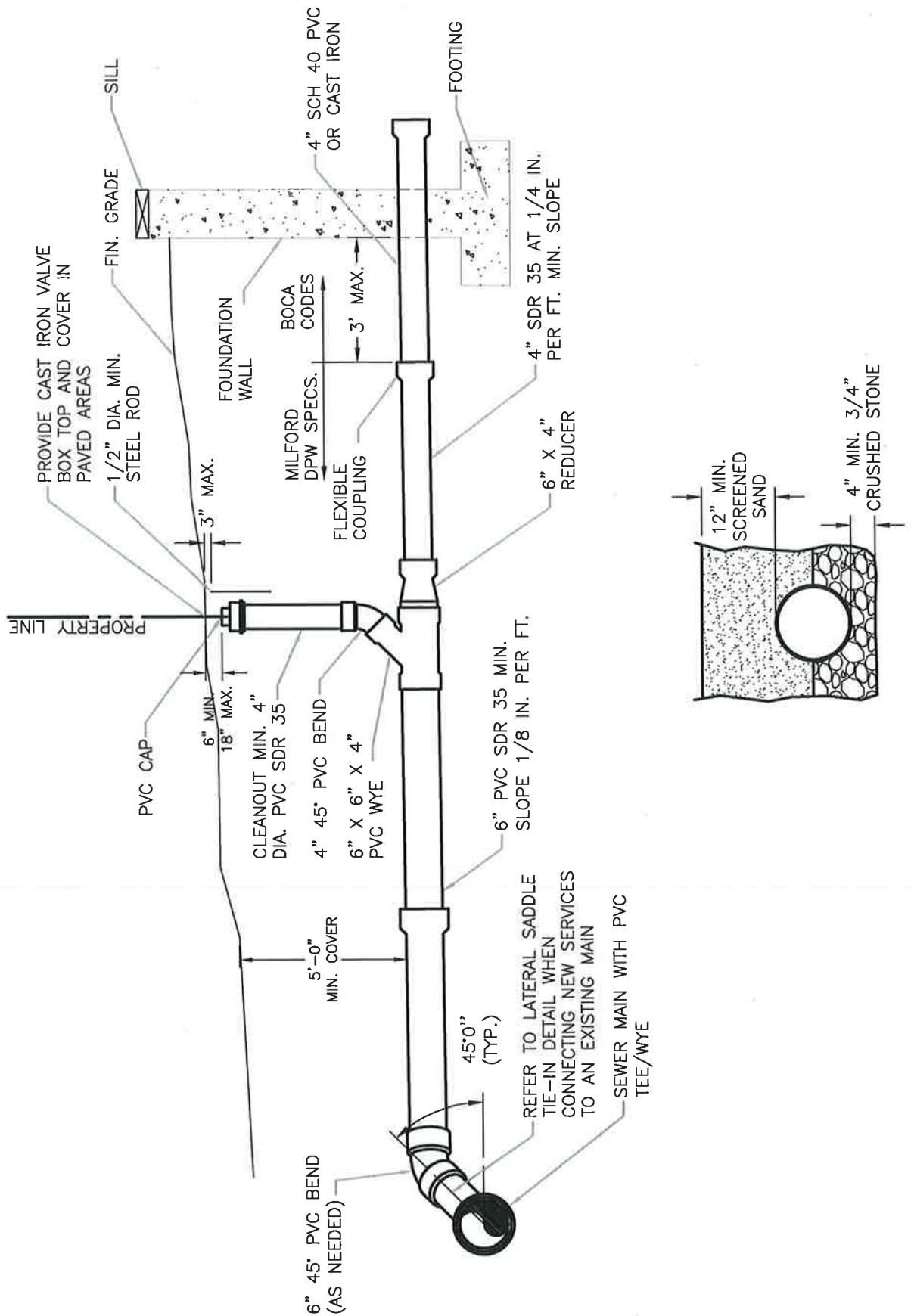
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 APPROVED BY: R.L.
 SCALE: AS SHOWN
 DATE: NOVEMBER 2003

TOWN OF MILFORD, NEW HAMPSHIRE
 DESIGN SPECIFICATIONS

GREASE TRAP DETAILS

REV.	DESCRIPTION	DATE

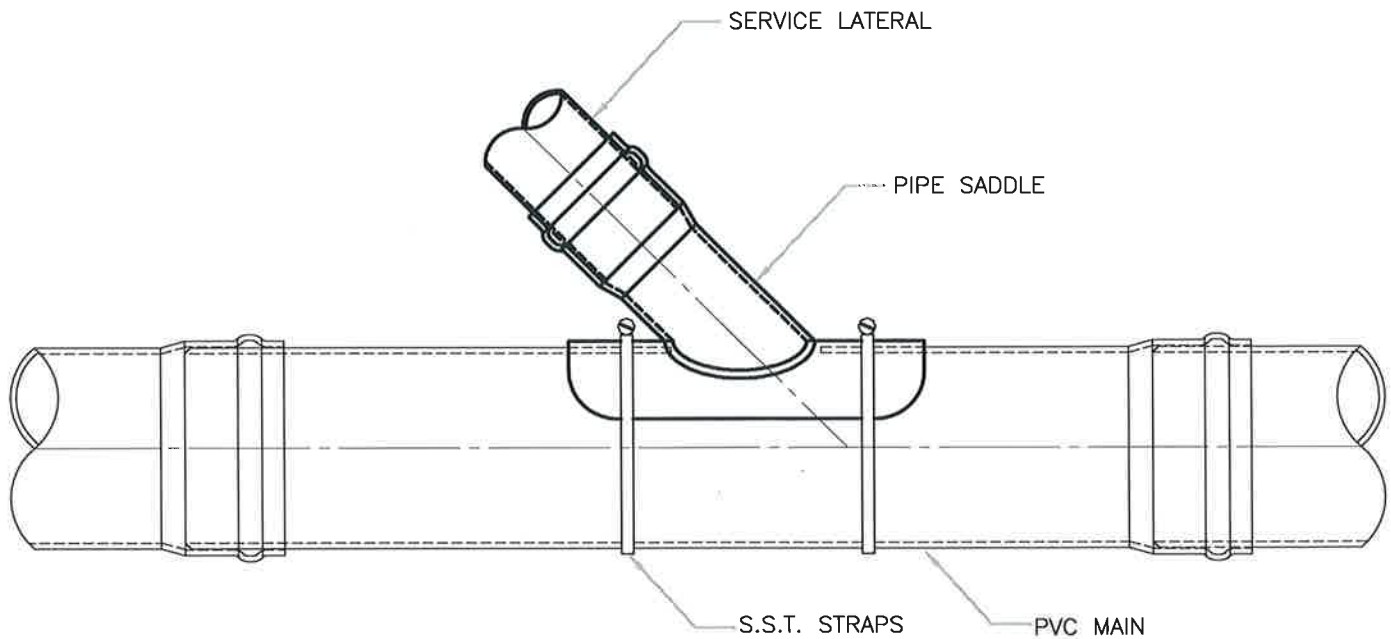
FIGURE: S-7 A



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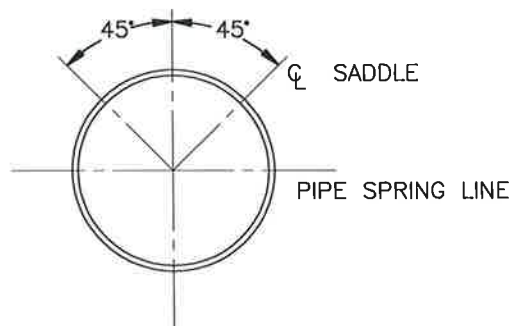
TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS
TYPICAL SEWER SERVICE DETAIL

REV.	DESCRIPTION	DATE
FIGURE:	S-8	A



NOTE:

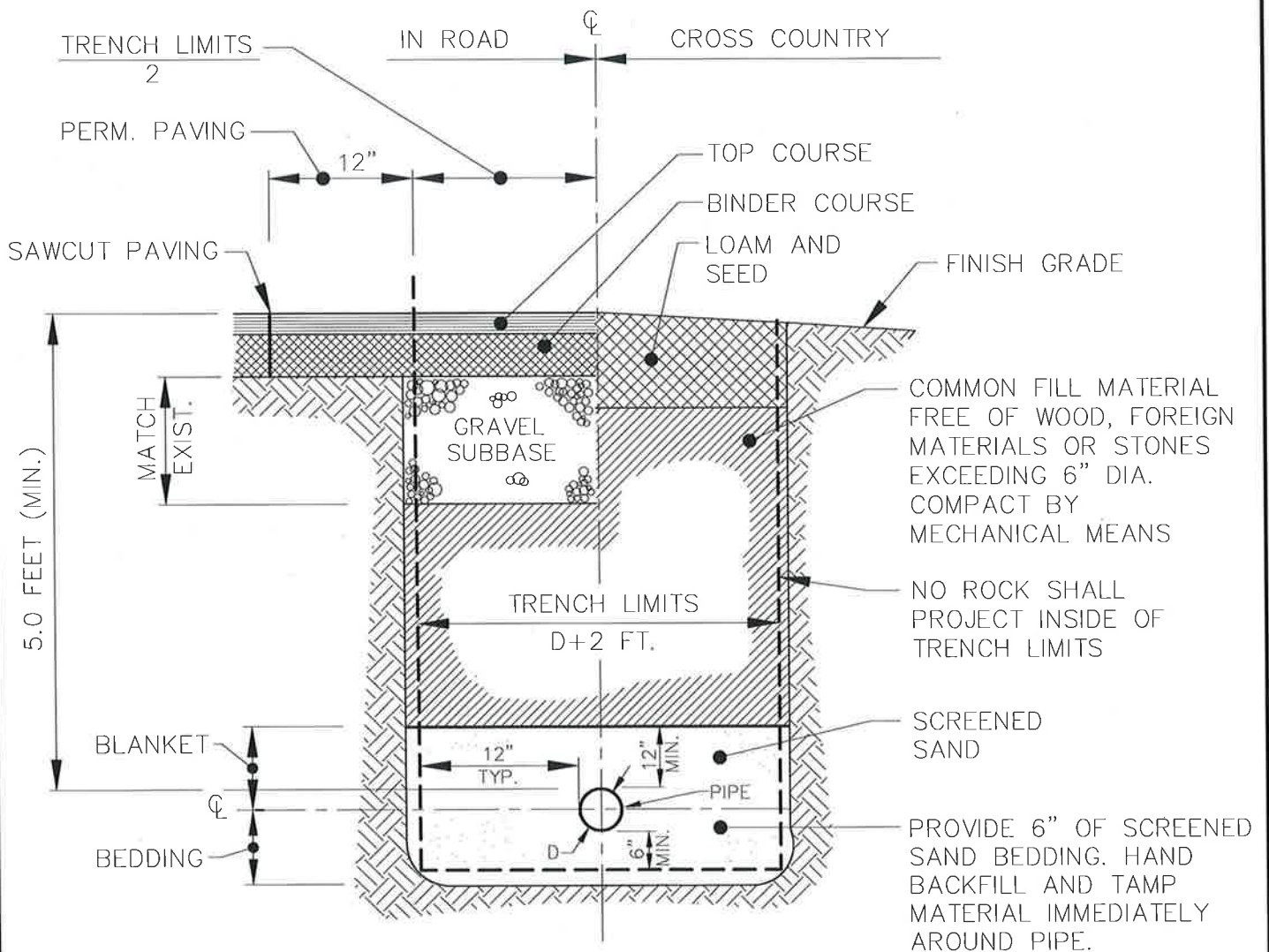
1. A PVC SADDLE CONNECTION CAN BE USED TO TIE IN A NEW SEWER SERVICE TO AN EXISTING SEWER MAIN ONLY.
2. THE PLAN VIEW IS SHOWN ROTATED 45° FOR CLARITY, REFER TO THE END VIEW FOR ACTUAL LAYING POSITION.



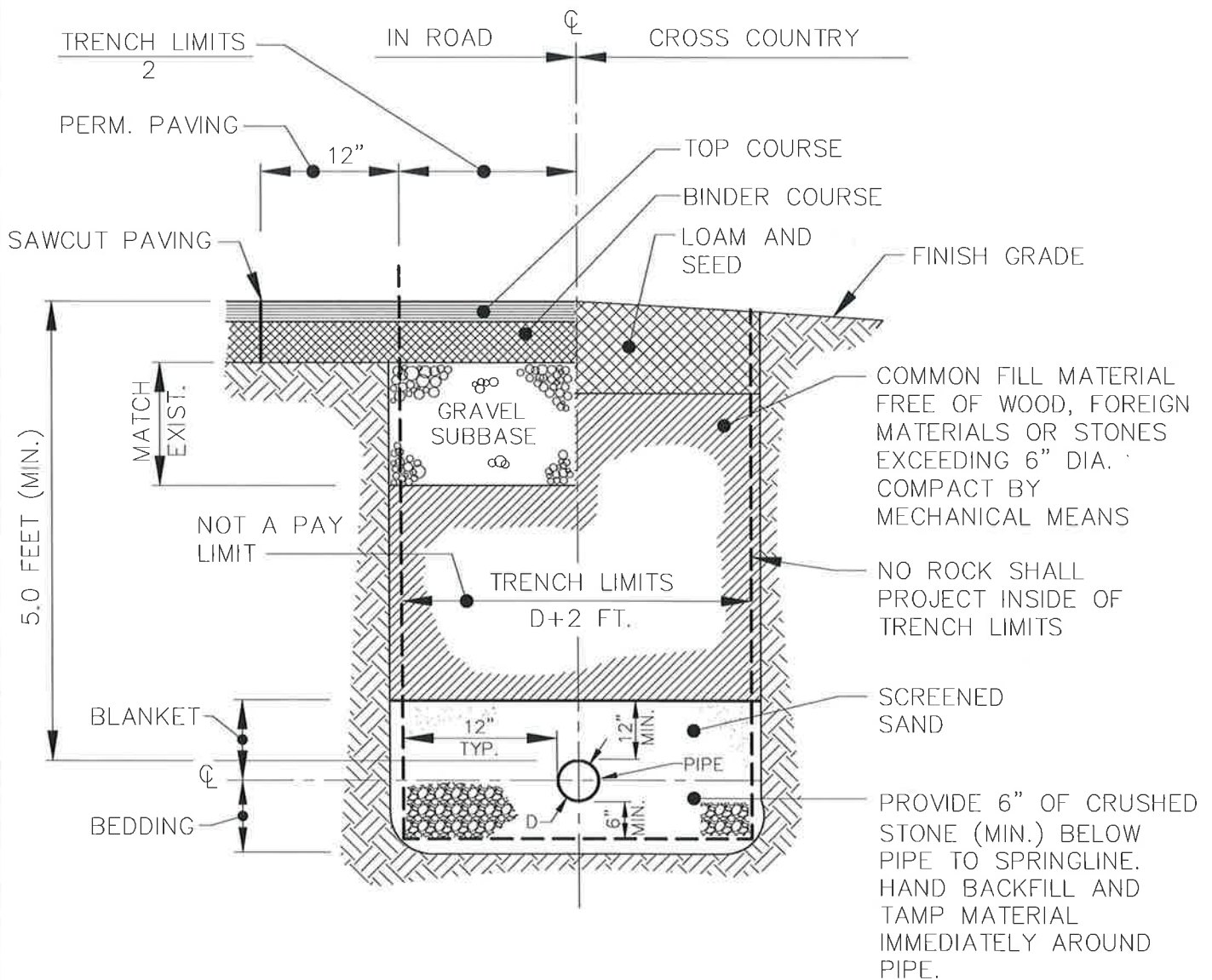
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APPROVED BY:	R.L.
SCALE:	NO SCALE
DATE:	NOV. 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS
LATERAL SADDLE TIE-IN DETAIL

REV.	DESCRIPTION	DATE
FIGURE:	S-9	A



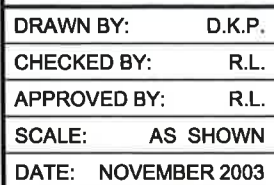
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APPROVED BY:	R.L.				
SCALE:	NO SCALE		REV.	DESCRIPTION	DATE
DATE:	NOV. 2003		FIGURE:	S-10	A



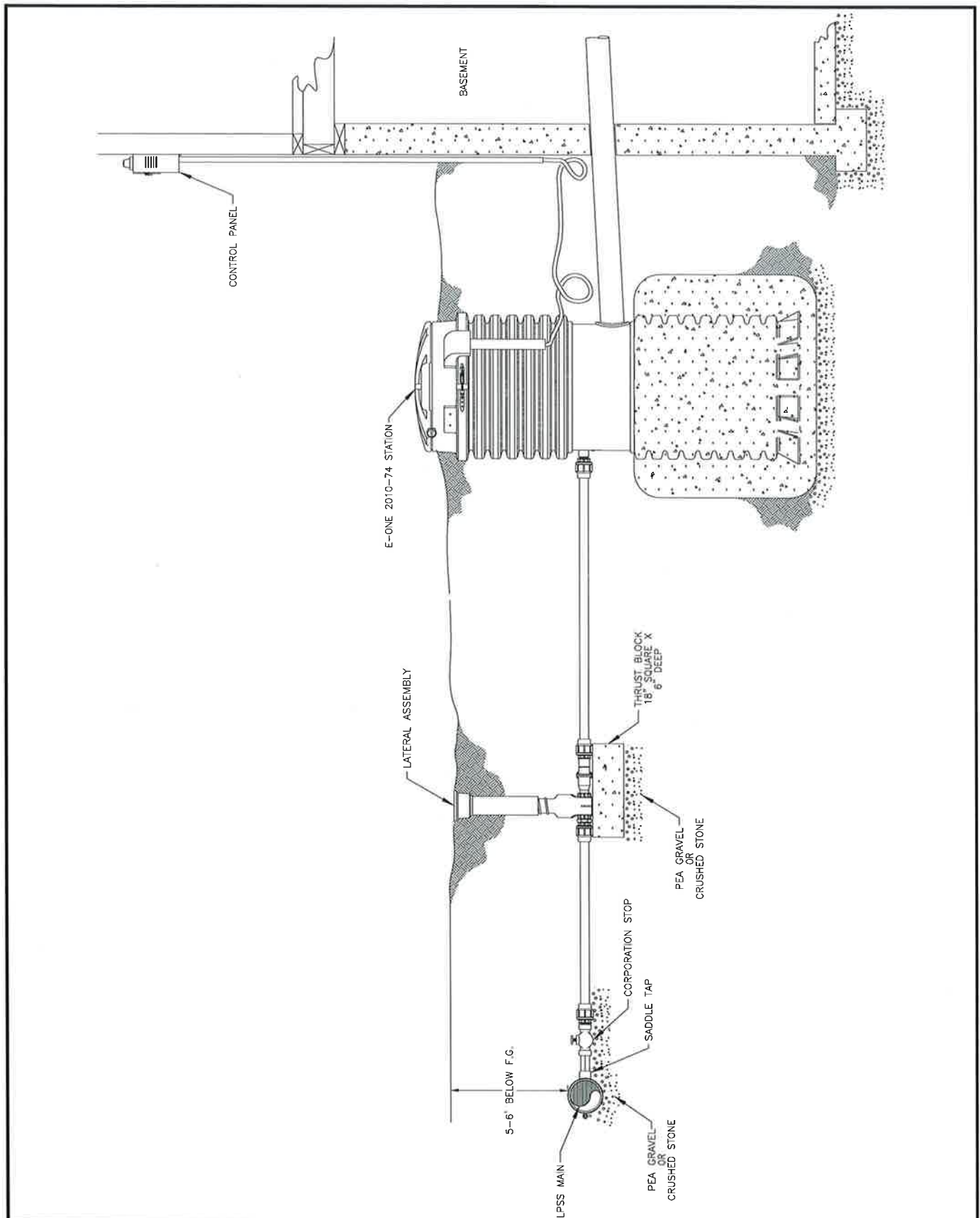
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APPROVED BY:	R.L.
SCALE:	NO SCALE
DATE:	NOV. 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS
GRAVITY SEWER TRENCH DETAIL

REV.	DESCRIPTION	DATE
FIGURE:	S-11	A



REV.	DESCRIPTION	DATE
FIGURE:	S-14	A



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APPROVED BY:	R.L.
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DATE:	NOVEMBER 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS
**TYPICAL GRINDER PUMP
LATERAL INSTALLATION**

REV.	DESCRIPTION	DATE
FIGURE:	S-15	A

PART D

Water System

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 SCOPE

- A. The CONTRACTOR/DEVELOPER shall furnish all water pipe, hydrant assemblies, valves and valve boxes, fittings, couplings, labor, tools and equipment necessary to lay and join all pipe in accordance with the specifications herein.
- B. All references to AWWA shall refer to the latest Edition.

PART 2 MATERIALS

2.01 GENERAL

- A. Materials for new water mains shall be of new and unused materials and shall conform to the requirements specified herein.
- B. All materials shall conform to the latest Edition of AWWA Specifications.
- C. All materials for water distribution systems shall be manufactured in the U.S.A.

2.02 DUCTILE IRON PIPE AND FITTINGS

- A. Pipe:
 - 1. The ductile iron pipe shall be Class 52 modified and conforming to AWWA Specifications C151. The bell for this type of joint shall be cast with a shouldered gasket groove of a shape which will prevent the gasket from being blown or forced out of the joint. Rubber gasket joints shall be used per ANSI/AWWA specification C111/A21.11-85.
- B. Fittings:
 - 1. Fittings shall be ductile iron, 350 psi pressure rating. Ductile or cast iron fittings shall conform to ANSI A21.10/AWWA C110 with mechanical joints. Joints and gaskets shall conform to ANSI A21.11 AWWA C111. Joints shall be furnished with GRIP-RINGS. Fittings shall be double cement-lined and seal-coated inside and out in accordance with ANSI A21.4/AWWA C104. Hydrant tees shall be anchor tees.
- C. Joint Restraint:
 - 1. GRIP-RING - Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, articulating wedge action to force from system pressing against the pipe evenly spreading, increasing the mechanical joints resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C 153/A21.53 of latest revision.

The mechanical joint restraint device shall have a working pressure of at least 250 psi, with a minimum safety factor of 2:1, and shall be GRIP-RING or equal.

- D. Lining and Coating:

1. The inside of ductile iron pipe and fittings shall be given a double cement lining and bituminous seal coat in accordance with AWWA Specifications C104.
2. The outside of ductile iron pipe and fittings shall be coated with bituminous varnish as required in AWWA Specification C151-76.
3. Machined surfaces shall be cleaned and coated with a suitable rust-preventive coating at the shop immediately after being machined.

E. Ductile Iron Ford FC1 Coupling (2" to 12") - (or approved equal)

Coupling shall be for plain cast iron or ductile iron pipe made of ductile iron with grade 27 rubber gaskets and black, steel, track head bolts with nuts, as manufactured by Ford Meter Box Co., Wabash, Indiana.

F. Mechanical Joint Ductile Iron Sleeve

The pipe coupling shall be of the mechanical type, with ductile iron body; minimum body length of 12 inches. The pitting pressure rating shall be 350 psi and shall conform to ANSI/AWWA A21.10/C100. The fitting shall be cement lined with interior and exterior seal coating in accordance with ANSI/AWWA A21.2/C104.

2.03 VALVES AND APPURTENANCES

A. Gate Valves

1. Gate valves shall be resilient wedge-type, meeting or exceeding the requirements of AWWA C 509 latest edition. All gate valves shall open right.
2. Valve bodies shall be cast or ductile iron conforming to AWWA C 509. Interior and exterior surfaces shall be fusion bond epoxy coated in compliance with AWWA C 550 and NSF 61. Valves shall have mechanical joints.
3. The operating nut shall be 2-inch square. The stem shall be bronze, non-rising, with two (2) replaceable o-rings above the thrust collar.
4. The wedge shall be cast or ductile iron fully encapsulated with resilient elastomeric material conforming to AWWA C 509. The wedge shall be symmetrical around the center line, with wedge guides maintaining alignment during operation.
5. The resilient seat gate valves shall have stainless steel or zinc-plated bonnet nuts and bolts. The valves shall meet or exceed AWWA C 509 Specifications for 200 psi working pressure and 400 psi test pressure. The valves shall be UL/FM approved.
6. Resilient seat gate valves shall be Mueller 2360 Series, AFC Series 500 or approved equal.

B. Tapping Sleeves and Valves

1. General: The CONTRACTOR shall furnish and install tapping sleeves and valves to make connections under service pressure to existing mains. Locations and sizes of tapping sleeves and valves are indicated on the Drawings.
2. Sleeves and Valves: The tapping sleeves and valves shall be installed with a suitable tapping machine by skilled workmen experienced in such work. The tapping sleeves shall be of the bolted sleeve type with flanged end outlets for connection to the tapping valves. Tapping sleeves and valves shall be suitable for a cold water working pressure of 200 psi. The outlet flanges shall

conform to the 125-pound American Standard. U.S. Pipe or Dresser tapping sleeves or approved equal are acceptable. Resilient wedge gate valves shall be mechanical joint tapping by Mechanical Joint) and comply with all other requirements of this specification.

3. A tapping sleeve can be used for a new water main lateral as long as the proposed lateral main is smaller than the tapped main. A size on size tapping sleeve installation is prohibited.
4. Stainless Steel Tapping Sleeves can be used when the main tapped is two times larger than proposed connecting lateral. The stainless steel tapping sleeve shall be suitable for a cold water working pressure of 150 psi. The outlet flange shall conform to the 125 pound American Standard. Ford or Rockwell stainless steel tapping sleeves are acceptable.
5. A poured concrete thrust block must be placed behind all tapping sleeves. Boulders or precast concrete thrust blocks are unacceptable.

C. Valves Boxes

1. Unless otherwise specified or required, each buried valve shall be provided with a valve box. Valve boxes shall be of tough even grain cast iron and of the adjustable, slip, heavy pattern type. They shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valve.
2. The upper or sliding section of the box shall be provided with a flange having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve. The boxes shall be adjustable trough at least 6 inches vertically without reduction of the lap between sections to less than 4 inches.
3. The inside diameter of boxes shall be at least 4.2 inches and the lengths shall be as necessary for the depth of the valves with which the boxes are to be used.
4. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. An arrow and the word "OPEN" to indicate the direction of turning to open the valve shall be cast in the top of the cover.
5. Valve boxes shall be manufactured in the U.S.A. by Tyler, Bibby LaPearle or approved equal.

D. Wrenches for Buried Valves

1. The CONTRACTOR shall furnish two(2) tee handle wrenches of sufficient length to permit operation of all buried valves, regardless of depth, by the operators of average height working in normal positions.
2. The CONTRACTOR shall supply one (1) water service wrench.

E. Painting

1. Interior surfaces of all valves, and exterior surfaces of valves shall be fusion-bond epoxy; miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V-51c, for Varnish, Asphalt, as specified in AWWA Specification C500.

2. Parts customarily finished at the shop shall be given coats of paint filler and enamel or other approved treatment customary with the manufacturer.
3. After thorough cleaning exterior surfaces of various parts of valves and miscellaneous piping appurtenances exposed within structures shall be given one shop coat of an approved rust inhibitive primer compatible with the field coats and applied in accordance with the instructions of the paint manufacturer.
4. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust resistant coating.

2.04 HYDRANTS AND APPURTENANCES (EDDY F-2640, US PIPE METROPOLITAN 250)

A. Hydrants

1. Hydrants shall conform to the requirements of AWWA Standard for Fire Hydrants for Ordinary Water Works Service, Designation C502, and all addenda thereto. Hydrants shall be equipped with 5 1/4 inch main valves, as sized by seat ring internal opening. The pipe connection shall be 6 inches. The gate valve shall be herein before specified.
2. The hydrants shall have one (1) – 4.5-inch National Standard pumper and two (2) – 2.5-inch hose connections. Thread standards shall be as approved by the Owner.
3. For purposes of standardization, hydrants shall be Eddy-2640 and U.S. Pipe Metropolitan 250 (with break-away construction).

Hydrants shall be thoroughly cleaned and given two shop coats of paint in accordance with the above mentioned AWWA Specification C502-73. Paint color shall be the standard hydrant color of the Town of Milford.

4. Hydrants shall open right.

B. Painting

1. Hydrants shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V-51c, for Varnish, Asphalt, as specified in AWWA Specification C502. The hydrant colors shall be as specified by the TOWN.
2. Parts customarily finished at the shop shall be given coats of paint filler and enamel or other approved treatment customary with the manufacturer.
3. After thoroughly cleaning exterior surfaces of various parts of valves and miscellaneous piping appurtenances exposed within structures shall be given one shop coat of an approved applied in accordance with the instructions of the paint manufacturer.
4. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust resistant coating.

2.05 WATER SERVICE CONNECTION

A. Pipe

1. Pipe shall be Type K copper tubing or DR11 HDPE pipe (to be determined by the Water Department), hard temper tubing for sizes larger than one inch; and one inch and smaller shall be soft temper tubing.
2. For purposes of standardization 1" dia. HDPE pipe shall be used unless design requirements necessitate larger.
3. Corporation cocks less than 1-1/2" shall be of bronze with a lapped, ground key. The inlet thread shall be of steep taper type. Outlet connection shall be compression. The cocks shall be Ford F-1000 manufactured by Ford Meter Box Company, Inc. Wabash, Indiana, or an approved equal.
4. Corporation cocks 1-1/2" and larger shall be of bronze, with a (cc) threaded inlet CPPJ and a compression outlet connection to the pipe. The corporation shall be Ford Ball Corporation FB-1000, or an approved equal.
5. Service clamps shall be made of bronze with a single strap with a neoprene gaskets cemented in place, (cc) threads for use on ductile iron and cast iron pipe. The clamps shall be Ford, or an approved equal.
6. Curb stop ball valves shall be bronze full port as manufactured by Ford B-44-333, or an approved equal.
7. All corporations, curb valves, and fittings shall have packed or compression joints.
8. Service boxes shall be the Erie style, with a plug cover and 1/2" SS service rod.
9. Compression Couplings: coupling shall be made of bronze, both sides of the coupling shall be compression type. The couplings shall be Ford C-44 type, or an approved equal.

PART 3 INSTALLATION

A. Pipe and Fittings

1. Laying pipe and fittings: Gasket-type joints shall be made up by first inserting the gasket into the groove of the bell and applying a thin film of special non-toxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot and of the pipe. The gasket lubricant must be used on both push-on joints and mechanical joint gaskets. The end of the plain pipe shall be beveled to facilitate assembly. The end shall be inserted into the gasket and then forced past it until it seats against the bottom of the socket. All fittings shall be mechanical joint with GRIP-RING JOINT RESTRAINTS. All push-on pipe joints shall have two serrated brass wedges installed to provide electrical continuity.
2. A torque wrench must be used when installing mechanical joint connections on the tee-head bolts on the restraining devices. Bolt size torque requirements are shown on Table 02555-A.

TABLE 02555-A

BOLT SIZE		TORQUE	
Inches	(mm)	Ft-Lbs	(N-m)
5/8	(16)	45-60	(61-81)
3/4	(19)	75-90	(102-122)
1	(25)	100-120	(136-163)
1-1/4	(32)	120-150	(163-103)

3. Pipe Supports - The CONTRACTOR shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the drawings or specified.
4. All bends, tees, and other fittings shall be backed up with Class C concrete thrust blocks placed against undisturbed earth where firm support can be obtained. Thrust blocks shall be as shown on the typical drawing, then suitable bridle rods, clamps, and accessories to brace the fitting properly shall be provided. Such bridle rods, etc. shall be coated thoroughly and heavily with an approved bituminous paint after assembly or, if necessary, before assembly. Granite blocking with hard wood wedges shall not be acceptable. The REPRESENTATIVE OF THE WATER AND SEWER COMMISSION may permit the use of precast concrete thrust blocks which are equal to the size and bearing area shown on the thrust block detail. If precast blocks are permitted, the fitting must be covered with polyethylene and all voids between the block and fitting and between the block and trench shall be filled with field mixed concrete.
5. Handling and Cutting Pipe - The CONTRACTOR's attention is directed to the fact that ductile iron pipe and the cement lining are brittle. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe or lining, scratching or marring machined surfaces, and abrasion of the pipe coating or lining.
6. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
7. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by and at the expense of the CONTRACTOR before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack.
8. Excavation, bedding, backfill and compaction for water mains, hydrants, services and appurtenances shall conform to the specification for Excavation, Backfilling, and Compacting and the typical water detail sheets.
9. All water main installed with less than 5'-0" of cover shall be insulated with a minimum of 2" rigid rap-around insulation with PVC jacket.

B. Valves and Appurtenances

1. Setting Valves: Valves and valve boxes shall be set plumb and centered with the valve box directly over the valve. Backfill around the valves shall be as specified under Section 02221.
2. All valves shall be carefully erected and supported in their respective positions free from all distortion and strain. Care shall be taken to prevent damage or injury to the valves or appurtenances during handling and installation.
3. All material shall be carefully inspected for defects in workmanship and materials, all debris and foreign material cleaned out of valve openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced at the CONTRACTOR's expense.

C. Hydrants and Appurtenances

1. Setting Hydrants: Hydrants shall be set plumb and centered. The hydrant connecting pipe shall have at least the same depth of cover as the distribution main. The hydrant shall be set upon a slab of stone or concrete not less than 4 inches thick and 15 inches square. The side of the hydrant opposite the pipe connection shall be firmly wedged against the vertical face of the trench with a concrete thrust block, as indicated on the drawings. Backfill around the hydrants shall be as specified under the specification for Excavation, Backfill and Compaction and the Typical Detail Sheets.
2. Hydrants, valves, anchor tees, and valve boxes shall be set plumb and centered with the valve boxes directly over the valves. Earth fill shall be thoroughly compacted around the valve boxes to a distance of 4 feet on all sides of the box, or to the undisturbed trench face, if less than 4 feet. Valves shall have the interiors cleaned of all foreign matter before installation, and shall be inspected in opened and closed positions.
3. All hydrants shall be non-draining or shall have the drain holes plugged.

D. Water Service Connections

1. Water Service Connections: The CONTRACTOR shall furnish all labor, material, and equipment necessary to install water service connections as herein specified. The work shall include all excavation and backfill, in accordance with and the specification for Excavation, Backfill and Compaction and the Typical Detail Sheets.
2. Permanent service connections shall be made after the new water main is completed.
3. Before any temporary or permanent connection is put into service, the CONTRACTOR shall disinfect the piping as specified herein.

PART 4 WATER MAIN TESTING AND DISINFECTION

4.01 WATER MAIN TESTING

A. Field Testing

1. The ductile iron pipe shall be given pressure and leakage tests in sections of approved length. For these tests, the Owner shall furnish a water meter. The CONTRACTOR shall furnish and install a suitable temporary testing plug or cap for the pipeline; all necessary

pressure pumps, test gauges, pipe connections, and other similar equipment; and all labor required; all without additional compensation. The meter and gauge shall be installed by the CONTRACTOR in such a manner that all water entering the section under test will be measured and the pressure in the section indicated, and they shall be kept in use during both tests.

2. The scheduling of pressure and leakage tests shall be as directed by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION, in accordance with AWWA Specification C600.
3. Unless it has already been done, the section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe. If hydrants or blowoffs are not available at high points for releasing air, the CONTRACTOR shall make the necessary excavation and do the necessary backfilling, and the CONTRACTOR shall make the necessary taps and shall plug said holes after completion of the test with brass or bronze plugs.
4. For the pressure test, the CONTRACTOR shall, by pumping, raise the water pressure (based on the elevation at the lowest point of the section under test and corrected to the gauge location) to a pressure in pounds per square inch numerically equal to the class rating of the pipe. If the CONTRACTOR cannot achieve the specified pressure and maintain it for a period of one hour, the section under test shall be considered as having failed to pass the pressure test.
5. Following a successful pressure test, the CONTRACTOR shall make a leakage test by metering the flow of water into the pipe while maintaining in the section being tested a pressure equal to 150% of the average pressure to which the pipe will be subjected under normal conditions of service. This shall be done by pumping.
6. The amount of leakage which will be permitted shall be in accordance with the Specifications for Installation of Cast Iron Water Mains by AWWA C600. Per the following formula:
 - A. Water to be furnished by CONTRACTOR.
 - B. Test Duration: Two (2) hours.
 - C. Test Pressure: One hundred and fifty percent (150%) of maximum operating pressure as determined by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION, or 100 psi minimum, whichever is greater.
 - D. Allowable Pressure Loss: Pressure shall not vary more than 5 psi for the duration of the pressure test.
 - E. Allowable Leakage: Allowable leakage shall be determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200}$$

L = allowable leakage, in gallons per hour.
S = length of pipe tested, in feet.
D = nominal pipe diameter, in inches.
P = average test pressure, in psi (gauge)

- F. Allowable leakage, in gallons per hour, per 1000 feet of pipe line can be determined from the following chart.

Avg. Test Pressure psi	Nominal Pipe Diameter-in.										
	3	4	6	8	10	12	14	16	18	20	24
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80

7. If the section shall fail to pass the pressure test, the leakage test, or both, the CONTRACTOR shall do everything necessary to locate, uncover, even to the extent of uncovering the entire section, and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work.

4.02 DISINFECTION AND FLUSHING

B. Field Disinfection

Chlorination

1. After a section of the main has been tested and found acceptable, it shall be flushed thoroughly by the CONTRACTOR. After completion of the flushing operation, the CONTRACTOR shall disinfect the water mains with a solution consisting of 50 ppm of chlorine in accordance with the AWWA Specifications for Disinfecting Water Mains (C601).
2. A chlorine dosage chart is included in this specification at the end of this section to aid in computing chlorine dosages.
3. Special disinfection procedures, such as soaking or swabbing, approved by the REPRESENTATIVE OF THE WATER AND SEWER COMMISSION, shall be used in connection to existing mains and where the method outlined is not practical.

Dechlorination

1. Following chlorination, the mains shall be flushed again.
2. Following the chlorination period, all treated water shall be flushed from the lines at their extremities, and replaced with water from the distribution system. Bacteriological sampling and analysis of the replacement water shall then be made by the CONTRACTOR in full accordance with the AWWA Manual C601. The CONTRACTOR shall be required to rechlorinate, if necessary, and the line shall not be placed in service until the requirements of the State Public Health Department are met.

END OF SECTION

WATER DEPARTMENT CROSS-CONNECTION CONTROL PROGRAM

PART 1 PURPOSE

- A. To protect the public potable water supply served by the MILFORD WATER AND SEWER COMMISSION from the possibility of contamination or pollution by isolating, within its customers internal distribution system, such contaminants or pollutants which could backflow or backsiphon into the public water system.
- B. To promote the elimination or control of existing cross-connection, actual or potential, between its customers in-plant potable water system, and non-potable systems.
- C. To provide for the maintenance of a continuing program of cross-connection control which will effectively prevent the contamination or pollution of all potable water systems by cross-connection.

PART 2 AUTHORITY

- A. The Federal Safe Drinking Water Act of 1974, and the New Hampshire Code of Administrative Rules, Part Ws 314, Cross-Connections RSA 148-B:2, VI and 148.22, 148.25 & 148.27, Protection of sources of water, the water purveyor has the primary responsibility for preventing water from unapproved sources, or any other substances, from entering the public potable water system.
- B. Schedule for Water Service, Water Department, Milford, NH August 1, 1974, pg 5, Maintenance of Plumbing.

PART 3 RESPONSIBILITY

The SUPERINTENDENT OF WATER UTILITIES shall be responsible for the protection of the public potable water distribution system from contamination or pollution due to the backflow or backsiphonage of contaminants or pollutants through the water service connection. If, in the judgment of the MILFORD WATER AND SEWER COMMISSION, an approved backflow device is required at the town's water service connection to any customers premises, the SUPERINTENDENT OF WATER UTILITIES, or a designated agent, shall give notice in writing to said customer to install an approved backflow prevention device at each service connection to his premises. The customer shall, within thirty (30) days, install such approved device, or devices, at this own expense, and failure or refusal, or inability on the part of the customer to install said device or devices within thirty (30) days, shall constitute a ground for discontinuing water service to the premises until such device or devices have been properly installed.

PART 4 DEFINITIONS

A. Approved

Accepted by the MILFORD WATER AND SEWER COMMISSION or a designated agent as meeting an applicable specification stated or cited in this regulation, or as suitable for the proposed use.

B. Auxiliary Water Supply

Any water supply, on or available, to the premises other than the purveyor's approved public potable water supply.

C. Backflow

The flow of water or other liquids, mixtures or substances, under pressure into the distribution pipes of a potable water supply system from any source other than its intended source.

D. Backflow Preventer

A device or means designed to prevent backflow or back siphonage. Most commonly categorized as air gap, reduced pressure principle device, double check valve assembly, pressure vacuum breaker, atmospheric vacuum breaker, hose bib vacuum breaker, residential dual check, double check with intermediate atmospheric vent, and barometric loop.

1. Air Gap

A physical separation sufficient to prevent backflow between the free-flowing discharge end of the potable water system and any other system. Physically defined as a distance equal to twice the diameter of the supply side pipe diameter but never less than one (1) inch.

2. Atmospheric Vacuum Breaker

A device that prevents back siphonage by crating an atmospheric vent when there is either a negative pressure or sub-atmospheric pressure in a water system.

3. Barometric Loop

A fabricated piping arrangement rising at least thirty-five (35) feet at its topmost point above the highest fixture it supplies, having a "U" bend at the top and returning to the point of origin. It is utilized in water supply systems to protect against back siphonage.

4. Double Check Valve Assembly

An assembly of two (2) independently operating spring loaded check valves with tightly closing shut-off valves on each side of the check valves, plus properly located test cocks for the testing of each check valve.

5. Double Check Valve with Intermediate Atmospheric Vent

A device having two (2) spring loaded check valves separated by an atmospheric vent chamber.

6. Hose Bibb Vacuum Breaker

A device that is permanently attached to a hose bib and which acts as an atmospheric vacuum breaker.

7. Pressure Vacuum Breaker

A device containing one or two independently operated spring loaded check valves and an independently operated spring loaded air inlet valve located on the discharge side of the check or checks. Device includes tightly closing shut off valves on each side of the check valves and properly located test cocks for the testing of the check valve (s).

8. Reduced Pressure Principle Backflow Preventer

An assembly consisting of two (2) independently operating approved check valves with an automatically operating differential relief valve located between the two (2) check valves, tightly closing shut off valves on each side of the check valves, plus properly located test cocks for the testing of the check valves and the relieve valve.

9. Residential Dual Check

An assembly of two (2) spring-loaded, independently operating check valves without tightly closing shut off valves and test cocks. Generally employed immediately downstream of the water meter to act as a containment device.

E. Backpressure

A condition in which the Owner's system pressure is greater than the suppliers system pressure.

F. Back-Siphonage

The flow of water or other liquids, mixtures or substances into the distribution pipes of a potable water supply system from any source other than its intended source caused by the sudden reduction of pressure in the potable water supply system.

G. NHDES

The New Hampshire Department of Environmental Services.

H. Containment

A method of backflow prevention that requires a backflow prevention preventer at the water service entrance.

I. Contaminant

A substance that will impair the quality of the water to a degree that it creates a serious health hazard to the public leading to poisoning or the spread of disease.

J. Cross-Connection

Any actual or potential physical connection between the public water supply and another source of liquids, mixtures, substances or gases constituting a potential source of contamination or pollution.

K. COMMISSION

MILFORD WATER AND SEWER COMMISSION

L. Fixture Isolation

A method of backflow prevention in which a backflow preventer is located to correct a cross-connection at an in-plant location rather than at a water service entrance.

M. Owner

Any person who has legal title to, or license to operate of habitat in, a property upon which a cross-connection inspection is to be made or upon which a cross-connection is present.

N. Person

Any individual, partnership, company, public or private corporation, political or agency of the State Department, agency or instrumentality of the United States or any other legal entity.

O. Permit

A document issued by the MILFORD WATER AND SEWER COMMISSION that allows the use of a backflow preventer.

P. Pollutant

A foreign substance, that if permitted to get into the public water system, will degrade its quality so as to constitute a moderate hazard, or impair the usefulness or quality of the water to a degree which does not create an actual hazard to the public health but which does adversely and unreasonably effect such water for domestic use.

Q. Water Service Entrance

That point in the owners water system beyond the sanitary control of the MILFORD WATER AND SEWER COMMISSION, generally considered to be the outlet end of the water meter and always before any unprotected branch.

R. Superintendent of Water Utilities

The MILFORD WATER AND SEWER COMMISSION or a delegated representative in charge, of the Water Department of the Town of Milford, is invested with the authority and responsibility for the implementation of a cross-connection control program and for the enforcement of the provisions of the Ordinance.

S. Degree of Hazard

The WATER AND SEWER COMMISSION recognizes the difference in the threat to public water system arising from various types of cross-connection. These are classified as follows:

1. Low degree of hazard
If backflow were to occur, the resulting effect on the water supply would be a change in the water's aesthetic quality. The foreign substance must be nontoxic to humans as determined by the United States Environmental Protection Agency (USEPA).
2. High degree of hazard
If backflow were to occur, the resulting effect on the water supply could cause illness or death if consumed by humans. The foreign substance may be toxic to humans either from a chemical, bacteriological or radiological standpoint. The effects of the contamination may result from short or long-term exposure.

PART 5 ADMINISTRATION

- A. The COMMISSION will operate a cross-connection control program, to include the keeping of necessary records, which fulfills the requirements of the COMMISSION's Cross Connection Regulations and is approved by the COMMISSION.
- B. The Owner shall allow their property to be inspected for possible cross-connections and shall follow the provisions of the COMMISSION's program and the COMMISSION's Regulations if a cross-connection is permitted.
- C. If the COMMISSION requires that the public supply be protected by containment, the Owner shall be responsible for water quality beyond the outlet end of the containment device and should utilize fixture outlet protection for that purpose. He may utilize public health officials and/or the Town Building Inspector to assist him in the survey of his facilities, the selection of proper fixture outlet devices, and the proper installation of these devices.

PART 6 REQUIREMENTS

A. COMMISSION

1. On new or renewal plumbing work, the WATER AND SEWER COMMISSION will provide a backflow preventer application for completion by the Owner; will complete on-site evaluation and/or inspect plans in order to determine the type of backflow preventer, if any, that will be required, issue backflow permit, and perform inspection and testing.
2. For premises existing prior to the start of this program, the COMMISSION will perform evaluations and inspections of plans and/or premises and inform the Owner by letter of any corrective action deemed necessary, the method of achieving the correction, and the time allowed for the correction to be made. Ordinarily, thirty (30) days will be allowed; however, this time period may be shortened depending upon the degree of hazard involved and the history of the device(s) in question.
3. The COMMISSION will not allow any cross-connection to remain unless it is protected by an approved backflow preventer for which a permit has been issued and which will be regularly tested to insure satisfactory operation.
4. The COMMISSION shall inform the Owner, by letter, of any failure to comply, by the time of the first re-inspection. The COMMISSION will allow an additional fifteen (15) days for the correction. In the event that the Owner fails to comply with the necessary correction by the time of the second re-inspection, the COMMISSION will inform the Owner by letter, that the water service to the owner's premises will be terminated within a period not to exceed five (5) days. In the event that the Owner informs the COMMISSION of extenuating circumstances as to why the correction has not been made, a time extension may be granted by the COMMISSION but in no case will exceed an additional thirty (30) days.
5. If the COMMISSION determines at any time that a serious threat to the public health exists, the water service will be terminated immediately.
6. The COMMISSION shall have on its staff, or shall have a delegated representative, who is a certified backflow device tester.

B. OWNER

1. The Owner shall be responsible for the elimination or protection of all cross-connections on his premises.
2. The Owner, after having been informed by a letter from the WATER AND SEWER COMMISSION, shall at his expense, install, maintain, and test, or have tested, any and all backflow preventers on his premises.
3. The Owner shall correct any malfunction of the backflow preventer that is revealed by periodic testing, including the replacement of parts or the replacement of the backflow preventer if deemed necessary by the COMMISSION.
4. The Owner shall inform the COMMISSION of any proposed or modified cross-connections and also any existing cross-connections of which the Owner is aware but has not been found by the COMMISSION.
5. The Owner shall not install a bypass around any backflow preventer unless there is a backflow preventer of the same type on the bypass. Owners who cannot shut down operation for testing of the device(s) must supply additional devices necessary to allow testing to take place.

6. The Owner shall install backflow preventers in a manner approved by the COMMISSION.
7. The Owner shall install only backflow preventers approved by the WATER AND SEWER COMMISSION.
8. Any Owner having a private well or other private water source must have a permit if the well or source is cross-connected to the WATER AND SEWER COMMISSION's system. Permission to cross-connect may be denied by the COMMISSION. The Owner may be required to install a backflow preventer at the service entrance if a private water source is maintained, even if it is not cross-connected to the COMMISSION's system.
9. In the event that the Owner installs plumbing to provide potable water for domestic purposes, which is on the COMMISSION's side of the backflow preventer, such plumbing must have it's own backflow preventer installed.
10. The Owner shall be responsible for the payment of all fees for permits, annual or semi-annual device testing, re-testing in the case that the device fails to operate correctly, and second reinspections for non-compliance with the WATER AND SEWER COMMISSION's requirements.
11. The Owner shall maintain a spare parts kit and any special tools required for the removal and reassembly of the device.
12. The Owner is responsible for ensuring that his hot water or any pressurized system is equipped with a safety pressure relief valve.

PART 7 PERMITS

The MILFORD WATER AND SEWER COMMISSION shall not permit a cross-connection within the public water supply system unless it is considered necessary and cannot be eliminated.

- A. Plumbing permits are required for the installation of each backflow prevention device and are obtained from the MILFORD WATER AND SEWER COMMISSION or the Milford Building Inspection Department.
- B. Cross-connection permits that are required for each back-flow prevention device are obtained from the COMMISSION. There is no fee for the initial permit and no fee shall be charged for the renewal of each permit.
- C. Permits shall be renewed every five (5) years and are non-transferable. Permits are subject to revocation and become immediately revoked if the Owner should so change the type of cross-connection or degree of hazard associated with the service.
- D. A permit is not required when fixture isolation is achieved with the utilization of a non-testable backflow preventer.

PART 8 EXISTING IN-USE BACKFLOW PREVENTION DEVICES

Any existing backflow preventer shall be allowed by the COMMISSION to continue in service unless the degree of hazard is such as to supercede the effectiveness of the present backflow preventer, or result in an unreasonable risk to the public health.

PART 9 PERIODIC TESTING

- A. Backflow prevention devices shall be tested and inspected at least semi-annually in high hazard situations and annually in low hazard situations.

- B. Periodic testing shall be performed by the COMMISSION's certified tester or its delegated representative.
- C. The testing shall be conducted during the COMMISSION's regular business hours.
- D. Any backflow preventer that fails during a periodic test will be repaired or replaced. When repairs are necessary, upon completion of the repair the device will be re-tested at Owner's expense to insure correct operation. High hazard situations will not be allowed to continue unprotected if the backflow preventer fails the test and cannot be repaired immediately. In other situations, a compliance date of not more than thirty (30) days after the test date will be established. The Owner is responsible for spare parts, repair devices in an effective means of the Owner insuring that uninterrupted water service during testing or repair of devices and is strongly recommended when the Owner desires such continuity.
- E. Backflow prevention devices will be tested more frequently than specified in A. above, in cases where there is a history of test failures and the COMMISSION feels that due to the degree of hazard involved, additional testing is warranted. Cost of the additional tests will be born by the Owner.
- F. Costs for all device testing will be the responsibility of the Owner of the device. (Reference Section 12 Fees and Charges).

PART 10 RECORDS AND REPORTS

A. Records

The COMMISSION will initiate and maintain the following:

- 1. Master files on customer cross-connection tests and/or inspections
- 2. Master files on cross-connection permits
- 3. Copies of permits and permit applications
- 4. Copies of lists and summaries supplied to the NHDES

B. Reports

The COMMISSION will submit the following to the NHDES:

- 1. Initial listing of low hazard cross-connections on NHDES Low Hazard form X-1 (L).
- 2. Initial listing of high hazard cross-connection on NHDES High form X-1 (H).
- 3. Annual update lists of items 1 and 2 above.
- 4. Annual summary of cross-connection inspections on NHDES form X-2.

PART 11 FEES AND CHARGES

The COMMISSION will publish a list of fees or charges for the following services or permits:

- 1. Testing fees
- 2. Re-testing fees
- 3. Fee for re-inspection

4. Charges for after-hours inspections or tests.

ADDENDUM:

1. RESIDENTIAL DUAL CHECK

Effective the date of the acceptance of this Cross-Connection Control Program for the Town of Milford, New Hampshire, all new residential buildings will be required to install a residential dual check device immediately downstream of the water meter. (Ref. Figures 6 and 7, page 15). This device will be provided by the WATER AND SEWER COMMISSION and its cost will be assumed by the homeowner. Installation of the residential dual check device on a retrofit basis of existing service lines will be performed as deemed necessary by the COMMISSION.

END OF SECTION

COMMUNITY WATER SYSTEMS

PART 1 - GENERAL

- 1.01 This section applies to proposed Community Water Systems within Milford not served by the TOWN OF MILFORD water system. For this regulation, community water systems are defined as water systems serving a continuous residential population of 25 persons or more. Any reference herein to Community Water systems shall refer to this definition.
- 1.02 This specification is intended to supplement New Hampshire Department of Environmental Services - Water Supply & Pollution Control Division (NHDES-WSPCD) regulations for public drinking water systems, including Env-Ws 372 and other applicable standards. In the event of conflict, the more stringent standard shall apply.
- 1.03 Community Water System construction shall not be undertaken or started until approval of TOWN OF MILFORD WATER AND SEWER COMMISSION has been secured.
- 1.04 The TOWN OF MILFORD is in no way responsible for operation, maintenance or repair of Community Water Systems. The entity which shall own the system shall remain solely responsible for water service.

PART 2 - COMMUNITY WATER SYSTEM OWNERSHIP AND OPERATION

- 2.01 Prior to commencing operation, the entity which shall own, operate and maintain the Community Water System shall submit to the MILFORD WATER AND SEWER COMMISSION the following completed documentation:
 - A. Officers of Operating Entity, including:
 - 1. Name and mailing address of operating entity.
 - 2. Name, address and phone number(s) of licensed system superintendent and operator(s).
 - 3. Name, address and phone number(s) of licensed system superintendent and operator(s).

It is the responsibility of the above-named individuals to notify the MILFORD WATER AND SEWER COMMISSION of changes in personnel. The most recently named officer shall be considered as such until the MILFORD WATER AND SEWER COMMISSION is otherwise notified.
 - B. Two complete sets of as-built plans of water distribution system as defined by Env-Ws 372.07.
 - C. Two complete sets of as-built plans of well construction including at least three (3) measured dimensions to fixed and visible points.
 - D. Two complete sets of as-built plans of pump station, control building, and any treatment facilities.
 - E. Two complete sets of manufacturers' Operation and Maintenance Manuals.
 - F. Two complete sets of as-built site and utility plans of the community (e.g. condominium or subdivision) which the system shall serve.
 - G. Two complete sets of well pump test report including all pump rate and water level data.

- 2.02 In the event of an occurrence which may produce or cause a long-term interruption in service, the MILFORD WATER AND SEWER COMMISSION shall be notified.
- 2.03 In the event that any parameter of water quality regulation has been exceeded, or if any indication of a water quality problem exists, the MILFORD WATER AND SEWER COMMISSION shall be notified, and a copy of any supporting information supplied.

PART 3 - WATER SYSTEM

3.01 WATER SUPPLY

- A. Water supply shall be designed in accordance with Env-Ws 372.10, 372.11, 372.12, 372.13, 372.14, and 372.15.
- B. Water supply shall not be derived from surface water sources.
- C. All Community Water Systems which are permitted to provide only one well shall provide reserve area suitable for construction of another well. Reserve area shall include required Sanitary Protective Area as defined in Env-Ws 372.13. Reserve well shall be located as far as possible from the proposed production well.

3.02 PUMP STATION FACILITIES:

- A. All pump stations shall be designed and constructed in accordance with Env-Ws 372.19 and 372.20.
- B. All Pump Station Facilities shall be designed with a standby electric generator to enable operation during electrical failure.

3.03 WATER MAINS:

- A. Water mains shall be designed and constructed in accordance with Env-Ws 372.21.
- B. Water mains shall be located in community roads and accessible areas whenever possible.
- C. Water mains shall be located no closer than 3 feet from any underground utility including electrical, telephone, cable TV, gas, and storm drains.
- D. Gate valves shall be located to provide isolation of branches, and major sections of the system. In-line gate valves shall be located no farther apart than 1500 feet.
- E. Water mains shall be no smaller than six inches in diameter.
- F. Water mains shall be constructed in networks or "loops" wherever possible. Dead ends shall be avoided.

3.04 WATER STORAGE FACILITIES:

- A. Water storage facilities shall be designed and constructed in accordance with Env-Ws 372.17.

PART 4 - MATERIALS AND INSTALLATION

- 4.01 MATERIALS AND INSTALLATION: All materials and installation used in Community Water Systems water works construction shall conform to the requirements defined in Section 02555, Water Distribution System, latest revision, and to Env-Ws 372.08.

END OF SECTION

MOTOR CONTROL CENTER

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnishing motor control center. Transfer switch to be mounted in motor control center are specified in Section 16490.
- B. Installation.

1.02 REFERENCE STANDARDS

- A. NEMA ICS 2 - Motor Control Centers rated 600V and less.
- B. UL 845 - Standard for Motor Control Centers.

1.03 SUBMITTALS

- A. Submit catalog information data in accordance with Division 1, General Requirements.
- B. The CONTRACTOR shall also submit a manufacturer's statement that the variable frequency drive shall meet the requirements of Federal Communication Commission and IEEE as described in paragraph 2.05-B.8 Adequate LC (inductance-capacitor) filters shall be provided as required to meet this criteria.
- C. In addition to the required equipment submittals for this Section, submit to the ENGINEER one set of full size transparencies of time-current curves for all circuit breakers in the motor control center for review. Additional manufacturer's information, recommended trip settings and coordination studies may be submitted in addition to the above.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. New motor control centers:
 - 1. Allen Bradley
 - 3. Cutler-Hammer
 - 4. General Electric
 - 5. Siemens
- B. Substitutions: Products of equal quality, detail, function and performance may be proposed for substitution by following the procedures in Division 1, General Requirements.

2.02 CONSTRUCTION

- A. The motor control center shall be the product of a single manufacturer who shall also be the manufacturer of all the circuit breakers or of all the motor starters included in the motor control center.
- B. The motor control center shall be designed for 480Y/277 volts, 3 phase, 4 wire, 60 Hertz service. Bus bracing shall be 30,000 RMS symmetrical amperes and minimum breaker interrupting rating rms symmetrical amperes shall match the respective MCC bus bracing, unless otherwise noted.
- C. Construction shall be NEMA Class 1, unless otherwise indicated, wiring Type B with NEMA 1 gasketed doors, metal enclosed, free standing, dead front cabinet fabricated from formed sheet

steel. Total height shall not exceed a nominal 90 inches. Circuit breakers shall be coordinated to maximum extent possible.

- D. Motor control center shall provide equipment of type, capacity and trip ratings as shown on the Drawings or otherwise specified.
- E. All sections shall have the same structural features with provisions for the addition of similar sections at the end. Each compartment shall meet NEMA standards for the control equipment installed and units of similar size shall be interchangeable.
- F. Each section shall be provided with a horizontal wiring space which shall line up with a similar space in the adjacent section or sections, with openings between so that wires may be pulled the entire length of the control center. There shall also be provided in each section a vertical wiring space with suitable wiring clamps.
- G. The motor control center shall be designed for against-the-wall floor mounting. All wiring, bus joints, and other mechanical parts requiring tightening or other maintenance shall be accessible from the front.
- H. The motor control center shall have engraved laminated nameplates screwed to the doors of each individual compartment and wiring diagrams pasted inside each door. Compartments containing motor starters shall each have an overload heater selection table pasted inside the door.
- I. The motor control center overall width shall not exceed those dimensions as indicated on the drawings.
- J. Main Circuit Breaker:
 - 1. The main circuit breaker shall be 3-pole, 480 volts, 3-phase, 4-wire service. The short circuit rating shall be 30,000 RMS symmetrical amperes minimum, unless otherwise noted.
 - 2. The main breaker shall be UL listed as service entrance equipment.

2.03 BUS

- A. All buses shall be aluminum; main buses shall be rated as noted but not less than 600 amps, vertical buses not less than 300 amps. All phase buses shall be completely isolated by steel plates or insulating material.
- B. Full length ground bus.
- C. Main and ground lugs.
- D. Neutral pad.

2.04 CIRCUIT BREAKERS

- A. Furnish molded case circuit breakers in motor control center as indicated on the Drawings. Minimum interrupting capacity 30,000 RMS symmetrical amps as indicated on the Drawings unless otherwise noted. Breakers shall be fully rated and series ratings will not be accepted.

2.05 VARIABLE FREQUENCY DRIVES

- A. Listing:
 - 1. Variable frequency drive shall be listed by Underwriters Laboratories (UL).

B. General:

1. Pump applications, constant torque, sized to match motor nameplate rating.
2. Motor type - standard NEMA design B.
3. The drive shall not require an isolation transformer, even if motors are located in a damp area.
4. All components shall include original manufacturer's identification and part number.
5. High power factor input with minimal line distortion, notching or harmonics.
6. Basic drive design shall be pulse width modulated with carrier frequency greater than 10 KHZ.
7. All drives shall be subjected to a 48-hour burn-in test.
8. The drive shall comply with Federal Communications Commission requirements under Part 15 Rules for Radio Frequency Interference and IEEE 519 for maximum harmonic distortions. (See Table Below)

Maximum Harmonic Current Distortion in Percent of Fundamental						
Harmonic Order (Odd Harmonics)						
	<11	11<h<17	17<h<23	23<h<35	35<h	THD
<20	4.0*	2.0*	1.5*	0.6*	0.3*	5.0*
20-50	7.0	3.5	2.5	1.0	0.5	8.0
50-100	10.0	4.5	4.0	1.5	0.7	12.0
100-1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

- Even Harmonics are limited to 25% of Odd Harmonics Above.

* All power generation equipment is limited to these values of Current Distortion, regardless of I_{sc}/I_L .

- I_{sc} = Maximum short Circuit Current at Point of Common Coupling.

- I_L = Maximum Load Current (Fundamental Frequency) at Point of Common Coupling.

- THD = Total Harmonic Distortion.

C. Environmental:

1. Ambient operating temperature range - 10 to 40EC.
2. Humidity: 5 to 95%, noncondensing.
3. Altitude: 0 to 3300 feet above sea level.

D. Electrical:

1. Input line voltage: 480 volts, 3-phase, 60 Hz with +/- 10% voltage fluctuations.
2. Motor nameplate voltage: 460 volts, 3-phase, 60 Hz.
3. Output frequency range: 0 to 60 Hz.
4. Minimum drive efficiency: 95% at 100% speed.
5. Current rating: 110% (min) output rated current continuous at full speed, 150% for one minute.
6. Power loss ride through: 16 ms.

7. Input line fuses.
 8. External control circuit voltage: 120 V AC, maximum.
- E. The drive shall include the following protective features with status indicators:
1. Overvoltage.
 2. Undervoltage.
 3. Overcurrent.
 4. Ground fault.
 5. Overtemperature.
 6. Phase loss/blown fuse.
 7. Running overload protection.
 8. Common alarm contact for external user.
 9. Line circuit breaker.
 10. Line side harmonic filters mounted inside the MCC enclosure as shown on the one line diagram. The units can be mounted above the MCC, supported from the wall if adequate space exist. Size as required by the manufacturer. The harmonic traps shall be manufactured by TCI or approved equal.
- F. The power circuit design shall be such that the following conditions will not damage the drive:
1. Single or three-phase fault from line-to-line or line-to-ground.
 2. Opening of all three phases during operation by disconnect switch at motor location.
- G. Indicator light safety feature shall indicate when DC bus is energized and capacitors are charged.
- H. Internal calibration adjustments:
1. Minimum speed.
 2. Maximum speed.
 3. DC boost.
 4. Acceleration/deceleration rates.
 5. Stop mode (ramp or coast).
 6. Automatic restart after fault trip with lockout after five attempts to restart.
 7. Anti-windmilling adjustable brake time.
 8. Adjustable volts/Hertz.
- I. Unit mounted operator controls:
1. Drive-bypass selector switch.
 2. Hand-Off-Auto selector switch.
 3. Speed adjust potentiometer.
 4. Indicating speed meter.
 5. Power ON light.
 6. Alarm reset switch.
 7. VFD and bypass lights.
 8. Pump on/off lights.
 9. Speed local-remote selector switch.
 10. Motor high temp. light.
 11. All pilot lights shall be of push-to-test type or, provided with lamp test button.
 12. Motor run time display.
- J. Provision for remote external controls:
1. Two wire ON-OFF control - VFD.
 2. Speed adjust, analog input (4-20MADC).
 3. Refer to drawings for wiring diagrams.
 4. Motor overtemperature switch input.

- K. Where indicated, a bypass contactor or solid-state starter shall be provided for full speed operation of the pump should the drive fail to operate.
- L. The VFD associated hardware shall be housed inside MCC sections as indicated on the Drawings. Static filters shall be provided with the drive enclosure to prevent the dust from entering the drive assemblies.
- M. Functional Description: The drive shall start locally or remotely from the MCC. In manual mode, the speed shall be adjusted locally utilizing potentiometer. The speed selector switch shall be on "local" mode. In automatic mode, the drive shall be started from a start signal from the main Control Panel PLC.

PART 3 EXECUTION

3.01 MOTOR CONTROL CENTER

- A. Mount on a 4-inch concrete subbase as indicated on the Drawings.
- B. Maintain in an upright position at all times. Lifting shall be only at the top mounted lifting angle.
- C. Protect against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by the manufacturer of the control center.
- D. Provide a factory representative to inspect completed installation and provide start-up service.
- E. Ground the motor control center ground bus.
- F. Vacuum clean all interior equipment.

3.02 TESTS

- A. The motor control center shall be tested in the manufacturer's plant. The test shall consist of manufacturer's standard factory tests.
- B. Field testing of control center shall also include the following:
 - 1. Operational test on at least one of each type of selected circuit breakers, starters and contactors. Control wiring shall be energized and electrically operated devices shall be electrically operated in both normal and test position.
 - 2. Operation of all protective relays shall be tested by manually operating relay with its control circuit energized to demonstrate that the relay will trip its associated circuit breaker(s) or other control device(s).
 - 3. Operation of all ground detecting system shall be tested with the systems energized and by simulating faults on each line.
 - 4. The CONTRACTOR shall submit a manufacturer's statement to the effect that variable frequency drive is compatible with associated pump furnished by others. If the variable frequency drive fails to operate the pump or blower at full rated load conditions, the CONTRACTOR shall furnish and install new correctly sized drive at no additional cost to the OWNER.
 - 5. The CONTRACTOR shall also submit a manufacturer's statement that the variable frequency drive shall meet the requirements of Federal Communication Commission and IEEE as described in paragraph 2.05-B.8.

- B. The following minimum test and checks shall be made on-site before energizing the motor control center:
 - 1. Megger terminals and buses for grounds after disconnecting devices sensitive to megger voltage.
 - 2. Install overload heaters based on actual nameplate current (adjusted for power factor correction capacitors, if provided).
 - 3. Check all mechanical interlocks for proper operation.
- C. Training: Provide one full day vender's on site training and start-up supervision.

END OF SECTION

WATER PUMP STATION - PUMPING EQUIPMENT

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The work of this section includes the furnishing and installation of pumps, including motors and appurtenances.
- B. Start-up and four hour performance tests of all pumping equipment.

1.02 SUBMITTALS

- A. Pump curves shall be submitted including information on the sizes required, efficiency, HP required, TDH, GPM, RPM, dimensions, materials, and motor data.
- B. Shop drawings showing details of pump assembly and installation details and procedures, materials, accessories, dimensions and all appurtenant wiring and plumbing.
- C. A "Certified Factory Curve" indicating the results of a factory test shall be accepted before the pump is delivered.
- D. Pump Operation and Maintenance Manuals: Submit copies of operation and maintenance manuals to include the following:
 - 1. General - equipment function, description and normal and limiting operating characteristics.
 - 2. Installation instructions - assembly procedures and alignment and adjustment procedures.
 - 3. Operation instructions - start-up procedures, normal operating conditions, emergency and normal shutdown procedure.
 - 4. Lubrication and maintenance instructions.
 - 5. Troubleshooting.
 - 6. Parts list and predicted life of parts subject to wear.
 - 7. Drawings - cross-sectional view, assembly and wiring diagrams.
 - 8. Performance curves for the design conditions specified.

1.03 END SUCTION PUMPS

- A. Pump
 - 1. Impellers shall be of cast bronze of the enclosed type secured to a stainless steel pump shaft with steel taper locked bushings and bronze lock nuts. Impellers shall be polished.

2. Pump shaft shall be turned and ground stainless steel having a chromium content not less than 12%.
3. The following information shall be provided for the pumps proposed for use at each pump station:
 - GPM
 - Pump Size (max.) suction
 - Pump Efficiency (min.)
 - Pump Size (discharge)
 - RPM (max.)
 - TDH
4. Pump shall be hydraulically and dynamically balanced and shall operate vibration free.
5. Pumps shall be self priming.

1.04 SERVICE CONDITIONS

- A. Pumps may require variable frequency drives and shall be designed to operate at an acceptable level of efficiency as determined by the COMMISSION.

PART 2 PRODUCTS

2.01 GENERAL

- A. Workmanship and the method and materials of construction shall conform to the best practice and highest standards applicable for the design use as specified, and in accordance with AWWA E101 unless otherwise specified herein.

2.02 MANUFACTURERS

- A. Pump manufacturers shall certify proof of successful operating experience during the last ten years of five installations of equipment comparable to that specified herein.
- B. Centrifugal pumps shall be manufactured by Aurora Pump, N. Aurora, Illinois, Peerless Pumps, Indianapolis, Indiana, Worthington Pumps, Taneytown, Maryland or approved equal.
- C. Motors shall be U.S., General Electric, or approved equal.

2.03 MOTORS FOR CENTRIFUGAL PUMPS

- A. Motors shall be 3-phase, 60 Hz, 480 volt, High Efficient Design for use with adjustable frequency power supplies. Motors shall be performance matched with the pumps and drives specified. Motors shall be rated for operation at 40 degrees centigrade at a 1.15 service factor for constant speed and 1.0 service factor for variable speed.
- B. All motors shall conform to the latest applicable requirements of NEMA, IEEE, ANSI and NEC standards.
- C. The motors shall be Open Protected Enclosure, Mill and Chemical Duty, High Efficient Design, Cast Iron Construction, NEMA Design B, Class B insulation with the following minimum features:
 1. Cast iron conduit boxes, diagonally split, neoprene gaskets, rotatable 360 degrees in 90 degree increments.
 2. Grounding clamp in conduit box.

3. Anti-friction bearings, open bearing design, with a PLS Lubrication System.
 4. Removable lifting lug.
 5. Permanently numbered non-wicking leads.
 6. Lead separator between motor frame and conduit box.
 7. Zinc plated hardware.
 8. Stainless steel nameplate.
 9. Stator winding shall be copper construction.
 10. Stator and rotor completely epoxy coated for corrosion protection.
- D. Each motor shall be designed for the highest efficiency available standardly in the marketplace. The system shall have the following guaranteed efficiencies.
1. NEMA nominal efficiency: 94.1
 2. Minimum guaranteed: 93.0
 3. Power factor: 86.7 or higher.
 4. Controller efficiency

2.04 VARIABLE FREQUENCY DRIVE CONTROLLER

- A. A Variable Frequency Drive Controller (VFD) may be required by the COMMISSION and be compatible to the equipment in this section.

2.05 PRESSURE GAUGES

- A. The Contractor shall furnish and install pressure gauges on the suction and discharge pipes of Pump Nos. 1 through 3 with snubbers, bleed blocks, nipples and any other necessary appurtenances and the accuracy shall be within $\frac{1}{2}$ of one percent of full scale.
- B. They shall be black metal, round case, 4-1/2 inch diameter with threaded rings, and shall have phosphor bronze Bourdon tube elements with bottom connected $\frac{1}{4}$ inch N.P.T. male threads.
- C. They shall have stainless steel rack and pinion movements, black pointers with micrometer adjustments and white plastic dials with black figures.
- D. The gauges shall have a pressure range of 0 to 150 psi or higher if required. All gauges shall have readings incremented in both feet and psi. Snubbers shall be equal to Campbell micro bean pulsation dampers.

2.06 MAINTENANCE MATERIALS

- A. The following spare parts shall be furnished with each of the complete pumps:
1. One (1) set volute gaskets.
 2. Two (2) sets for all "O" rings and packing.

PART 3 EXECUTION

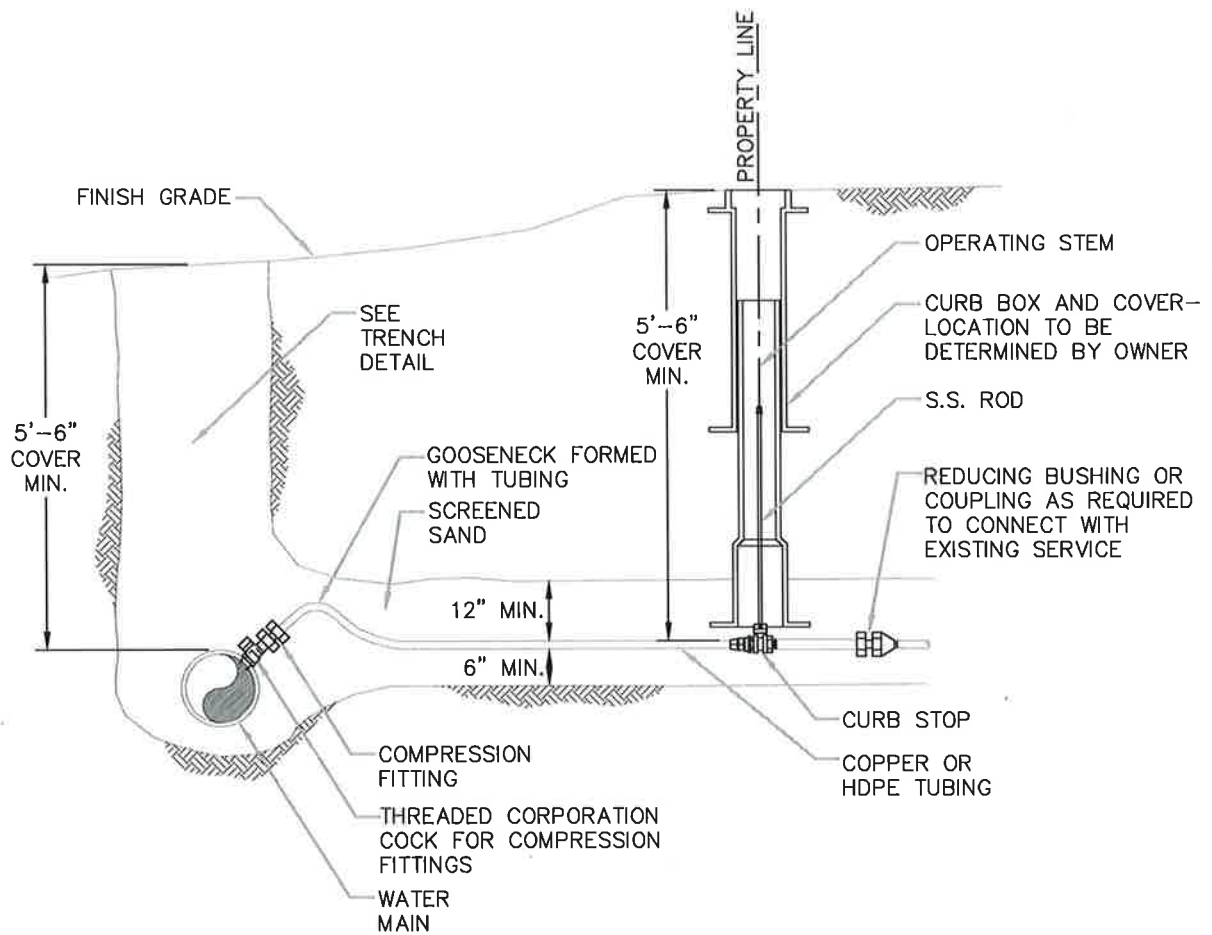
3.01 PUMP INSPECTION AND TESTING

- A. After acceptance of pump shop drawings, factory performance test data will be submitted for review on each pumping unit. Tests shall be witnessed and certified by a licensed Professional Engineer not employed by the pump manufacturer and by a representative of the COMMISSION. Tests shall be in accordance with the standards of the Hydraulic Institute including head, capacity, brake horsepower and pump efficiency. Pumps shall not be shipped prior to submittal of the factory tests to the COMMISSION.
- B. After all pumps have been completely installed, conduct in the presence of a representative of the COMMISSION, such tests as are necessary to indicate that pump efficiency and discharge conform to the Specifications. Field tests shall include all pumps included under this section. Contractor shall supply all oil, grease, electric power, water and all other material necessary to complete the field tests.
- C. If the pump performance does not meet the Specifications, corrective measures shall be taken by the Contractor, or pumps shall be removed and replaced with pumps which satisfy the conditions specified. A 24-hour operating period of the pumps will be required before acceptance. During this 24-hour operating period, the Contractor shall supply all power necessary.
- E. The pumps shall be designed and constructed to avoid the generation of objectionable noise or vibration. The sound pressure level at full load shall not exceed 90 (A Scale) decibels above 300 cycles when measured at a point not exceeding 5 feet from the motor. Mufflers or external baffles will not be accepted. When operating at any point between no-load and full load, the vibration measures in a horizontal plane at the top of the motor shall not exceed 5 mils displacement from peak to peak.
- F. Mount on frame and connect motors to be supplied under another section of these specifications to pump in accordance with all manufacturers' instructions.

END OF SECTION

WATER CONSTRUCTION DESIGN DETAILS

REV.	DESCRIPTION	DATE
FIGURE:	W-1	A

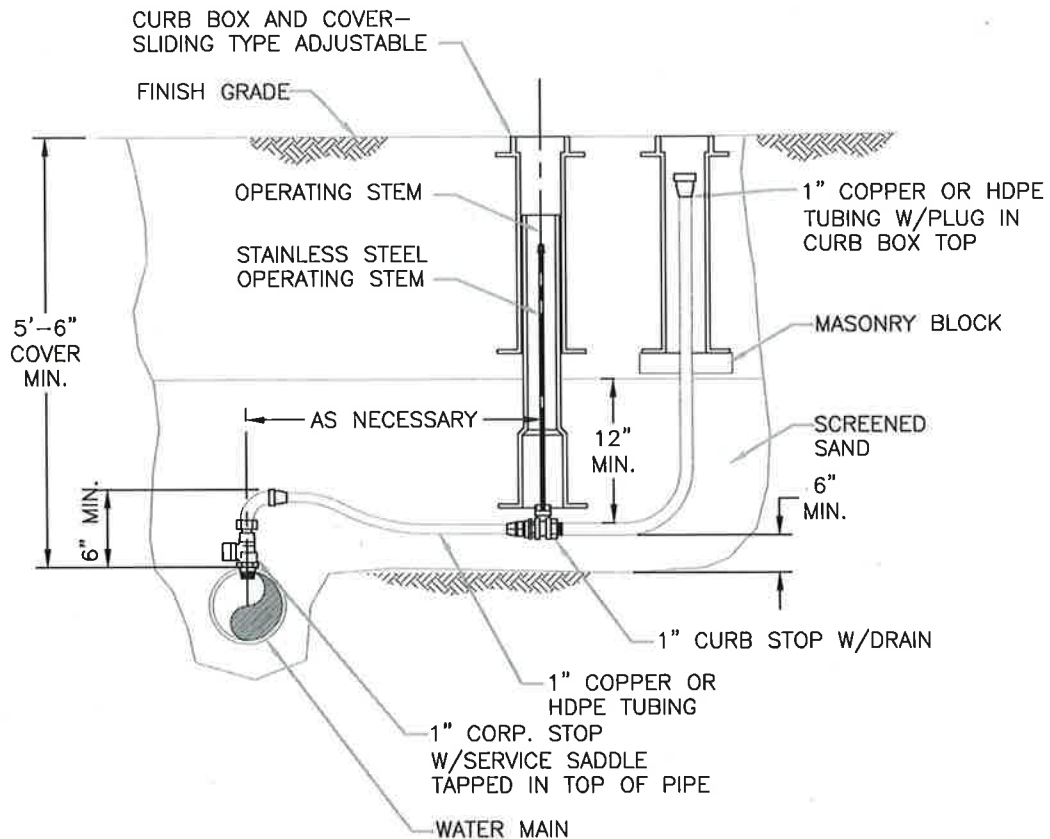


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CHECKED BY:	R.L.
APPROVED BY:	R.L.
SCALE:	AS SHOWN
DATE:	NOV. 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS

**TYPICAL SERVICE CONNECTION
DETAIL**

REV.	DESCRIPTION	DATE
FIGURE:	W-2	A

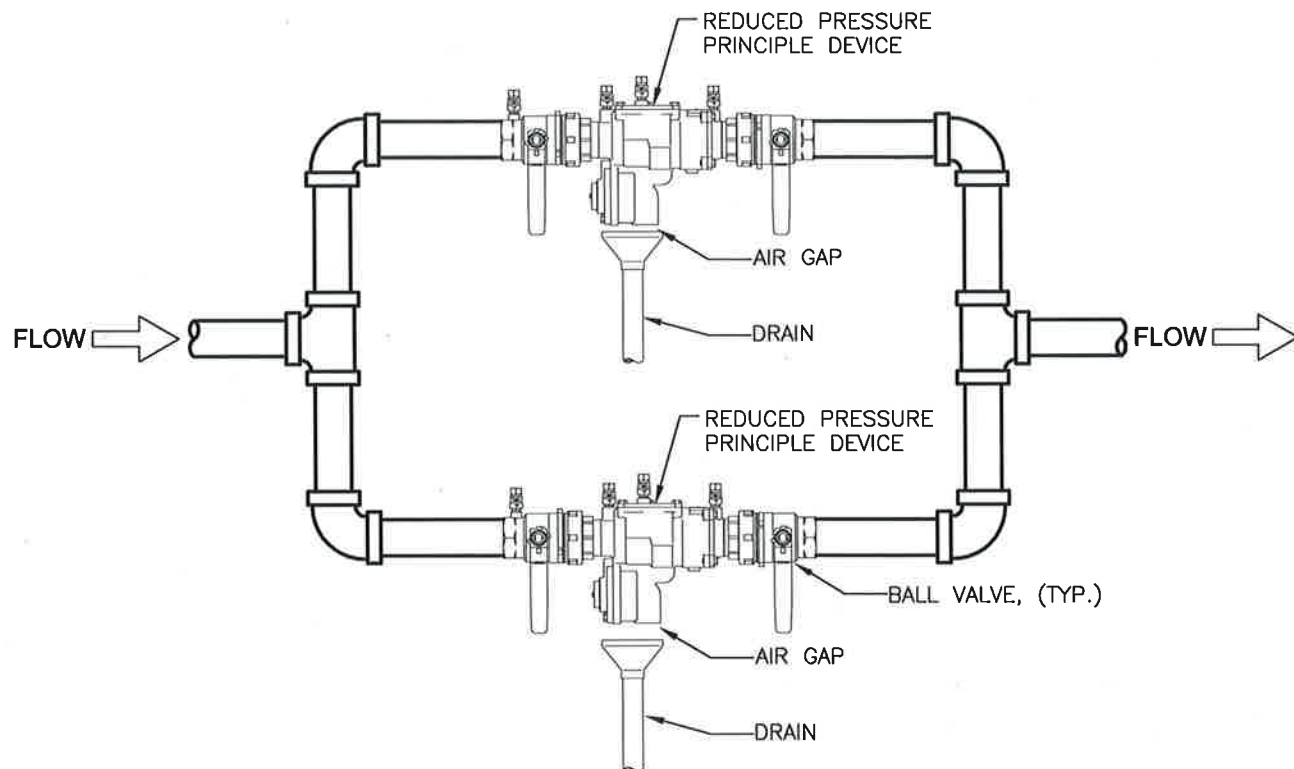


DRAWN BY:	D.K.P.
CHECKED BY:	R.L.
APPROVED BY:	R.L.
SCALE:	AS SHOWN
DATE:	NOV. 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS

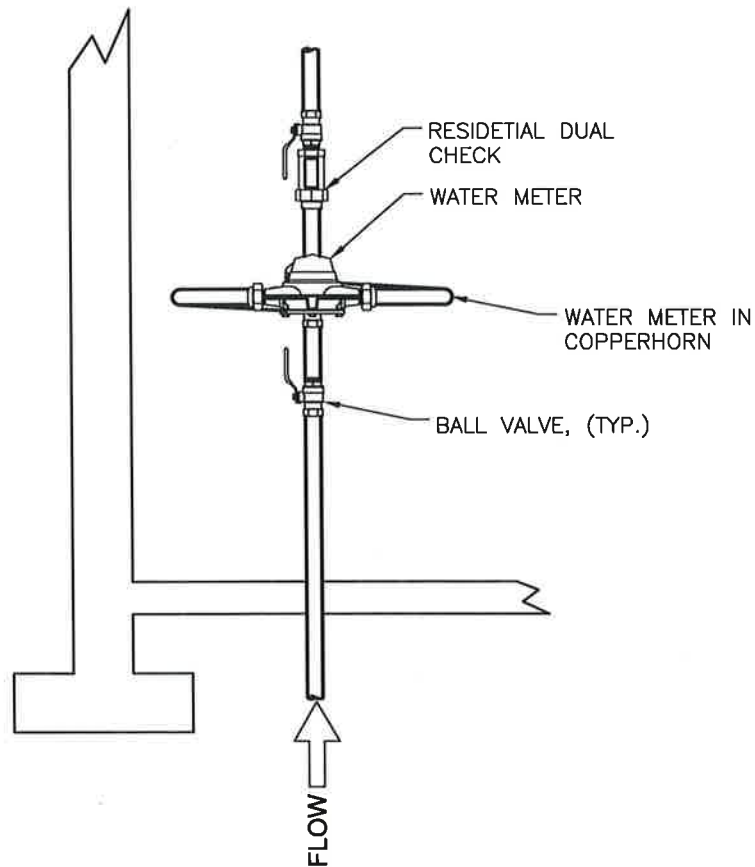
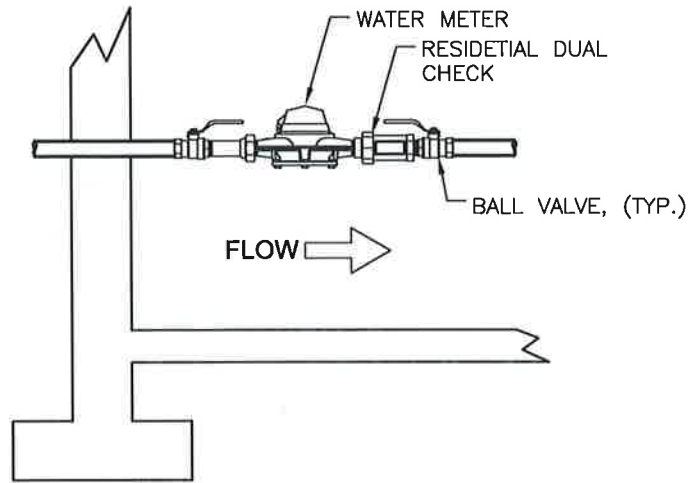
CHLORINE INJECTION CONNECTION DETAIL

REV.	DESCRIPTION	DATE
FIGURE:		W-3 A



NOTE: DEVICES TO BE SET A MIN. OF 12" AND A MAX. OF 30" FROM THE FLOOR AND 12" FROM ANY WALL.

DRAWN BY:	D.K.P.	TOWN OF MILFORD, NEW HAMPSHIRE DESIGN SPECIFICATIONS				
CHECKED BY:	R.L.					
APPROVED BY:	R.L.					
SCALE:	AS SHOWN					
DATE:	NOV. 2003	TYPICAL BYPASS CONFIGURATION REDUCED PRESSURE PRINCIPLE DEVICES		REV.	DESCRIPTION	DATE
				FIGURE:	W-5	A

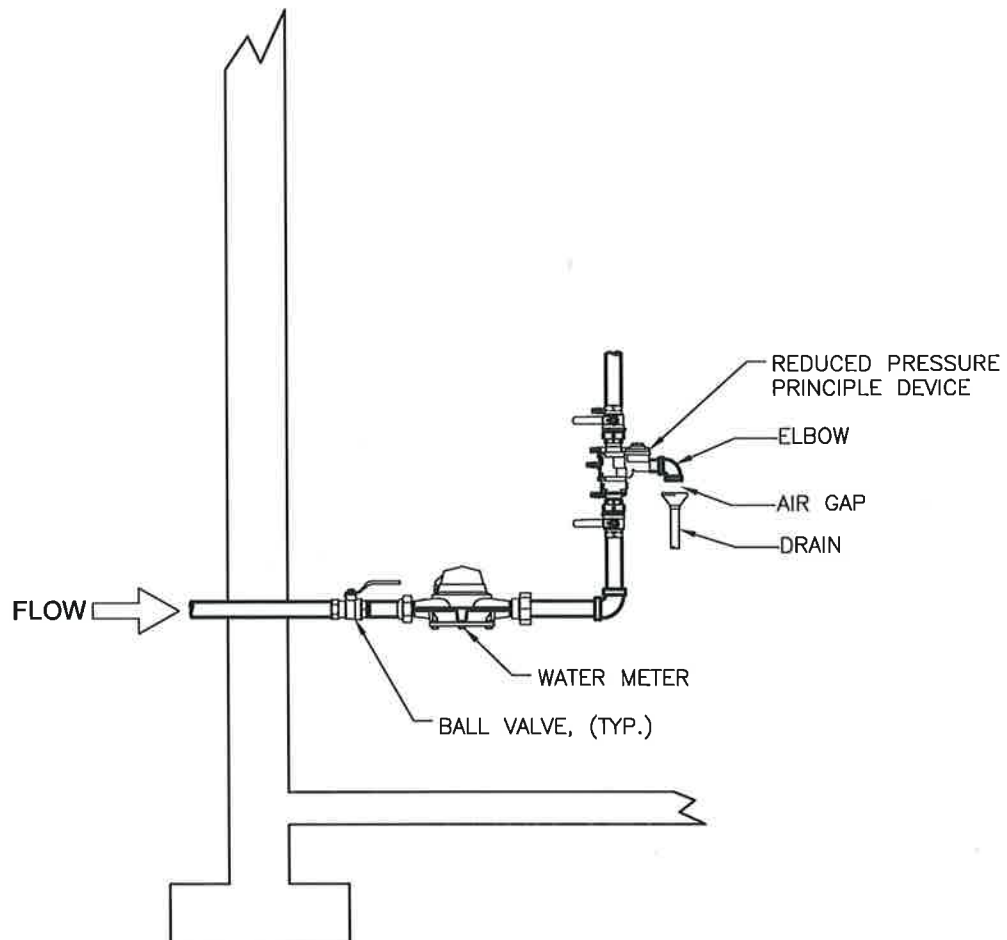


DRAWN BY:	D.K.P.
CHECKED BY:	R.L.
APPROVED BY:	R.L.
SCALE:	AS SHOWN
DATE:	NOV. 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS

TYPICAL RESIDENTIAL DUAL CHECK WITH STRAIGHT SET AND COPPERHORN

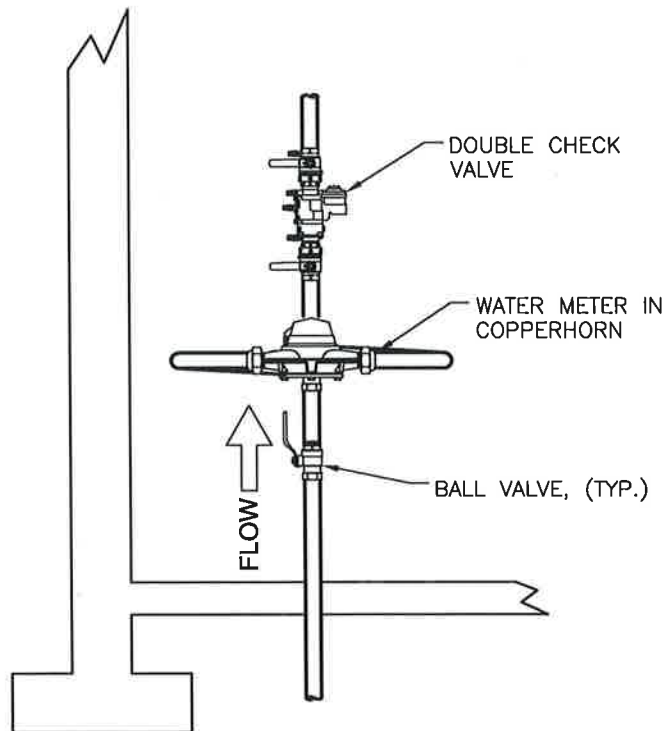
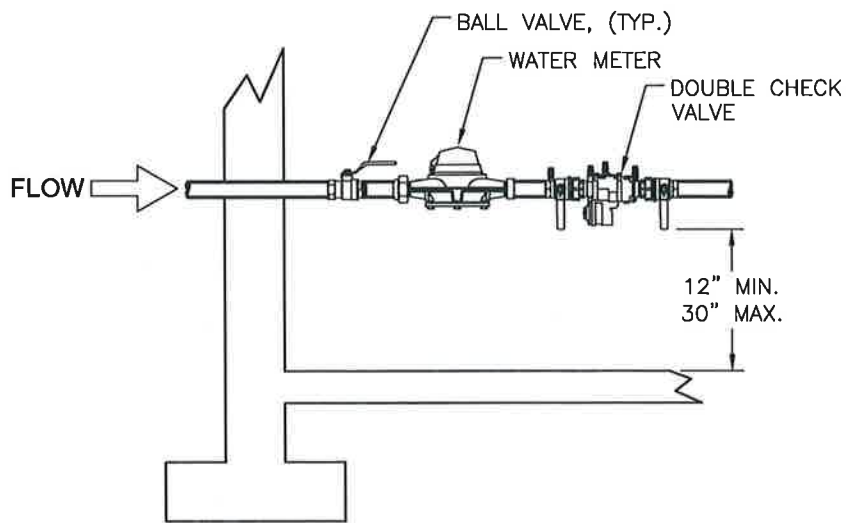
REV.	DESCRIPTION	DATE
FIGURE:	W-6	A



NOTE:

1. REFER TO MANUFACTURERS INSTALLATION DATA FOR VERTICAL MOUNT.
2. UNIT TO BE SET AT A HEIGHT TO PERMIT READY ACCESS FOR TESTING AND SERVICE.
3. VERTICAL INSTALLATION ONLY TO BE USED IF HORIZONTAL INSTALLATION CANNOT BE ACHIEVED.

DRAWN BY: D.K.P.	<p>TOWN OF MILFORD, NEW HAMPSHIRE DESIGN SPECIFICATIONS</p> <p>TYPICAL REDUCED PRESSURE PRINCIPLE DEVICE VERTICAL INSTALLATION</p>			
CHECKED BY: R.L.				
APPROVED BY: R.L.				
SCALE: AS SHOWN		REV.	DESCRIPTION	DATE
DATE: NOV. 2003		FIGURE:	W-7	A



NOTE:

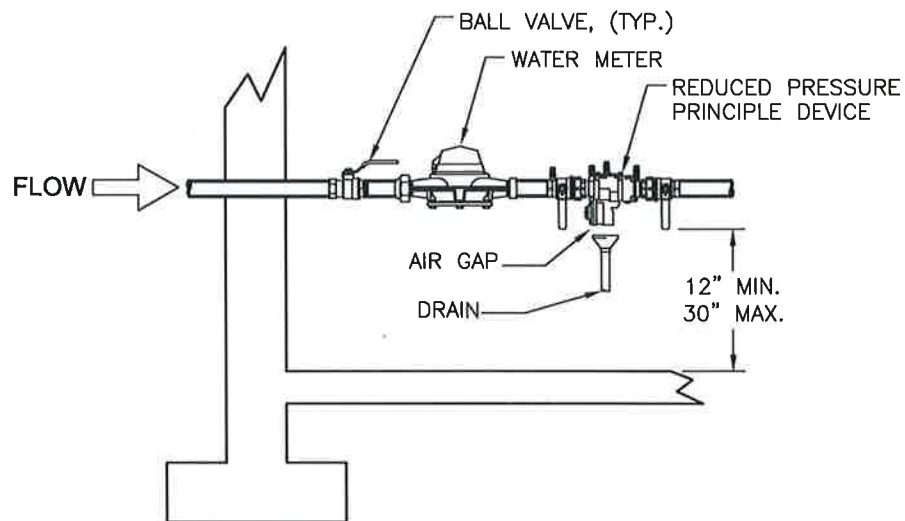
1. UNIT TO BE SET AT A HEIGHT TO PERMIT READY ACCESS FOR TESTING AND SERVICE.
2. VERTICAL INSTALLATION ONLY TO BE USED IF HORIZONTAL INSTALLATION CANNOT BE ACHIEVED.

DRAWN BY:	D.K.P.
CHECKED BY:	R.L.
APPROVED BY:	R.L.
SCALE:	AS SHOWN
DATE:	NOV. 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS

**DOUBLE CHECK VALVE HORIZONTAL
AND VERTICAL INSTALLATION**

REV.	DESCRIPTION	DATE
FIGURE:	W-8	A



NOTE:

DEVICE TO BE SET 12" MIN. FROM WALL.

DRAWN BY:	D.K.P.
CHECKED BY:	R.L.
APPROVED BY:	R.L.
SCALE:	AS SHOWN
DATE:	NOV. 2003

TOWN OF MILFORD, NEW HAMPSHIRE
DESIGN SPECIFICATIONS

**REDUCED PRESSURE PRINCIPLE DEVICE
HORIZONTAL INSTALLATION**

REV.	DESCRIPTION	DATE
FIGURE:	W-9	A

REV.	DESCRIPTION	DATE
FIGURE:	W-10	A