

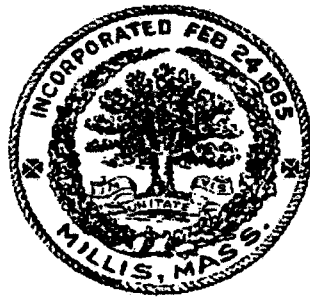
SEWER CONSTRUCTION GUIDELINES

Governing Sewer Work

in

**THE TOWN OF
MILLIS, MASSACHUSETTS**

EFFECTIVE OCTOBER 1992
(REVISED JULY 2007)



Department of Public Works
7 Water Street
Millis, MA 02054
(508)-376-5424
Fax: (508)-376-2442

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SECTION 1 AUTHORITY

The Board of Selectmen of the town of Millis, Massachusetts has adopted these guidelines governing the design and construction of sewers within the Town.

SECTION 2 GENERAL

A. DEFINITIONS

For the purpose of the guidelines, the following shall have the meaning hereunder assigned to them:

Applicant: The person who applies for the approval of a proposed sewer extension or connection. An applicant must be the owner of record who is requesting the extension or connection. An agent or his assigns may act for an owner provided that written evidence of such fact is submitted. A list of the stockholders and officers and a certified copy of the corporation resolution conferring authority to execute and deliver documents binding upon the corporation shall be submitted by every corporate applicant.

Department: The Department of Public Works

Final Plan: A final plan of the proposed sewer delineating existing information, utilities and proposed sewers. Plan shall be drawn in ink on polyester film (4 mil mylar, double matte) and prints thereof.

Profile: A complete and accurate representation of the finished vertical profile of proposed sewers to be constructed, drawn on plan/profile polyester film and prints thereof; on the plan portion, there shall be a plan of the sewer with stationing corresponding to the stationing on the profile.

Record As-Built Plan: A plan/profile, drawn on polyester film with prints thereof, showing the actual location and elevation of all improvements installed and stamped by a Massachusetts Registered Professional Engineer.

B. SUBMISSION OF CONSTRUCTION DRAWINGS & SPECIFICATIONS

All requests for sewer extension/connections shall be filed with the appropriate application forms and required documentation in the Department's office where required in these guidelines.

To be complete and properly submitted, each application must have all the required documentation and the required filing fee. The Department is empowered to reject, or return any application he deems to be non-conforming to the requirements, and shall specify those reasons, in writing, to the applicant.

Plans which have been properly submitted will be reviewed by the Town Sewer Consultant.

C. FEE SCHEDULE

Permit Fee (See Appendix B)

SECTION 3 PROCEDURES FOR APPROVAL OF SEWER

A. SUBMITTALS

Any person who desires approval of a sewer extension shall submit five copies of the following to the Department.

- a) The plan drawing
- b) Application Form
- c) Filing Fee as retainer for consultant to review and comment on documents.

B. PLANS AND SPECIFICATION CONTENTS

The sewer plans shall be prepared by a registered professional engineer and shall be clearly and legibly drawn in black ink upon mylar. The plan shall be at a scale of 1"=40', 1"=4' vertical or other such scale may be acceptable to show details clearly and adequately. Sheet sizes shall be 24"x36". The sewer plans shall contain the following:

- a) A title stating the date, scale, bench mark; name and address of owner, engineer; name of project, if any; names of streets.

- 1. Sewer Mains: An applicant shall show the size and location of the existing sewer facilities which the proposed system will tie into and shall put them on Preliminary and Definitive Plans, and show that the existing system will support the new addition to the system. Where adjacent property is not sub-divided provision shall be made for proper projection of the system by continuing appropriate sewer mains to the exterior boundaries of the subdivisions at such size and grade that may be deemed necessary by the Director of Public Works. Sewer lines and related equipment shall be constructed to serve all lots on each street in the subdivision, whether or not there is a building thereon. In some instances an applicant will be required to bring a sewer service to the property line of abutting lots of a subdivision. Before construction begins the Department may require that the existing sewer be T.V. scoped and studied for needed repairs and to upgrade the existing system by the applicant. Before a new development is approved, the Department of Public Works requires applicants to have the new sewer T.V. scoped and studied for needed repairs.

- b) Geographical Features

- 1. Topography and Elevations: Existing or proposed streets and all streams or water surfaces shall be clearly shown. Contour lines at suitable intervals should be included.

- 2. Streams: The direction of flow in all streams, and high and low water elevations of all water surfaces at sewer outlets and overflows shall be shown.

- 3. Boundaries: The boundary lines of the municipality and the sewer district or area to be sewered shall be shown.

- c) Location and ownership of abutting property.

- d) Location and character of all rights of way, or other easements existing or proposed.

e) Location of all permanent monuments properly identified as to whether existing or proposed.

f) Location of existing and proposed utilities which are in the proximity of the sewer.

g) Details showing sewer trench, manholes, concrete encasement, services, etc.

h) Location of streets and sewers. Line of ground surface, size, material and type of pipe, length between manholes, invert and surface elevation at each manhole, and grade of sewer between each two adjacent manholes. All manholes shall be numbered on the plan and correspondingly numbered on the profile.

Where there is any question of the sewer being sufficiently deep to serve any residence, the elevation and location of the basement floor, or slab elevation shall be plotted on the profile of the sewer which is to serve the house in question. The engineer shall state that all sewers are sufficiently deep to serve adjacent basements except where otherwise noted on the plans.

Locations of all special features such as depressed sewers (inverted siphons), concrete encasements, elevated sewers, etc.

All known existing structures and their material construction above and below ground which might interfere with the proposed construction, particularly water mains, gas mains, storm drains, etc.

i) Where unusual site conditions require additional details where the applicant is proposing a unique construction solution or where the consultant or DPW requests additional information, details shall be submitted by the applicant. Special detail drawings, made to a scale to clearly show the nature of the design, shall be furnished to show the following particulars:

1) All stream crossings and sewer outlets, with elevations of the stream bed and of normal and extreme high and low water levels.

2) Details of all special sewer joints and cross-sections.

3) Details of all sewer appurtenances such as manholes, inspection chambers, depressed sewers (inverted siphons), overflows, regulators, tide gates and elevated sewers.

j) Complete technical specifications for the construction of sewers, waste water pumping stations, and all appurtenances, shall accompany the plans.

The specifications accompanying construction drawings shall include, but not be limited to, all construction information not shown on the drawings which is necessary to inform the builder in detail of the design requirements as to the quality of materials, workmanship and fabrication of the project. They shall also include: the type, size, strength, operating characteristics and rating of equipment; the complete requirements for all mechanical and electrical apparatus, wiring, and meters; laboratory fixtures and equipment; operating tools; construction materials, special filter materials such as stone, sand or gravel; installation specifications for sewers; miscellaneous appurtenances; chemicals when used; instructions for testing materials and equipment as necessary to meet design standards; and operating tests for the completed works and component units.

C. REVIEW BY TOWN SEWER CONSULTANT

The consultant shall review the plans submitted and comment on their completeness and acceptability to the Town. The consultant shall recommend acceptance to the Town once in conformance with design and construction standards. Review is based upon all standards herein and DEP guidelines, Guidelines for Design of Wastewater Treatment Works, TR16 requirement, federal guidelines and Town sewer regulations.

D. APPROVAL

The consultant may give approval with or without modifications. Such approval does not constitute approval from the Town but does facilitate the procedure in securing final approval of the Town.

SECTION 4 DESIGN STANDARDS

A. DESIGN GUIDELINES

a) GRAVITY SEWER MAINS

Minimum Size: No public gravity sewer shall be less than eight inches in diameter.

Depth of cover: In general, sewers should be designed deep enough to drain basement fixtures and to prevent freezing. Insulation shall be provided for sewers that cannot be placed at a depth sufficient to prevent freezing.

Critical Depths

Of Cover: Sewers designed with a depth of cover of thirteen vertical feet or greater shall be constructed of Class 52 - ductile iron pipe. For material specifications refer to the "Water Main Construction Guidelines" for the Town of Millis.

Sewers designed with a depth of cover of four vertical feet or less may be required to be constructed of Class 52 - ductile iron pipe if constructed under a traveled way. For material specifications refer to the "Water Main Construction Guidelines" for the Town of Millis.

Materials: All materials shall be new and in accordance with Section 4 "Construction Specifications".

Bedding: Trench specifications shall be as specified in Section 4 "Standard Specifications and in Appendix A "Standard Details"

Slope: All sewers should be so designed and constructed to give a velocity when flowing full of not less than 2.0 feet per second based on Manning's formula using an "n" value of 0.013 constant with depth. Use of other "n" values may be permitted by the reviewing agency if deemed justifiable on the basis of research or field data presented. The following minimum slopes may be used only if absolutely necessary because of grade restrictions.

Sewer Size (Inches)	Minimum Slope (Feet/Foot)
8	0.004
10	0.0028

12	0.0022
14	0.0017
15	0.0015
16	0.0014
18	0.0012
21	0.0010
24	0.0008

Increasing Size: When a sewer joins one of a large diameter, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient.

Separation of
Sewers:

Whenever possible, a minimum ten foot horizontal separation shall be maintained from water mains. When conditions prevent the minimum ten foot horizontal separation, the sewer may be laid below the water main in a separate trench on undisturbed earth if a minimum eighteen inch vertical separation between sewer and water is maintained. Whenever it is impossible to maintain the minimum vertical and horizontal separations, the sewer and/or water main shall be encased in concrete according to the standard details in Appendix A.

Separation of
Other Buried Utilities:

A minimum five foot horizontal separation shall be maintained from any other buried utility (gas, electric, telephone, cable, fire, etc.). When conditions prevent the minimum five foot horizontal separation, the sewer main may be laid below the other buried utility in a separate trench on undisturbed earth if an eighteen inch minimum vertical separation between the other buried utility and sewer is maintained. Whenever it is impossible to maintain the minimum vertical and horizontal separations, the sewer and/or utility shall be encased in concrete according to the standard details in Appendix A.

Testing:

All sewer mains shall be tested, cleaned and video inspected according to Section 4 "Construction Specifications".

b) SEWER MANHOLES

Location:

Manholes shall be installed at the end of each line; at all changes in grade, size or alignment; at all intersections; and distances not greater than 300 feet for sewers 15 inches or less in diameter, and 400 feet for sewers 18 to 30 inches in diameter.

Drop Type:

A drop pipe should be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches the invert should be filleted to prevent solids deposition.

Diameter:

The minimum inside diameter of manholes shall be 48 inches. A minimum access diameter of 30 inches shall be provided.

Flow Channel:

The flow channel through manholes shall be made to conform in shape and slope to that of the sewers entering and leaving the

manholes. The top of the flow channel shall be constructed so that under peak design conditions the flow will remain in the channel.

- Watertightness:** Solid manhole covers shall be used in areas subject to flooding. Precast concrete manholes with O-ring gasketed joints are the preferred type, although other types are allowable subject to the approval of the reviewing agency. Special provisions for backfilling shall be made for manholes subjected to frost action.
- Testing:** All manholes shall be tested according to Section 4 "Construction Specifications".

c) **PRESSURE SEWER MAINS**

Pressure sewer systems shall be considered by the Town when shown by the designer to be absolutely necessary to provide sewer service. The design must utilize as much gravity sewer as possible. Systems shall be designed in like to pressure sewer systems already in use in the Town.

Minimum Size: No pressure sewer main shall be less than 4 inches in diameter when used in an effluent pump system. Effluent pumps shall be capable of passing a minimum solids size of three (3) inches in diameter.

No pressure sewer main shall be less than two (2) inches in diameter when used in a grinder pump system. Grinders shall be capable of reducing solids to pass through the passages of the pump and a minimum one and a quarter (1 ¼) inch diameter discharge piping.

Standby Power: All pressure sewer systems shall be designed with standby generators and remain fully functional during power outages or have sufficient storage capacity for a 24 hour outage.

Depth of Cover: In general, a pressure sewer main shall be designed with a minimum depth of cover of five feet unless approved. Insulation shall be provided for pressure sewer main that cannot be placed with a minimum depth of cover of four feet to prevent freezing.

Critical Depths Of Cover: A pressure sewer main designed with a depth of cover of four vertical feet or less may be required to be constructed of Class 52 - ductile iron pipe or equal if constructed under a traveled way. For material specifications refer to the "Water Main Construction Guidelines" for the Town of Millis.

Materials: All materials shall be new and in accordance with Section 4 "Construction Specifications".

Bedding: Trench specifications shall be as specified in Section 4 "Standard Specifications and in Appendix A "Standard Details". GREEN TRACER TAPE marked "Caution - Sewer Line Below" must be placed in the sewer trench 16" below finish grade.

Slope: Pressure sewer mains shall be designed with a continuous uphill slope from the pump whenever possible. When a continuous uphill

slope cannot be maintained, air/vacuum release and clean out manholes shall be added at high and low points along the pipe line.

Separation of
Sewers:

Whenever possible, a minimum ten foot horizontal separation shall be maintained from water mains. When conditions prevent the minimum ten foot horizontal separation, the sewer may be laid below the water main in a separate trench on undisturbed earth if a minimum eighteen inch vertical separation between sewer and water is maintained. Whenever it is impossible to maintain the minimum vertical and horizontal separations, the sewer shall be encased in concrete according to the standard details in Appendix A.

Separation of
Other Buried Utilities:

A minimum five foot horizontal separation shall be maintained from any other buried utility (gas, electric, telephone, cable, fire, etc.). When conditions prevent the minimum five foot horizontal separation, the sewer may be laid below the other buried utility in a separate trench on undisturbed earth if an eighteen inch minimum vertical separation between the other buried utility and sewer is maintained. Whenever it is impossible to maintain the minimum vertical and horizontal separations, the sewer shall be encased in concrete according to the standard details in Appendix A.

Testing:

All pressure sewer mains shall be tested and cleaned according to Section 4 "Construction Specifications".

d) GRAVITY BUILDING SEWER SERVICE

Minimum Size: No gravity sewer service shall be less than six inches in diameter.

Depth of cover: In general, sewers should be designed deep enough to drain basement fixtures and to prevent freezing. Insulation shall be provided for sewers that cannot be placed at a depth sufficient to prevent freezing.

Critical Depth
Of Cover:

Sewers designed with a depth of cover of thirteen vertical feet or greater shall be constructed of Class 52 - ductile iron pipe. For material specifications refer to the "Water Main Construction Guidelines" for the Town of Millis.

Sewers designed with a depth of cover of four vertical feet or less may be required to be constructed of Class 52 - ductile iron pipe if constructed under a traveled way. For material specifications refer to the "Water Main Construction Guidelines" for the Town of Millis.

Materials: All materials shall be new and in accordance with Section 4 "Construction Specifications".

Bedding: Trench specifications shall be as specified in Section 4 "Standard Specifications and in Appendix A "Standard Details". GREEN TRACER TAPE marked "Caution - Sewer Line Below" must be placed in the sewer-service trench (from the municipal main to each residence 16" below finish grade.)

Slope:	Residential, commercial, industrial, and institutional sewer services shall have its own separate minimum 6" sewer service line with a minimum acceptable grade of .01 or 1.0%.
Separation of Sewers:	There must be at least a 10 foot horizontal separation between water service pipes and sewer service pipes.
Connection to Sewer Stub:	Connections to a sewer service stub shall be made with like materials or when required a suitable watertight adapter coupling. If a flexible connection is required (i.e., "Fernco" adapter), the connection shall be encased in cement concrete. Building service pipe connections shall be a minimum of 6" P.V.C. meeting SDR-35/ASTM-D-3034 standards laid in straight lines with only one-eighth (22-1/2 degree) bends used for changes in direction. Wye connectors must be at least 7' apart.
Direct Connection To Existing Sewer Main:	Connection to an existing sewer main shall be made into a manhole whenever possible otherwise the sewer connection shall be made with a 6" PVC wye connector saddle (not tee connector) encased in cement concrete. Openings for saddles shall be clean cut and smooth. Building service pipe connections shall be a minimum of 6" P.V.C. meeting SDR-35/ASTM-D-3034 standards laid in straight lines with only one-eighth (22-1/2 degree) bends used for the changes in direction. Wye connectors must be at least 7' apart.
Connection to Building Plumbing:	Connection between the 6 inch sewer service and the 4 inch plumbing exiting the building shall be made with an elastomeric reducer secured with stainless - screw bands and encased in cement concrete.
Inspection:	Municipal personnel will inspect the sewer service and approval will not be made if a sewer permit is not on file in the DPW; all trenches shall be inspected and must be open at the time of inspection.

e) GRAVITY BUILDING SEWER SERVICE CLEANOUTS

All sewer service lines shall have a six (6) inch clean out installed at a minimum distance of ten (10) feet from the outside of the foundation wall, facing in the direction of the sewer main, unless there is a clean out immediately inside the building. Sewer service lines that change in direction, 45 degrees or more, in addition to the above clean out shall have a six (6) inch clean out installed, facing the direction of the flow, at each change of direction (see detail in Appendix A).

All sewer service lines that are one hundred (100) feet long or longer shall have a six (6) inch clean out installed, facing the direction of the flow, at the fifty (50) foot point for one hundred (100) foot services, or every one hundred (100) feet for longer services, in addition to the clean outs designated above. A sewer manhole shall be required in place of a clean out when two or more services join together. The pipe size from this manhole to the main will be increased to a minimum of 8 inches.

All sewer clean outs shall be brought up to finished grade and equipped with a

watertight removable cap. Any sewer service clean out that ends up in a driveway, walk or roadway shall be equipped with a Genco #DWG R-3212-C Riser and #CC6 Genco metal cap, or approved equal brought up to grade.

f) **PRESSURE BUILDING SEWER SERVICE**

Individual pressure sewer systems shall be considered by the Town when shown by the designer to be absolutely necessary to provide individual sewer service. The design must utilize as much gravity sewer as possible. Systems shall be designed in like to pressure sewer systems already in use in the Town.

Minimum Size: No pressure sewer service shall be less than one and a quarter (1 ¼) inch diameter.

Grinder pump systems shall be capable of reducing solids to pass through the passages of the pump and a minimum one and a quarter (1 ¼) inch diameter discharge piping.

Effluent pump systems shall only be considered when used in a two tank system. The first tank shall be capable of separating the solids from wastewater flow (i.e. septic tank) and be equipped with a suitable effluent filter. The clarified effluent shall then flow into the second tank (i.e. pump chamber) where the effluent pump system shall be placed. Pumps shall be capable of passing solids of a minimum one and a quarter (1 ¼) inch diameter.

Standby Power: All individual pressure sewer systems shall be designed with standby generators and remain fully functional during power outages.

Depth of Cover: In general, a pressure sewer service shall be designed with a minimum depth of cover of five feet unless approved. Insulation shall be provided for pressure sewer service that cannot be placed with a minimum depth of cover of four feet to prevent freezing.

Critical Depths

Of Cover: A pressure sewer service designed with a depth of cover of four vertical feet or less may be required to be constructed of Class 52 - ductile iron pipe or equal if constructed under a traveled way. For material specifications refer to the "Water Main Construction Guidelines" for the Town of Millis.

Materials: All materials shall be new and in accordance with Section 4 "Construction Specifications".

Bedding: Trench specifications shall be as specified in Section 4 "Standard Specifications and in Appendix A "Standard Details". GREEN TRACER TAPE marked "Caution - Sewer Line Below" must be placed in the sewer-service trench (from the municipal main to each residence 16" below finish grade.)

Slope: Pressure sewer mains shall be designed with a continuous uphill slope from the pump whenever possible. When a continuous uphill slope cannot be maintained, air/vacuum release and clean out manholes shall be added at high and low points along the pipe line.

Separation of
Sewers:

There must be at least a 10 foot horizontal separation between water service pipes and sewer service pipes.

Testing:

All pressure sewer services shall be tested and cleaned according to Section 4 "Construction Specifications".

B. EASEMENTS

Easements for municipal sewers outside of the street layout shall be provided where necessary. Easements shall be at least 20 feet wide and centered on lot lines where practical.

C. CONSTRUCTION SPECIFICATIONS

1. POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 MATERIALS

- 1.01 PVC - PRESSURE PIPE AND FITTINGS
- 1.02 PVC - GRAVITY SEWER AND FITTINGS
- 1.03 PUSH - ON JOINTS
- 1.04 PVC BELL (INTEGRALLY CAST)
- 1.05 SOLVENT WELD JOINT
- 1.06 PIPE MARKINGS

PART 2 EXECUTION OF WORK

- 2.01 HANDLING AND CUTTING PIPE
- 2.02 PIPE BEDDING
- 2.03 INSTALLATION OF PIPE
- 2.04 PIPE ENCASEMENT

PART 1 MATERIALS

1.01 PVC - PRESSURE PIPE AND FITTINGS

A. 4" THROUGH 16" DIAMETER

- a. The PVC pressure pipe shall be Class 150-SDR18 unless otherwise specified and conform to ANSI/AWWA C-900 standard for PVC Pressure Pipe. PVC pipe shall meet the criteria of ASTM D-2241 "Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR)". PVC Class 150 Pipe shall be manufactured to dimensions of standard Cast Iron Pipe outside diameters instead of dimensioning according to Iron Pipe Standards (I.P.S.). PVC pipe (SDR-18) shall meet all requirements of Uni-Bell Standard Uni-B-2-72. Class 150 pipe & couplings shall meet the following requirements:

<u>PHYSICAL PROPERTY</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>
90 second Minimum Burst Pressure	755 PSI	ASTM D-1599
Sustained Pressure	500 PSI	ASTM D-1598 ASTM D-2241
Impact	100 Ft. - lbs.	ASTM D-2244
Hydrostatic Integrity	Non-Failure	ANSI/AWWA C 900-81 Section 3.1.1
Flattening	Non-Failure	ASTM D-2412
Extrusion Quality	Non-Failure	ASTM D-2152
Coupling Pressure Seal	Non-Failure of Seal	ASTM D-3139

- b. Pipe fittings shall conform in all respects to ANSI 21.10 and 21.11 (AWWA C110 and C111) and shall be mechanical joint. Compact fittings 4 inches through 16 inches shall conform to ANSI/AWWA C153/A21.53 and shall be mechanical joint. Compact fittings larger than 16 inches shall not be used. All fittings shall be restrained with retainer glands or bolted restrainers ("Mega-lug" or equal).
- c. Pipe shall be of the push-on type, mechanical joint or flanged.
- d. All pipe and fittings shall be furnished with a cement lining on the inside of the pipe. The lining shall be twice the thickness as specified in ANSI A21.4 (AWWA C104). Cement lining shall be double thickness. The cement lining shall be given a seal coat of asphalt material.
- e. All fittings shall be Class 350 and all fittings shall conform to the weights and dimensions shown in the latest edition of the CIPRA Handbook of Ductile Iron Pipe and Cast Iron Pipe.
- f. When required, flanged fittings shall be furnished and installed.
- g. Retainer glands or bolted restrainers ("Mega-lug" or equal and acceptable for PVC) with double heat treated set screws and break away nuts shall be furnished for all fittings, valves, caps and plugs.
- h. Joint accessories shall consist of high strength ductile iron glands ("Mega-lug" or equal and acceptable for PVC), rubber gaskets, tee head or hex head bolts and nuts. Nuts and bolts shall be made of low alloy steel or stainless steel. Where corrosive soils and/or saltwater conditions exist, bolts and set screws shall be tightened in accordance with the manufacturer's recommendations.

B. 1 ¼" THROUGH 3" DIAMETER

Pressure pipe shall be Class 200-SDR 21 PVC pipe.

- a. COMPRESSION JOINT PVC CLASS 200 SDR 21 IPS PIPE. Each pipe shall be 20' in length and shall be furnished with an integral elastomeric-gasket bell end and one gasket. Valves, Curb stops, air/vacuum valves, check valves, etc. shall be brass and be rated for 200-psi. Fittings must meet ASTM D3139: SDR17 250 psi. Fittings must be gasketed compression: male adapter must be MIPT to gasket. Compression couplings must be SDR21, 200-psi. Service clamps must be brass or stainless steel hardware with grade 60 O-ring cemented in place.
- b. HIGH DENSITY POLYETHYLENE (HDPE) or SCH 40/SCH 80 PVC pipe and fittings will be considered depending on the application and shall be equal to Class 200 SDR 21 pipe system.
- c. Solvent weld pipe and fittings shall not be allowed for buried piping unless approved by the engineer.

1.02 PVC PIPE - GRAVITY SEWER AND FITTINGS

- A. PVC gravity sewer 8" through 15" shall be SDR 35 unless otherwise specified and shall conform to ASTM D3034 Standard for PVC pipe. PVC gravity Sewer pipe 18" through 27" shall be Type 1 heavy wall unless otherwise specified and shall conform

to ASTM F679-80 standard for PVC pipe. The PVC pipe shall be supplied in standard lengths as commonly manufactured.

- B. Gravity sewer pipe shall be furnished with standard integral bell and spigot ends and elastomeric gasket joint.
- C. PVC gravity sewer tees, wyes and tee wyes to be used for service connections shall be PVC SDR 35 fittings with ring-tite joints. All fittings shall be capped.

1.03 PUSH-ON JOINTS

- A. Push-on joints shall be used shall consist of:
 - 1. A single continuous, molded, rubber, ring gasket.
 - 2. A bell socket cast integrally with the pipe or fitting
 - 3. A pipe or fitting plain end. The configuration shall be such that when the plain end is inserted into the pipe fitting socket the gasket shall compressed radially to form a positive seal. The gasket and annular space shall be so designed and shaped that the gasket is locked in place after the plain end is inserted into the fitting socket.
- B. Push-on joints shall have the same pressure rating as the pipe or fitting of which they are a part.
- C. Gaskets for push-on joints shall be vulcanized natural or synthetic rubber. All gaskets shall be free of porous areas, foreign material and visible defects.

1.04 PVC BELL (INTEGRALLY CAST)

- A. The bell shall consist of an integral wall section with locked-in, solid cross section elastomeric ring which meets the requirements of ASTM F-477. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of AWWA C-900.

1.05 SOLVENT WELD JOINTS

- A. Where solvent weld joints are required they shall be made with solvent supplied by the pipe manufacturer's specifications or with ASTM Recommended Practice D2855. The dry fit of joints shall be primed and snug; pipe and fittings that afford loose fits will be rejected by the Engineer. The use of multiple layers of filler solvent to overcome a loose fit will not be permitted. Solvent cements shall conform to ASTM D-2564.
- B. Solvent weld pipe and fittings shall not be allowed for buried piping unless approved by the engineer.

1.06 PIPE MARKINGS

- A. Pipe and couplings shall bear identification markings that will remain legible during normal handling, storage, installation and during the life of the pipe. Markings shall have been applied to the pipe and couplings in a manner which will not reduce strength or durability or otherwise damage the pipe.

- B. Markings for pressure pipe shall be applied at intervals of not more than 5 Feet and shall include the following: nominal size and OD base, "PVC", dimension-ratio number, AWWA pressure class, AWWA designation number for AWWA C-900, manufacturer's name or trademark and production record code, and mark or seal of pipe testing agency

PART 2 EXECUTION OF WORK

2.01 HANDLING AND CUTTING PIPE

- A. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring its surfaces and ends.
- B. 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.
- C. 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 before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be at least 12 inches from the visible limits of the crack.
- D. All cutting of PVC pipe is to be square. The pipe to be cut shall be marked around its entire circumference prior to cutting.
- E. Using a factory finished beveled end as a guide to determine the angle and length of the taper, the end of a freshly cut pipe shall be beveled similarly.

2.02 PIPE BEDDING

- A. Pipe bedding and foundation design shall be as specified on the construction details

2.03 INSTALLATION OF PIPE

- A. Standard laying lengths shall be 20 feet for pressure pipe with 85% of the total footage of pipe being full lengths and the remaining 15% being furnished as random lengths. Random lengths shall not be less than 10 feet long. Standard laying lengths for gravity sewer shall be 14 feet.
- B. Prior to assembling, the bell and plain end shall be cleaned of all foreign matter. Push-on joints shall be made up by uniformly applying a thin film of special non-toxic gasket lubricant to the factory preinstalled gasket in the bell which will be in contact with the spigot end of the pipe. The end of the plain pipe shall be chamfered to facilitate assembly and prelubed for the first 6" of length. The end shall be inserted into the gasket, given ¼ turn and then forced passed it until it seats against the bottom of the socket.
- C. Pipe shall be installed in such a manner that will ensure that external loads will not subsequently cause a deflection of greater than 5% in the vertical cross-section dimension.
- D. For PVC pressure pipe horizontal deflection from joint to joint shall be limited to 12 inches for PVC pipe sizes 6 inches to 12 inches based on 20 foot length.

- E. The bedding of the pipe shall conform to the standard trench detail. Installation precautions are also given in ASTM D 2774.
- F. Installed pipe shall rest flat and straight on the bedding at all locations without bridging or binding. Backfill shall be carefully placed to avoid damage to the pipe.
- G. Only laborers competent in laying plastic pipe and suitable equipment shall be employed. Pipe and fittings shall be handled with care so as to prevent scratching or other damage to the materials. All joints shall be properly cleaned and free of foreign matter. The installation instructions of the manufacturer shall be strictly followed with the exception that the pipe bedding shall be as shown on the Construction Details in Appendix A.
- H. The pipe shall not be driven down to grade by striking it with a shovel handle, timber, hammer, or other unyielding object. When each pipe has been properly bedded, enough of the backfill material shall be placed and compacted between the pipe and the sides of the trench to hold the pipe in correct alignment.
- I. Before a joint is made, the pipe shall be checked to insure that a close joint with the next adjoining pipe has been maintained and that inverts are matched and conform to the required grade.
- J. When pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary water-tight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until the trench is properly dewatered. Groundwater shall not be allowed to enter the pipeline.
- K. Any defective pipe or fitting found in the line shall be removed and replaced at the contractor's expense. All pipes and fittings shall be kept clean of all dirt and debris before being laid, and shall be kept clean until acceptance.

2.04 PIPE ENCASEMENT

- A. Concrete encasement of the PVC Pipe shall be conducted as specified herein or as shown on the Construction Details in Appendix A.

2. GRAVITY SEWER AND FORCE MAIN PIPE - GENERAL

PART 1 EXECUTION OF WORK

- 1.01 GENERAL
- 1.02 LINES AND GRADES
- 1.03 PIPE FOUNDATION
- 1.04 NORMAL SOIL CONDITIONS
- 1.05 UNSTABLE SOIL CONDITIONS
- 1.06 CONCRETE ENCASEMENT
- 1.07 INSPECTION OF PIPE BEFORE INSTALLATION
- 1.08 INSTALLATION OF PIPE AND FITTINGS
- 1.09 FINAL INSPECTION
- 1.10 FINAL TESTING
- 1.11 LOW PRESSURE AIR TEST - GRAVITY SEWER
- 1.12 TEMPORARY PLUGS
- 1.13 CONNECTION TO EXISTING STRUCTURES
- 1.14 PRESSURE TEST - FORCE MAIN
- 1.15 SEWER MAHOLE - VACUUM TESTING
- 1.16 SEWER LINE - MANDREL TESTING
- 1.17 SEWER LINE - TELEVISION INSPECTION OF LINES

PART 1 EXECUTION OF WORK

- 1.01 GENERAL
 - A. The specifications in this section are applicable to the installation of gravity sewer and force main pipe.
- 1.02 LINES AND GRADES
 - A. The grade shown on the profile is that of the invert of the pipe. The work shall conform to this grade. A variation of one-eighth (1/8) inch or more from the true invert grade on gravity sewers laid on a one percent or less grade and one-fourth (1/4) inch or more on sewers laid on grades above one percent will be deemed sufficient reason to cause the work to be rejected.
 - B. The grade and alignment of the pipe may be maintained by the use of laser beams.
- 1.03 PIPE FOUNDATION
 - A. All pipes to be laid in open trench excavation shall be bedded and uniformly supported over their full length on foundations of the types specified and shown on the detail in Appendix A. Flat-bottomed trenches shall be excavated and dewatered prior to preparing the specified foundation. All work shall be performed in a dry trench.
- 1.04 NORMAL SOIL CONDITIONS
 - A. All pipes shall be supported on a normal soil condition foundation. The trench shall be excavated to a depth equal to 1/4 of the outside diameter of the pipe to be installed (4" minimum) below the bottom of the pipe. Screened gravel bedding shall be furnished and placed in the trench for its full width to uniformly support the

pipe at the required line and grade. Suitable recesses shall be provided in the bedding to permit adequate clearance for bells, couplings, or similar projections. The bedding shall extend upward around the pipe barrel. Bedding material shall be spread in 6 inch layers, and each layer shall be compacted with twenty pound hand tampers or pneumatic tampers until the required total depth of bedding has been built up.

1.05 UNSTABLE SOIL CONDITIONS

- A. Where unstable soil conditions are encountered, the pipe shall be supported on a special foundation. The foundation shall be installed where a suitable supporting soil or rock stratum occurs at a depth greater than 1/4 of the outside diameter or 4" minimum. The trench shall be excavated to the depth necessary to reach the suitable supporting stratum (3'-0" minimum). The trench bottom and walls shall be covered with a geotextile fabric. Screened gravel of the type selected shall then be furnished as bedding and placed in the trench for its full width. The bedding shall be spread in 12 inch layers, and each layer shall be compacted with twenty pound hand or pneumatic tampers. The bedding shall carry vertically from the supporting stratum up to an elevation 1/4 of the outside diameter (12" minimum) above the top of the pipe. The special foundation shall extend for a minimum of 5'-0" beyond poor subgrade conditions.

1.06 CONCRETE ENCASEMENT

- A. Where required, the pipe shall be supported on foundation. The foundation shall be installed where excavations have been carried outside the normal limits. The trench shall be excavated to 1/4 of the outside diameter (6 inch minimum and a 12 inch maximum depth) below the bottom of the pipe. The excavated space shall then be completely filled with concrete, and the entire pipe encased in concrete such that the minimum concrete encasement at any point around the outside barrel of the pipe measures 4 inches thick. The depth of encasement over the pipe shall be 1/4 of the outside diameter (12" minimum). The total minimum width of the concrete encasement shall equal the width of trench excavation. Concrete shall be 3,000 psi. Concrete mix, formwork, curing, etc., shall be in accordance with the requirements of appropriate sections. Freshly poured concrete shall be maintained free from ground water for at least the first four hours. No backfilling of the trench shall begin until a minimum time period of 24 hours has elapsed after the encasement has been poured.

1.07 INSPECTION OF PIPE BEFORE INSTALLATION

- A. All pipes and fittings shall be carefully inspected in the field before placing the trench. Cracked, broken, warped, out-of-round or otherwise defective pipe, fittings shall be pulled and not installed. Such rejected pipe shall then be removed from the job site.

1.08 INSTALLATION OF PIPE AND FITTINGS

- A. After the trench has been brought to the proper grade, as hereinbefore specified, the pipe shall be laid.
- B. All pipe and fittings shall be carefully lowered into the trench with ropes, slings and proper equipment.

- C. Any pipe that has its alignment disturbed after laying shall be taken up and relayed. The interior and ends of all pipes shall be thoroughly cleaned during laying operations by means of plugs or other approved methods.

1.09 FINAL INSPECTION

- A. Each section of installed sewer lines shall be visually inspected by DPW personnel prior to any backfilling or final testing. The pipe shall be true to both line and grade, shall contain no broken pipe, shall show no leaks, shall show neither obstructions nor the projection of connecting pipes into the main pipe, and shall contain no debris or other deposits which will in any way reduce the full cross-section area of the pipe.
- B. Any section of sewer pipe which does not comply with these inspection criteria shall be promptly corrected, replaced or repaired.

1.10 FINAL TESTING

- A. All debris shall be removed from manholes and shall thoroughly flush from sewers and force mains prior to testing for watertightness. All sewers and force mains, (not including manholes), service connections and sewer laterals constructed shall be tested under this section and shall satisfactorily meet the test requirements prior to final acceptance of the work. An exfiltration, infiltration, or low pressure air tests for gravity sewers and shall perform water pressure test for the force main.

1.11 LOW PRESSURE AIR TEST - GRAVITY SEWERS

- A. The low pressure air test shall be performed with AIR-LOC equipment manufactured by Cherne Industrial Inc., Hopkins, Minnesota; New Britain Prod., New Britain, Pa., or equal.
- B. All wyes, tees, or ends of lateral stubs, shall be capped to withstand the internal test pressures. Caps shall be easily removable for future lateral connections or extensions.
- C. After a manhole-to-manhole section of sewer has been backfilled and cleaned, it shall be plugged at each manhole with pneumatic plugs. The pneumatic plugs shall be such that they will hold against the line test pressure without requiring external blocking or bracing. One of the plugs shall have three hose connections. Air for inflation of the triple connection pneumatic plug shall be supplied through a factory-equipped control panel. One hose shall be used for inflation of the plug. The second hose shall be used for continuously reading the air pressure in the sealed line. The third hose shall be used for introducing low pressure air into the sealed line.
- D. There shall be a 3 1/2" or larger diameter, 0-30psi gauge mounted on the control panel for reading of the internal pressure in the line being tested. Calibrations from 0-10 psi shall cover 90% of the complete dial range.
- E. Low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psi greater than the average backpressure of any ground water that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the third hose shall be quickly disconnected from the control panel.
- F. The portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.003 cfm per square foot of internal pipe surface when

tested at an average pressure of 3.0 psig greater than any back pressure exerted by ground water that may be over the pipe at the time of the test.

- G. The requirements shall be accomplished by performing the test as follows:

The time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water over the pipe) shall not be less than the time shown for the given diameters in the following tables:

<u>Pipe Diameter in Inches</u>	<u>Minutes</u>
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

- H. In areas where ground water is known to exist, a one-half inch diameter capped pipe nipple, approximately 10" long, shall be installed through the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test the ground water level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.
- I. If leakage exceeds the specified amount make the necessary repairs or replacements required to permanently reduce the leak-age to within the specified limit, and the test shall be repeated until the leakage requirement is met.

1.12 TEMPORARY PLUGS

- A. At all times when sewer and force main pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of earth or other materials entering the pipe has passed.

1.13 CONNECTION TO EXISTING STRUCTURES

- A. Piping to be connected to existing manholes where no stub or other opening has been provided shall be made through an opening of minimum diameter cut in the wall of the structure at the required elevation and location. All penetrations shall be made by core boring unless otherwise approved.
- B. The annular space outside of the pipe stub shall be filled and sealed with non-shrinking grout. The outer surface of the sealing mortar shall be given a coating of heavy bit mastic waterproofing compound of a type approved. Kor N Seal watertight boots are required.

- C. The bench walls within the existing structure shall be altered as required to form a new flow channel from the new connection to the existing flow channel. The new channel shall be constructed with a smooth and continuous radius as indicated and approved.

1.14 PRESSURE TEST - FORCE MAIN

- A. The section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe.
- B. For the pressure test, 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 pressure cannot be maintained for a period of one hour, the section under test shall be considered as having failed the pressure test.
- C. Following a successful pressure test, perform 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. If the average leakage pressure or by pumping. If the average leakage during a 12 hour period exceeds 75gallons per inch diameter per mile of pipe per day, the section shall be considered as having failed the leakage test.
- D. The lengths of joint to be used in determining the allowable leakage shall be based on the nominal diameter of the pipe.
- E. If the section fails to pass the pressure test, the leakage test, or both, everything necessary to locate, uncover, even to the extent of uncovering the entire section, and repair or replace the defective pipe, fitting, or joint shall be done.

1.15 SEWER MAHOLE – VACUUM TESTING

- A. Each manhole shall be tested immediately after assembly and prior to backfilling. All lift holes shall be plugged with an approved non-shrink grout. All pipes entering the manhole shall be plugged; taking care to securely brace the plug from begin drawn into the manhole. The test head shall be placed at the inside of the top of the core section and the seal inflated in accordance with the manufacturers recommendations. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass the test if the time is greater than those listed below:

Depth of Manhole 4 and 5 foot diameter	Maximum Allowable Time (sec)
0-10'	60
10-15'	75
15-25'	90

If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained. Following satisfactory test results, the manhole may be backfilled.

1.16 SEWER LINE – MANDREL TESTING

- A. Prior to testing all lines shall be flushed and jetted. A 5% maximum deflection test is required for the PVC mainline pipes after final trench compaction has taken place and 30 days after installation. The test shall be conducted with a rigid mandrel (go no go) device cylindrical in shape and constructed with a minimum of nine or ten evenly spaced arms or prongs. The mandrel shall be hand pulled by the contractor through all sewer lines. Any section of sewer not passing the mandrel shall be uncovered and the contractor shall re-round or replace the sewer at the contractor's expense. The excavation shall be mechanically compacted to a minimum of 95 percent and the pipe retested.

1.17 SEWER LINE – TELEVISION INSPECTION OF LINES

- A. All mainline sewer pipes shall be television tested upon completion of all other tests. The testing shall be done by a company specializing in this type of work. The camera shall be drawn through the pipe, with a color image projected upon a color video screen that includes a distance. All services shall be located a distance from the manhole on the tape. All imperfections should be noted on the tape. Two copies of the tape shall be furnished to the Town of Millis. Any misalignments, imperfections, sags, or other unacceptable observations shall be corrected by the contractor at his expense. If the line is not flushed properly and requires re-flushing the contractor shall re-video the line.

3. MODIFICATIONS AND CONNECTIONS TO EXISTING STRUCTURES

PART 1 MATERIALS

- 1.01 GENERAL
- 1.02 CEMENT CONCRETE BLOCKS
- 1.03 MORTAR
- 1.04 FRAMES, COVERS, GRATES AND MANHOLE STEPS
- 1.05 PRECAST SECTIONS

PART 2 EXECUTION OF WORK

- 2.01 GENERAL
- 2.02 INTERFERENCE
- 2.03 MODIFICATION OF STRUCTURES
- 2.04 CLEANING, CARE, & RESTORATION
- 2.05 NORMAL JOINT CONNECTIONS
- 2.06 CONNECTION TO EXISTING STRUCTURES
- 2.07 CONNECTION TO EXISTING SEWERS
- 2.08 MANHOLES INTERCEPTING EXISTING SEWERS
- 2.09 LAYING BRICK AND BLOCKS
- 2.10 PLACING CASTINGS
- 2.11 DRAINAGE OR SEWERAGE STRUCTURES ABANDONED OR REMOVED

PART 1 MATERIALS

1.01 GENERAL

- A. Brick masonry and cement concrete block or bricks for drop inlets, special modified drop inlets, catch basins, manholes or other related structures, where permitted or required for repair or construction shall be good sound, hard and uniformly burned, regular and uniform in shape and size, of compacted texture.
- B. Bricks and blocks that are broken, cracked or of improper size or quality, or unduly chipped or otherwise defective shall not be used in the work and shall be immediately removed from the site and satisfactory bricks substituted therefore.

1.02 CEMENT CONCRETE BLOCKS

- A. Cement concrete blocks shall be machine made solid segments, conforming to the requirements for Concrete Masonry Units for Construction of Catch Basins and Manholes, ASTM-C139, supplemented by the following requirements:
 - 1. The blocks shall be 6 inches in width for basins and manholes of 9 feet or less in depth, 8 inches in width below a depth of 9 feet when used in structures having a depth greater than 9 feet.
 - 2. The permissible dimensional variation for nominal size shall be in accordance with ASTM-C139.
 - 3. For cylindrical structures, the inside and outside surfaces of the blocks shall be curved to the necessary radius and so designed that the interior surfaces of the structures shall be cylindrical, except the top batter courses which shall be designed to reduce uniformly the inside section of the structure to the required top size and shape.

4. The blocks used in the top courses shall be designed to produce a surface 8 inches in width upon which to seat the frame and the curb inlet when one is used.
5. Blocks shall be so designed that only full length units are required to lay any one Course.
6. Blocks shall be sampled and tested in accordance with ASTM-C140. The minimum average compressive strength for 5 representative blocks shall be 3000 PSI. The minimum compressive strength for one individual block shall be 2500 PSI.

1.03 MORTAR

- A. Mortar shall be composed of Portland Type II cement, hydrated lime, and sand, materials.
- B. Hydrated lime shall be Type S conforming to the ASTM Standard Specification for Hydrated Lime for Masonry Purposes, Designation C207.

1.04 FRAMES, COVERS, GRATES, AND MANHOLE STEPS

- A. Frame covers and grates shall be all cast iron conforming to the Standard Details in Appendix A. All shall be designed for highway loads.
- B. The castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sand holes, 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. Allowances shall be made in the patterns so that the thicknesses specified or shown shall not be reduced in obtaining finished surfaces.
- C. All castings shall be thoroughly cleaned and subject to a careful hammer inspection.
- D. Castings shall be at least Class 30 conforming to the ASTM Standard Specification for Gray Iron Castings, Designation A48. Castings shall not be acceptable if the actual weight is less than 95 percent of the theoretical weight computed from the dimensions as shown.
- E. Before being shipped from the foundry, castings shall be sand-blasted and given two coats of 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.
- F. Manhole rungs where designated by or as specified shall be 14" extruded PVC. The portion of the legs to be embedded in the precast section shall have fins and be tapered to insure a secure bond.
- G. Manhole rungs shall be cast in place in the precast riser and cone sections during the manufacture of the sections. Precast sections having rungs which are grouted, mortared or driven in place shall not be accepted.

1.05 PRECAST SECTIONS

- A. Precast concrete barrel sections, cones, and bases shall conform to ASTM C478 except as may be otherwise shown on the Standard Details.

- B. Sections shall be steam cured and shall not be shipped until at least five days after having been cast.
- C. No more than two lift holes may be cast in each section.
- D. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.
- E. The tops of the bases shall be suitably shaped, and connections shall be made with approved round rubber "O" - ring gaskets or flexible plastic gaskets.
- F. The round rubber "O" - ring gaskets shall conform to ASTM C443. The flexible plastic gaskets shall conform to AASHTO M198. They shall be designed and manufactured so that the completed joint will withstand an internal hydrostatic pressure of excess of 13 psi for 10 minutes without showing any leakage by the gasket or displacement of it. The Contractor's supplier shall test the effectiveness of the joints against leakage. Such tests shall be made by an internal hydrostatic pressure against the joint of 13 PSI for 10 minutes. A complete set of records of the test shall be submitted to the Town.

PART 2 EXECUTION OF WORK

2.01 GENERAL

- A. Before initiation of any reconstruction work which requires interrupting the flow in an existing sewer, combined sewer, or storm drain, the applicant shall provide for temporary flow of the sewage and/or drainage during the reconstruction operations. The procedure used to reroute the flow shall be subject to the approval of the DPW.
- B. When removing the existing structure, care shall be taken to remove only as much of the existing structure as is necessary to make the proper repairs.

2.02 INTERFERENCE

- A. 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.

2.03 MODIFICATION OF STRUCTURES

- A. When the line and/or grade of the structure require a change of 6 inches or less, the structure shall be adjusted to line and grade.
- B. When the line and/or grade of the structure requires a change greater than 6 inches the structure shall be remodeled.
- C. When the change in type of structure is required, as converting a basin to a manhole, the masonry shall be removed to such a depth as required and new masonry shall be constructed to conform to the proposed design.

- D. A 6-inch compacted subbase, consisting of Type 3 sand and gravel shall be placed under the concrete foundations of structures which require complete removal and reconstruction.

2.04 CLEANING, CARE, AND RESTORATION

- A. All materials shall be removed from the catch basin sump and immediately disposed. Silt, sand, debris and all other materials shall be removed to the bottom of the sump. It will not be necessary to provide a wash-clean sump but hosing or cleaning of the brick faces where necessary to determine the condition of the structure may be required. Rodding and flushing of existing lines will be required to ensure fully functional drain systems. Cleaning by hand may be required.
- B. The structure shall be considered to be clean when the material remaining in the structure shall not be more than 2-inches in depth, if leveled, and when the outlet pipe has been rodded and flushed with water to ensure that all materials have been removed from within. In order to clean the outlet pipes of the modified catch basins, existing hoods will be removed and then replaced after the outlet pipes have been cleaned.
- C. The materials removed from the catch basins shall be transported immediately to the place of disposal. Materials removed on the site.
- D. During the cleaning operation, care shall be taken not to damage grates, frames, covers, hoods, the structure, or pipes. In case of damage caused by negligence the damaged parts shall be satisfactorily repaired or replaced.

2.05 NORMAL JOINT CONNECTIONS

- A. Make joint connections similar to those on the existing pipe or adaptable to such pipe.

2.06 CONNECTION TO EXISTING STRUCTURES

- A. Piping to be connected to existing manholes or other similar structures where no stub or other opening has been provided shall be made through an opening of minimum diameter cut in the wall of the structure at the required elevation and location. All penetrations shall be made by core boring.
- B. The annular space outside of the pipe stub shall be filled and sealed with non-shrinking grout. The outer surface of the sealing mortar shall be given a coating of heavy bitumastic water-proofing compound.
- C. The bench walls within the existing structure shall be altered as required to form a new flow channel from the new connection to the existing flow channel or from the existing flow channel to the new connection. The new channels shall be built with a smooth and continuous radius as indicated on the Detail Drawings in Appendix A.

2.07 CONNECTION TO EXISTING SEWERS

- A. Connections to existing sewers, and service connections constructed where there is not connection fitting or where the fitting has been damaged by or cannot be located shall be constructed by saddling the sewer. Sewer connections 8" in diameter or larger will require the installation of a cleanout manhole.

- B. Existing sewers shall be tapped cleanly and according to the saddle manufacturer instruction.
- C. Existing sewers shall be cleaned by rodding, flushing and/or derooting and shall include proper disposal of all material removed.

2.08 MANHOLES INTERCEPTING EXISTING SEWERS

- A. A manhole shall be installed to connect the existing and new sewers. The existing pipe shall not be disturbed, damaged, or altered in any manner which may disrupt its normal operation.
- B. The manhole shall be constructed by one of the following methods:
 - 1. The placement of a precast concrete base slab, of sufficient depth to accommodate a typical invert, beneath the existing pipe. The first barrel section shall be fitted with openings to allow the passage of the existing pipe or pipe sand the connection of the new pipe or pipes.
 - 2. A cast in place concrete base section shall be formed around the existing pipe. The formed base section shall accommodate the installation of a typical invert and also accept the remainder of the manhole precast sections or formed sections.
 - 3. All precast manhole sections, cast in place manholes, concrete formwork and appurtenances shall conform to the appropriate specification sections.
- C. The existing pipe shall not rest upon or support any manhole sections. The incoming existing pipe shall be saw cut and a flexible coupling (Dresser type 38, Clow type 248 or equal) installed.
- D. The annular space outside of the existing pipes shall be filled and sealed with non-shrinking grout. The outer surface of the sealing mortar shall be given a coating of heavy bitumastic waterproofing compound.
- E. The flow shall be altered and a new channel built only after the activation of the new sewer. The new channel shall be built with a smooth and continuous radius.

4. PRECAST MANHOLES, FRAMES AND COVERS

PART 1 MATERIALS

- 1.01 GENERAL
- 1.02 CONCRETE AND REINFORCEMENT
- 1.03 PRE-CAST SECTIONS
- 1.04 FRAME AND COVER
- 1.05 BRICK MASONRY
- 1.06 MANHOLE STEPS

PART 2 EXECUTION

- 2.01 INSTALLATION OF MANHOLE BASES AND SECTIONS
- 2.02 LAYING AND CURING BRICK AND COVERS
- 2.03 SETTING MANHOLE FRAMES & COVERS
- 2.04 LEAKAGE TESTS FOR SEWER MANHOLES

PART 1 MATERIALS

1.01 GENERAL

A. Manholes shall be as shown on the standard details and of the following types:

1. Barrels and cone sections shall be pre-cast reinforced or non-reinforced concrete, or poured-in-place reinforced or non-reinforced concrete.
2. Base sections shall be monolithic to a point 6" about the crown of the incoming pipe, and shall be pre-cast reinforced concrete or pre-cast non-reinforced concrete.
3. Waterproofing shall be applied to the exterior surfaces of the manholes and structures. The waterproofing material for precast manholes shall be Koppers Bitumastic 300M, Pittsburgh Coal-Cat, Tnemec 413 Tnemec Tar or approved equal.
4. Horizontal manhole joints and pipe connections shall be only as approved by the Engineer in accordance with the Standard Details and , in general, will depend for water tightness upon either an approved elastomeric sealant.
5. Cone sections shall be eccentric—see standard detail.
6. All pre-cast 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 invert channels shall be formed of brick and mortar upon the base. The inverts shall conform accurately to the size of the adjoining pipes. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent to the centerlines of adjoining pipes.
8. In any approved manhole, the structure shall be of such material and quality as to withstand loads of 8 tons (H-20 loading) without failure.
9. The top 12" (max) of the dome shall be built of brick or precast concrete rings for grade adjustments.

10. The barrel shall be not less than 5 in. thick.
 11. Type II cement shall be used except as otherwise approved.
- B. The following diameter manholes shall be used with the appropriate size diameter pipe:
1. 4'-0" diameter manhole for 21" diameter pipe or less.
 2. 5'-0" diameter manhole for greater than 24" diameter pipe up to and including 30" diameter pipe.
 3. 6'-0" diameter manhole for larger than 30" diameter pipe.
- 1.02 CONCRETE AND REINFORCEMENT
- A. Concrete for poured-in-place bases or complete manholes shall conform to the requirements for 4000-psi concrete.
 - B. Reinforcing steel for poured-in-place concrete shall conform to the requirements of AASHTO, M31 (Billet steel) or AASHTO, M55 (Welded Steel Wire Fabric).
- 1.03 PRE-CAST SECTIONS
- A. Pre-cast concrete barrel sections, cones, and bases shall conform to ASTM C478 except as may be otherwise shown on the Standard Details.
 - B. Sections shall be steam cured and not be shipped until at least five days after having been cast.
 - C. No more than two lift holes may be cast in each section.
 - D. Acceptance of the sections will be based on material tests and inspection of the inspection of the completed product.
 - E. If pre-cast-concrete sections are used, the tops of the bases shall be suitable shaped, by means of accurate bell-ring forms to receive the barrel sections.
 - F. Acceptable connections may be one or more of the following:
 - (1) The "Lock Joint Flexible Manhole Sleeve" shall be cast in precast manhole base. The stainless steel strap, conforming to ASTM C923 and ASTM A167 shall be protected from corrosion with a bituminous coat.
 - (2) The "Kor-N-Seal" flexible sleeve connection shall be a rubber like gasket cast in the precast manhole base. The rubber gasket shall be cast into a formed opening in the manhole.
- 1.04 FRAME AND COVER
- A. Standard manhole frame and cover shall provide a 30" diameter clear opening. The cover shall have the word "SEWER" in 3" letters cast into the top surface for sewer manholes and the word "DRAIN" in 3" letters for drain manholes.

- B. Watertight frames and covers shall be installed as indicated in Appendix A – standard Details. Watertight frames and covers shall be LeBaron Model LBW328, Campbell Model 1540, or equal.
- C. The castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sand holes, and defects of every nature that 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 Specification for Gray Iron Castings, Designation A48.
- F. Before being shipped from the foundry, castings shall be sandblasted and given two coats of coal-tar-pitch varnish, applied in a satisfactory manner to make a smooth coating, tough, tenacious, and not brittle or with any tendency to scale off.

1.05 BRICK MASONRY

- A. Brick masonry for shelf, invert, and grade adjustment shall consist of the following:
 1. Brick shall conform to ASTM Standard Specification for Sewer Brick (made from clay or shale), Designation C32, Grade 55, hard brick.
 2. Rejected brick shall be immediately removed from the work and brick satisfactory to the Engineer substituted.
 3. Mortar shall be composed of Portland cement, hydrated lime, and sand, in the proportions of 1 part cement to ½ part lime to 4 ½ 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.
 4. Cement shall be Type II Portland cement conforming to ASTM C150, Standard Specifications for Portland cement.
 5. Hydrated lime shall be Type S conforming to the ASTM Standard Specification for Hydrated Lime for Masonry Purposes, Designation C207.
 6. Sand shall consist of inert natural sand conforming to the ASTM Standard Specifications for Concrete (Fine) Aggregates, Designation C33 as follows:

1.06 MANHOLE STEPS

- A. Manhole steps shall be extruded PVC and shall be in accordance with ASTM-B211 and OSHA 1910.27.

PART 3 EXECUTION

2.01 INSTALLATION OF MANHOLE BASES AND SECTIONS

- A. Pre-cast bases shall be placed on a 6" layer of compacted material as described in the Standard Details-Appendix A. The excavation shall be properly dewatered while placing

bedding material and setting the base or pouring concrete. Water stops 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 manufacturers recommended procedure, and as shown on the Standard Details, or cast integrally with the poured base.
- C. Barrel sections and cones of the appropriate combination of heights shall then be placed, using manufacturers 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.
- D. Pre-cast reinforced-concrete manhole sections shall be set so as to be vertical and with sections in true alignment.
- E. Joints shall be painted with mortar and exterior joints thoroughly tooled to be lightly concave with a hard polished surface free from drying cracks. Interior joints shall be tooled flush in a similar manner. Mortar shall be as herein specified for brick masonry.
- F. All holes in sections, used for their handling, shall be thoroughly plugged with mortar. The mortar shall be one part cement to 1-1/2 parts sand; mixed slightly damp to the touch (just short of "balling"); hammered into the holes until it is dense and an excess of paste appears on the surface; and then finished smooth and flush with the adjoining surfaces.
- G. A leakage test shall then be made as described hereinafter.
- H. 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.

2.02 LAYING AND CURING BRICK

- A. Only clean bricks shall be used in brickwork for manholes. The brick shall be moistened by suitable means, as direct, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid. 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.
- B. Brick masonry shall be protected from too rapid drying by the use of burlaps kept moist, or by other approved means, and shall be protected from the weather and frost, all as required.

2.03 SETTING MANHOLE FRAMES AND COVERS

- A. Manhole 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 masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame 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.

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

2.04 LEAKAGE TESTS FOR MANHOLES

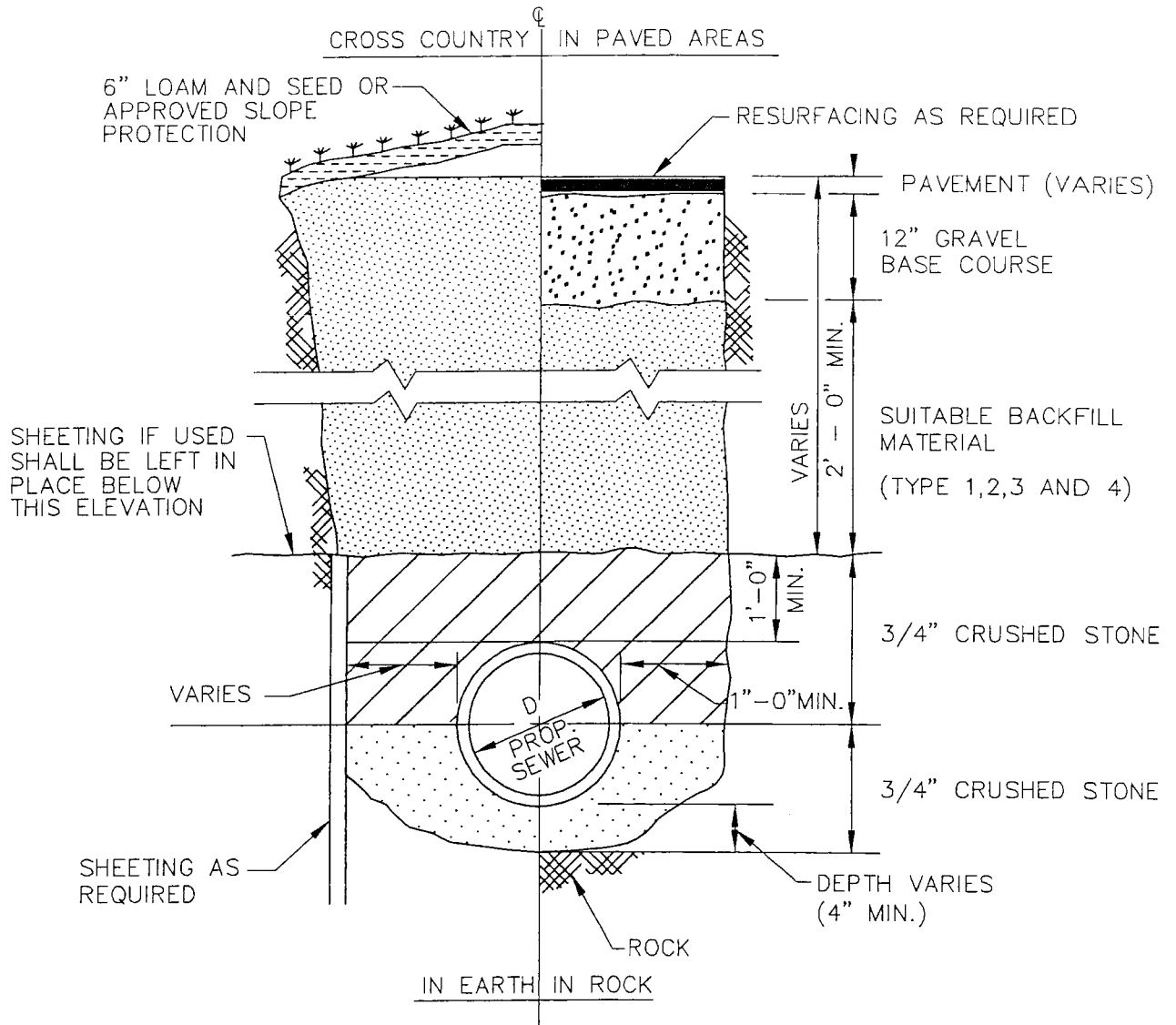
- A. General: Leakage tests shall be made and observed by the DPW on each manhole. The test shall be vacuum test made as described below.
- B. Each manhole shall be tested immediately after assembly and prior to backfilling. All lift holes shall be plugged with an approved non-shrink grout. All pipes entering the manhole shall be plugged; taking care to securely brace the plug from being drawn into the manhole. The test head shall be placed at the inside of the top of the core section and the seal inflated in accordance with the manufacturers recommendations. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass the test if the time is greater than those listed below:

Depth of Manhole 4 and 5 foot diameter	Maximum Allowable Time (sec)
0-10'	60
10-15'	75
15-25'	90

If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is until being drawn. Retesting shall proceed until a satisfactory test is obtained. Following satisfactory test results, the manhole may be backfilled.

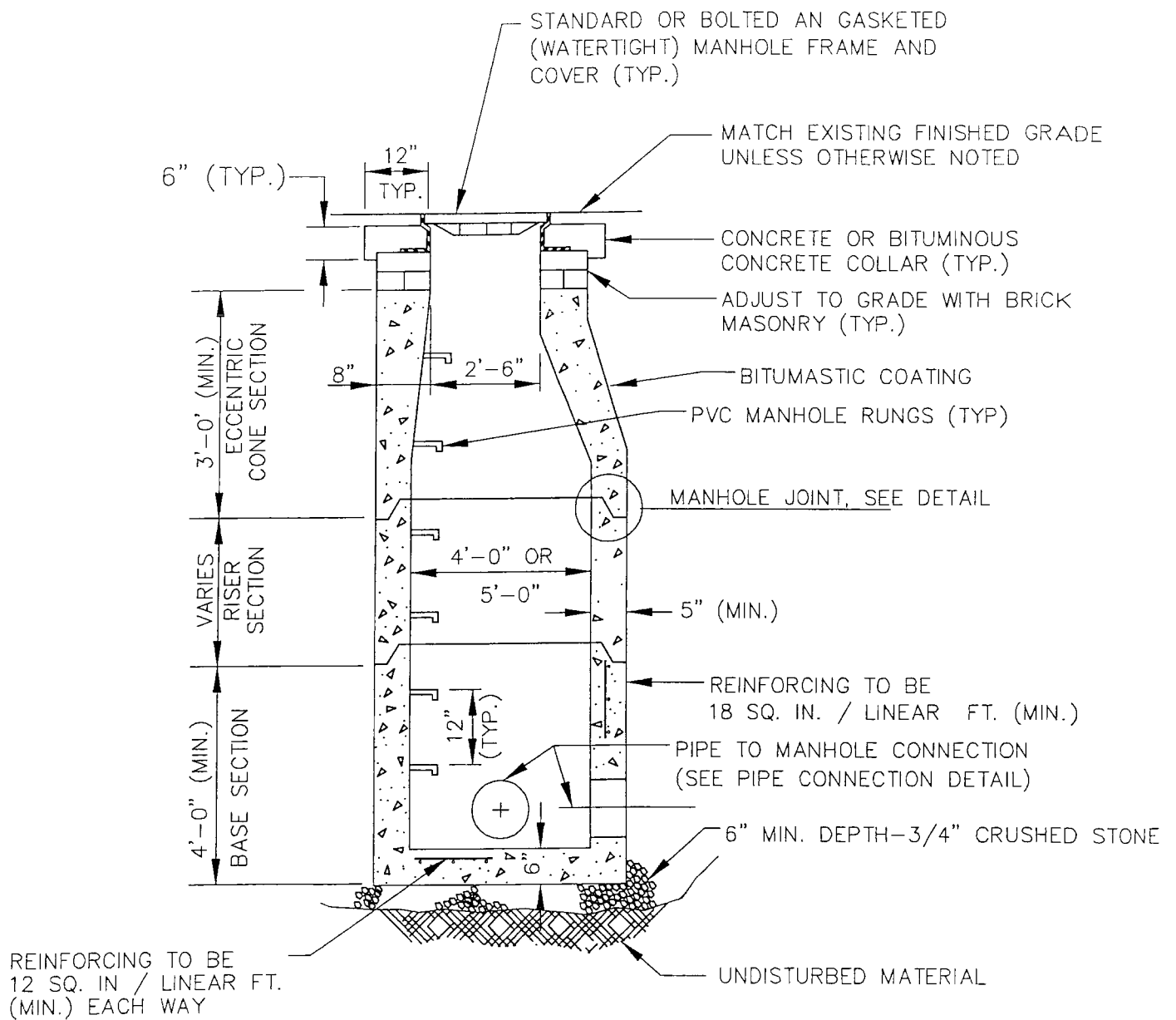
APPENDIX A

CONSTRUCTION DETAILS



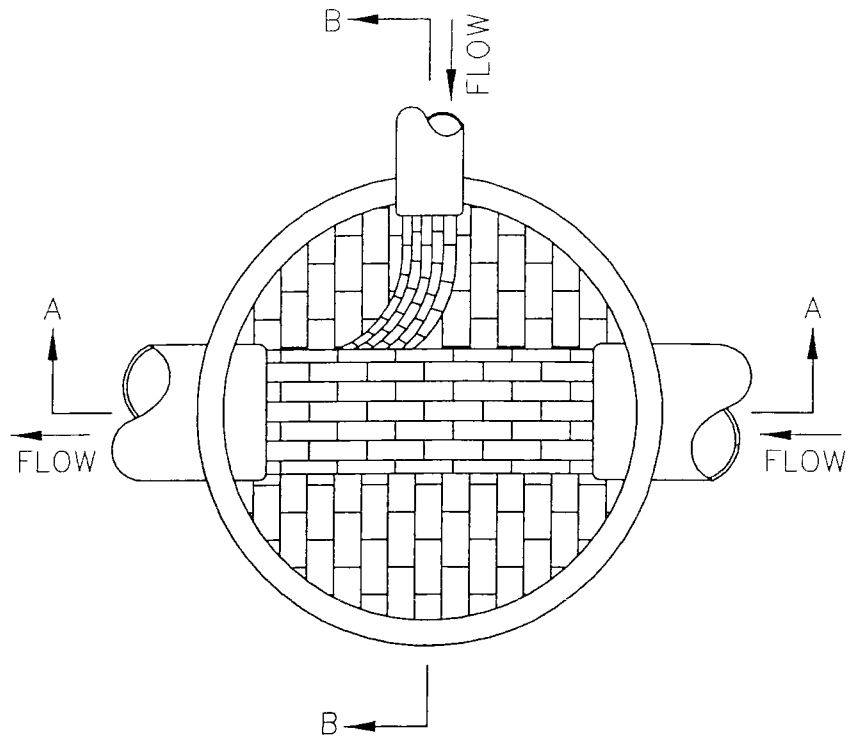
TYPICAL TRENCH DETAIL

NOT TO SCALE



4'-0" AND 5'-0" DIA. PRECAST MANHOLE

NOT TO SCALE

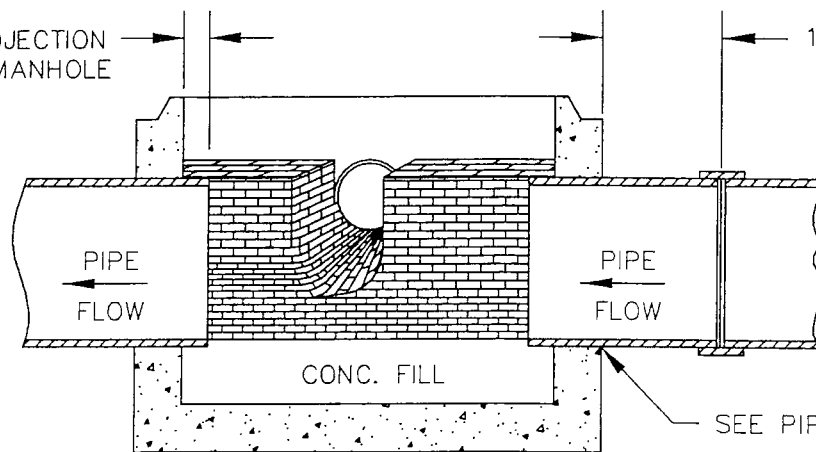


SEWER MANHOLE PLAN

NOT TO SCALE

2" MAXIMUM PROJECTION
OF PIPE INTO MANHOLE

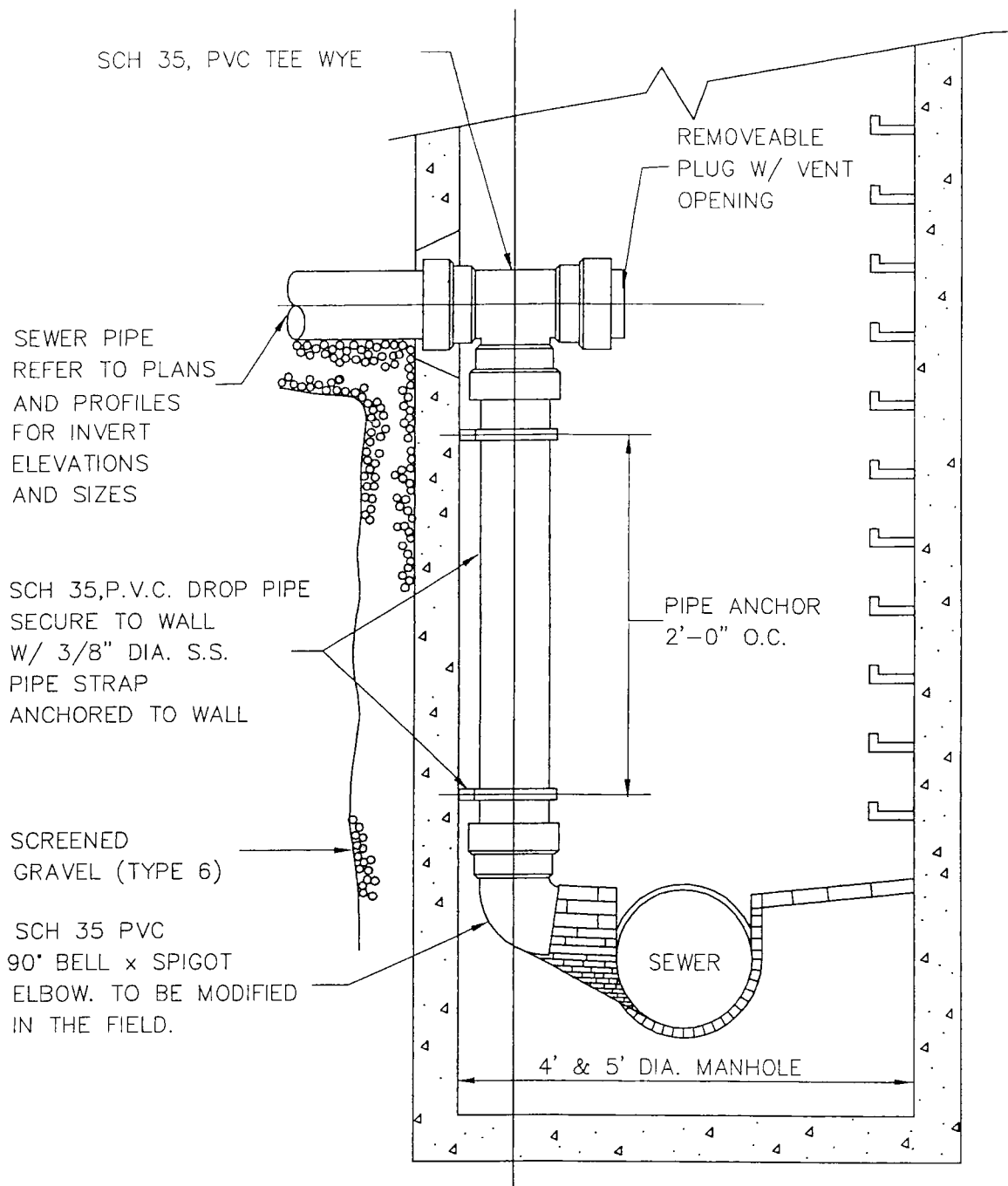
18" MAXIMUM DISTANCE
TO FLEXIBLE JOINT



SEE PIPE CONNECTION DETAIL

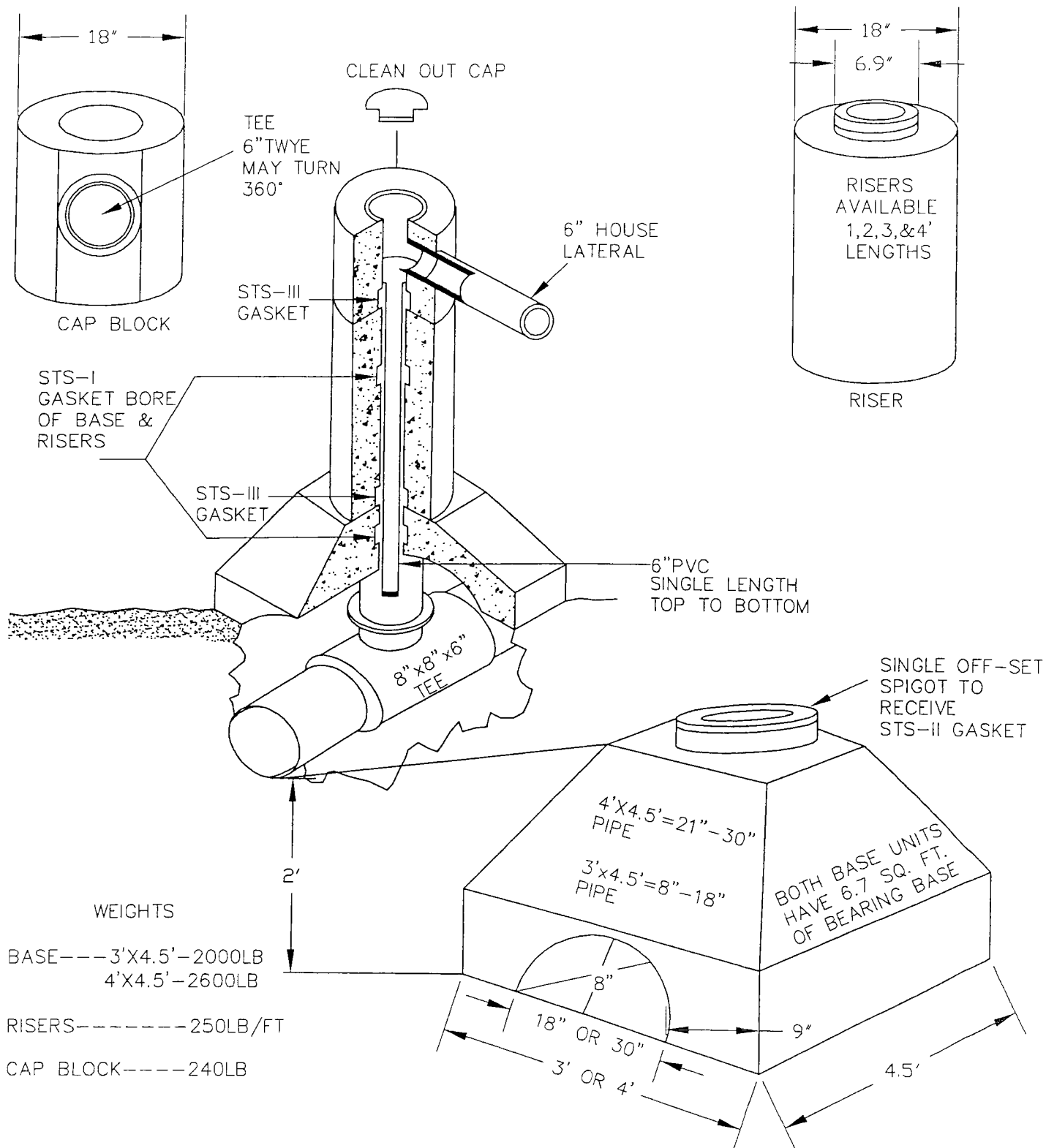
BASE SECTION TO BE FULL
WALL THICKNESS AND
MONOLITHIC TO A POINT 6"
ABOVE THE PIPE CROWN

SECTION A-A



INSIDE DROP DETAIL GRAVITY SEWER

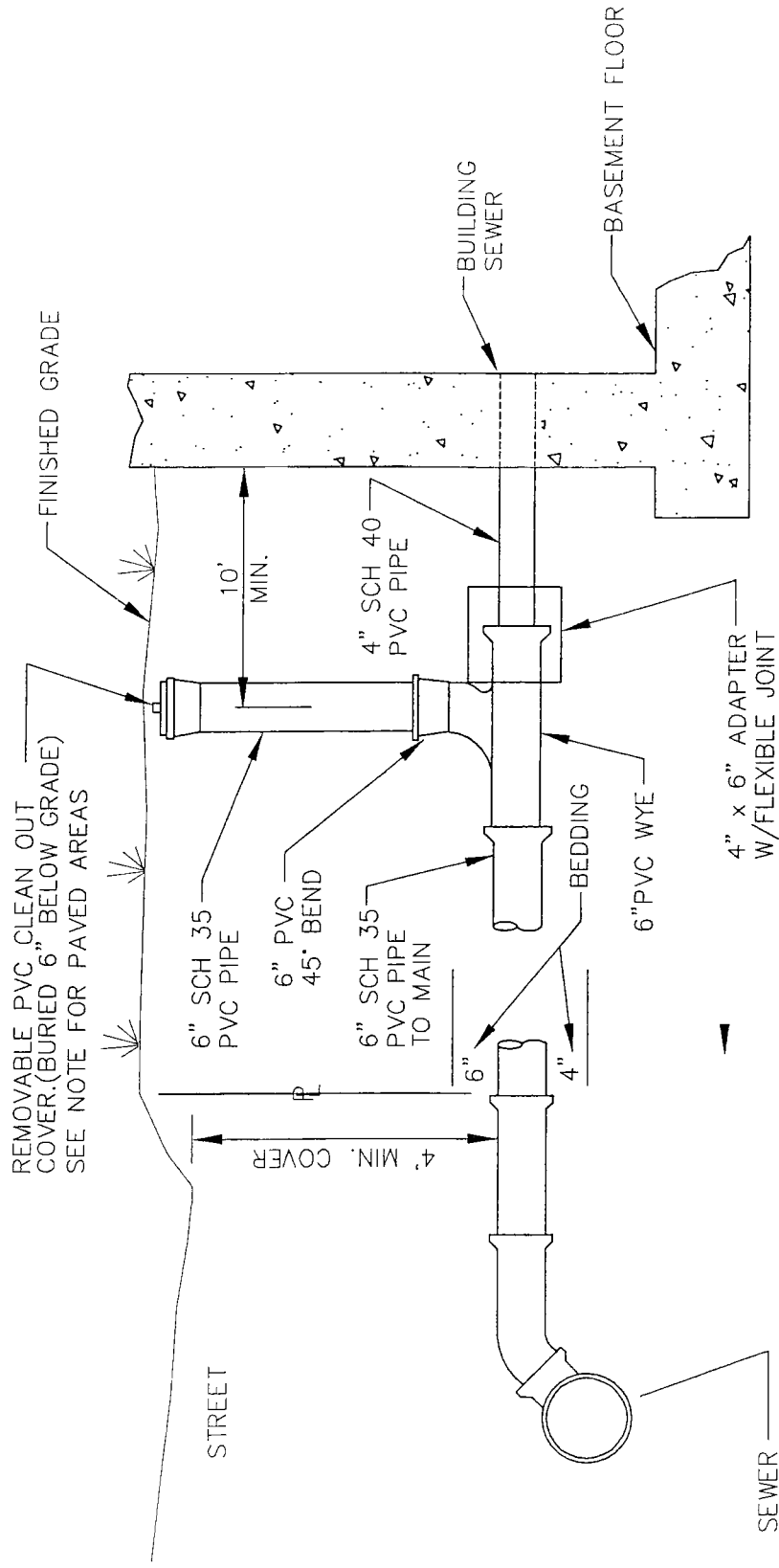
NOT TO SCALE



PRECAST CONCRETE SEWER CHIMNEY DETAIL
NOT TO SCALE

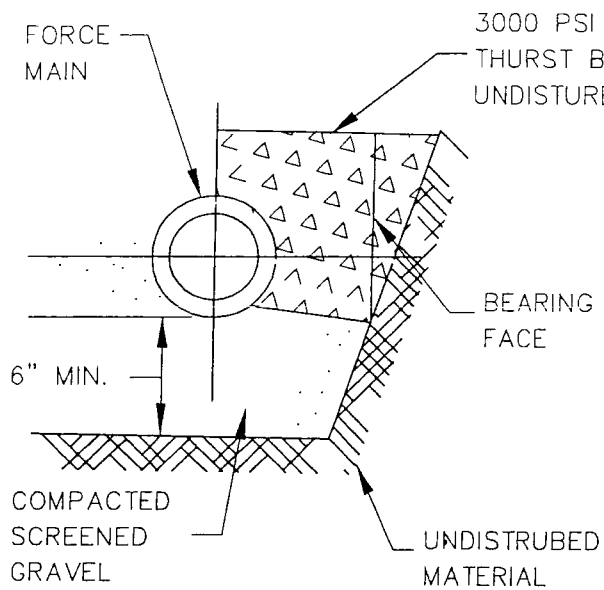
CONSTRUCTION NOTES

1. MINIMUM SLOPE 1/8" PER FOOT FOR 6" PVC SEWER SERVICE
2. OUTSIDE CLEAN OUT REQUIRED IF CLEAN OUT NOT INSIDE BASEMENT
3. "GENICO" STYLE CAST IRON FRAME AND COVER REQUIRED IN PAVED AREAS. INSTALL FLUSH TO FINISHED GRADE OF PAVEMENT.
4. GREEN TRACER TAPE MARKED "CAUTION SEWER LINE BELOW" MUST BE PLACED OVER THE SEWER SERVICE AT A 16" DEPTH BELOW FINISHED GRADE
5. PIPE BEDDING TO BE 3/4" CRUSHED STONE WHEN GROUND WATER IS PRESENT AND TYPE 2 "SAND" WHEN DRY.

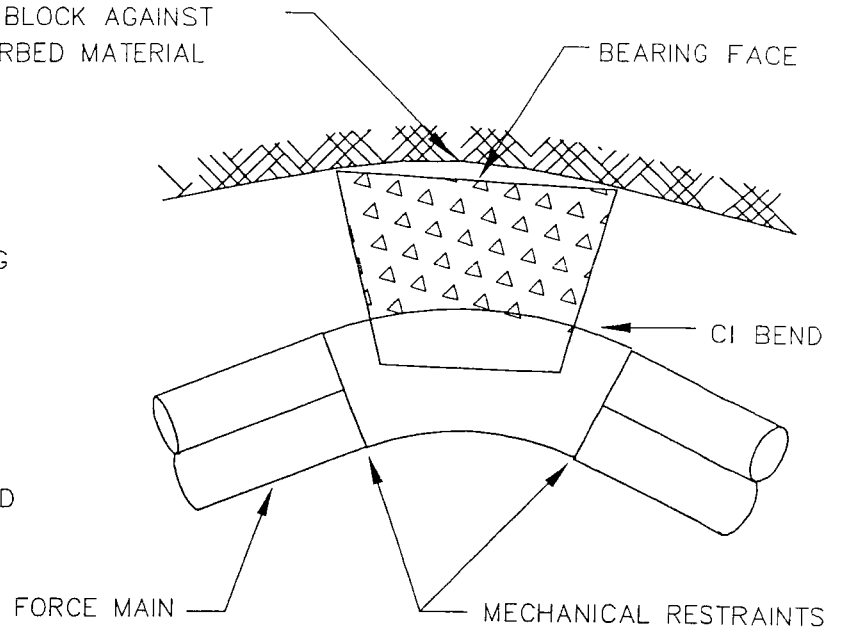


SEWER SERVICE LINE OUTSIDE CLEAN OUT AND FITTINGS

NOT TO SCALE



SECTION



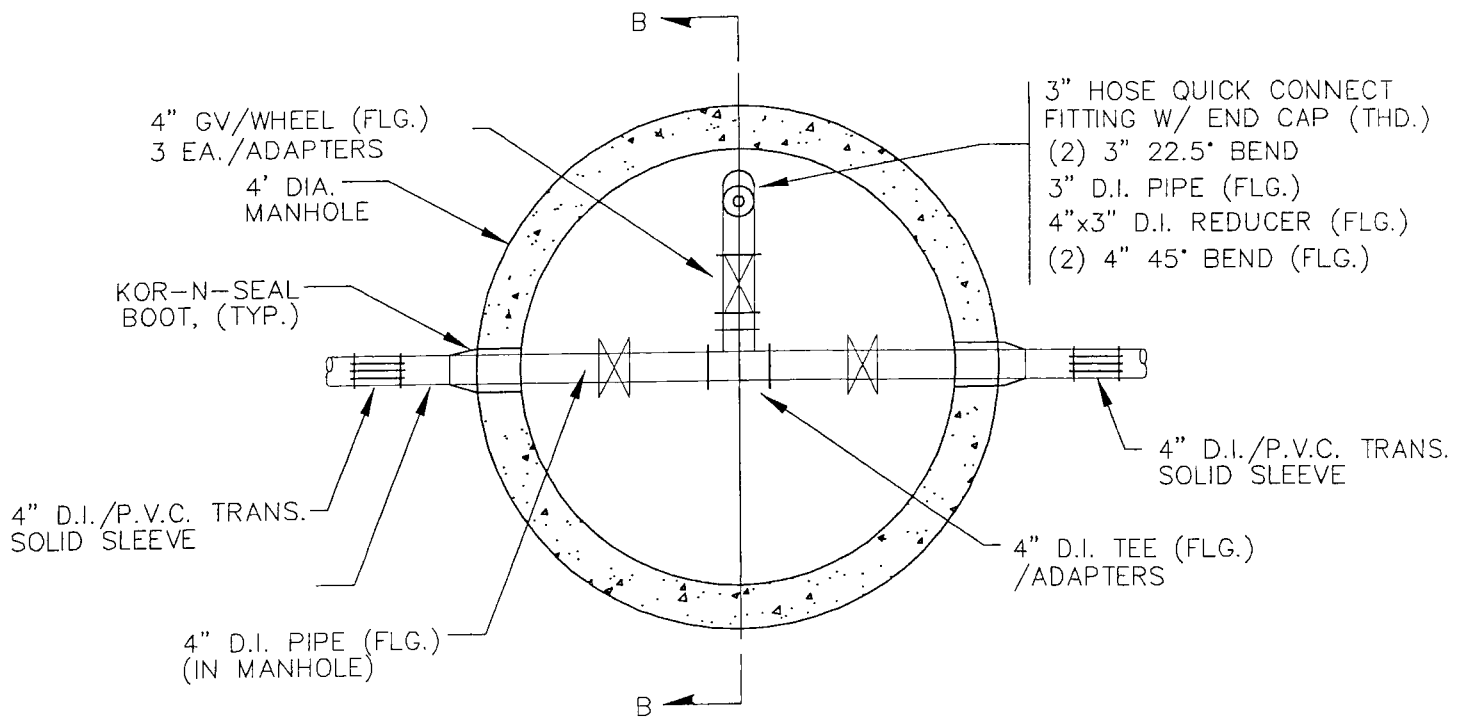
PLAN

FORCE MAIN THRUST BLOCK

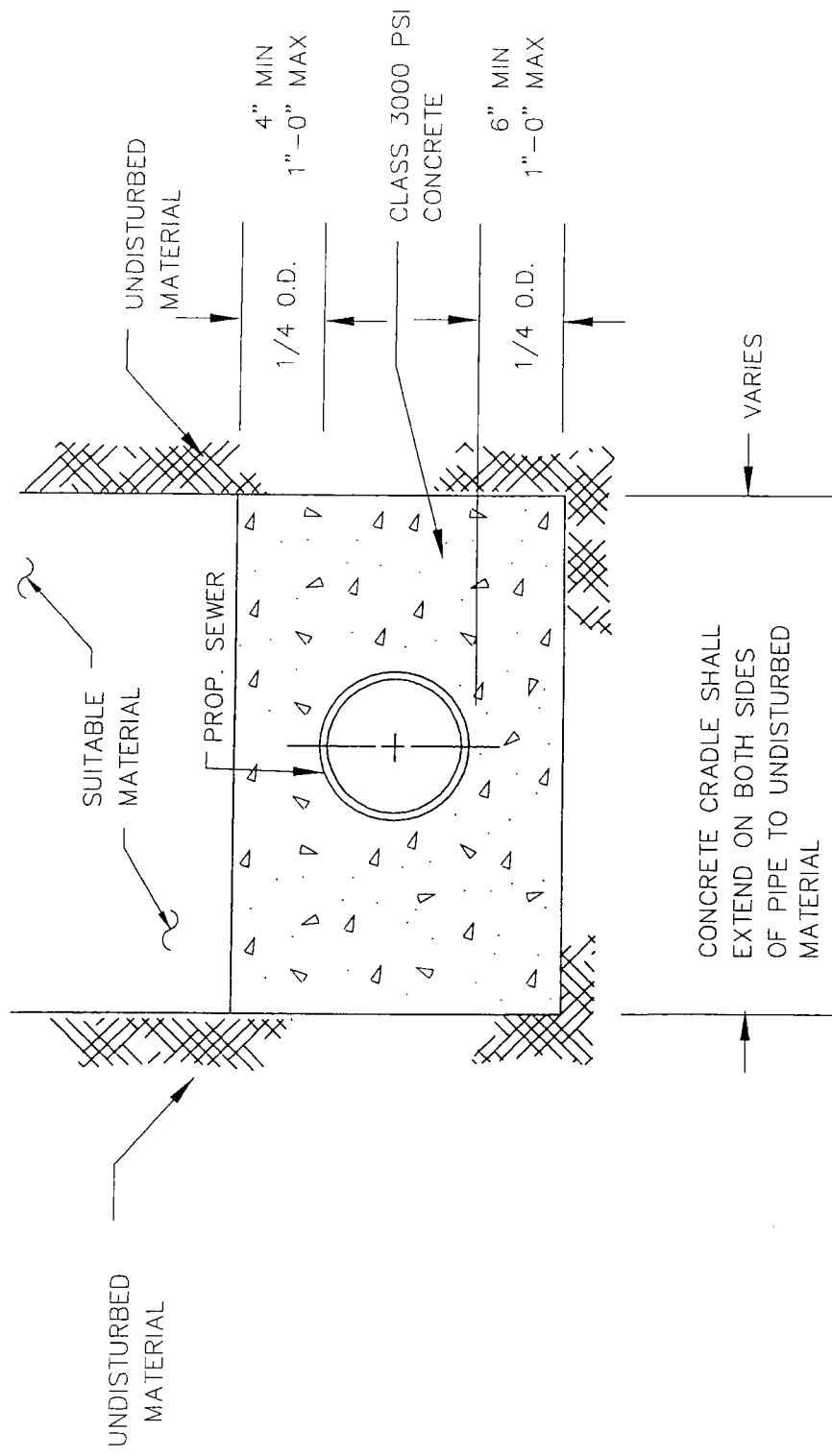
NOT TO SCALE

NOTES:

1. ALL FORCE MAIN BENDS SHALL BE BACKED UP WITH A CONCRETE THRUST BLOCK BETWEEN THE PIPE AND UNDISTURBED MATERIAL.
2. BEARING AREA REQUIRED ON VERTICAL PLANE 90° TO RADIUS PLANE PASSING THROUGH MIDPOINT OF BEND SHALL BE 6 SQ. FT.
3. MECHANICAL RESTRAINTS (MEGA-LUG OR EQUAL) ARE REQUIRED FOR ALL BENDS AND FITTINGS ALONG THE FORCE MAIN IN ADDITION TO CONCRETE THRUST BLOCKS.



TYPICAL FORCE MAIN
CLEANOUT MANHOLE DETAIL-PLAN VIEW
NOT TO SCALE

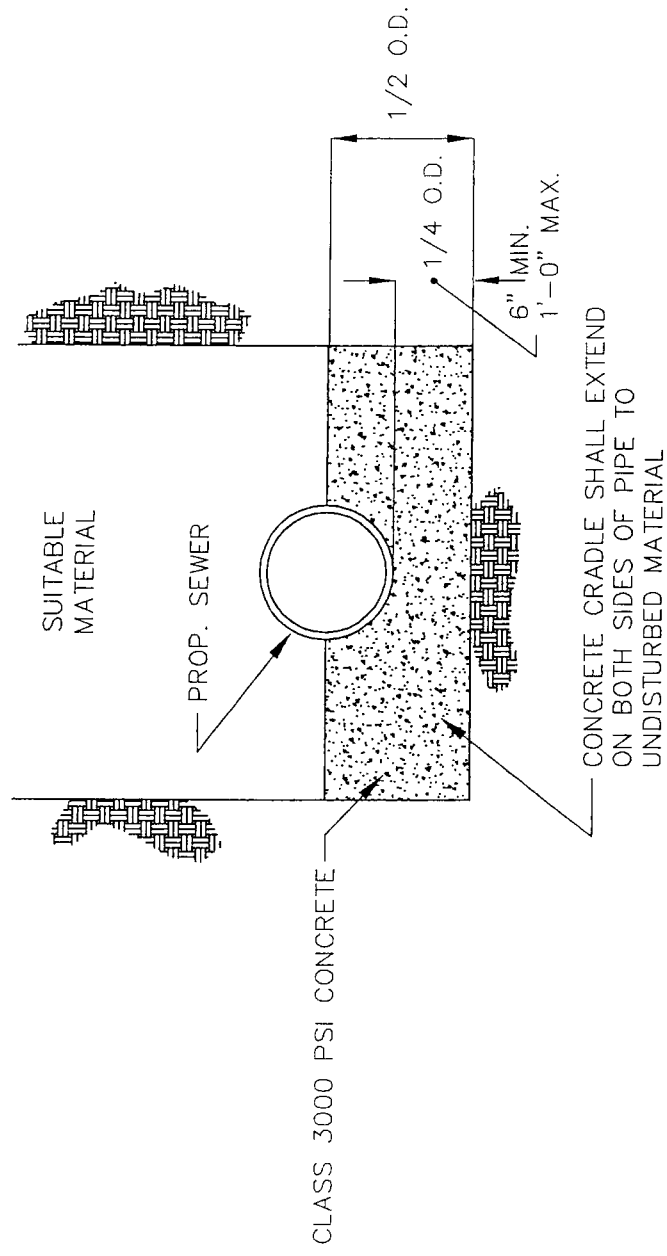


CONCRETE DAMS AND CONCRETE ENCASEMENT

NOT TO SCALE

NOTES:

1. CONCRETE CRADLE OR ENCASEMENT SHALL TERMINATE AT PIPE JOINTS.
2. PIPE SHALL BE BRACED TO PREVENT MOVEMENT WHILE CONCRETE IS POURED.

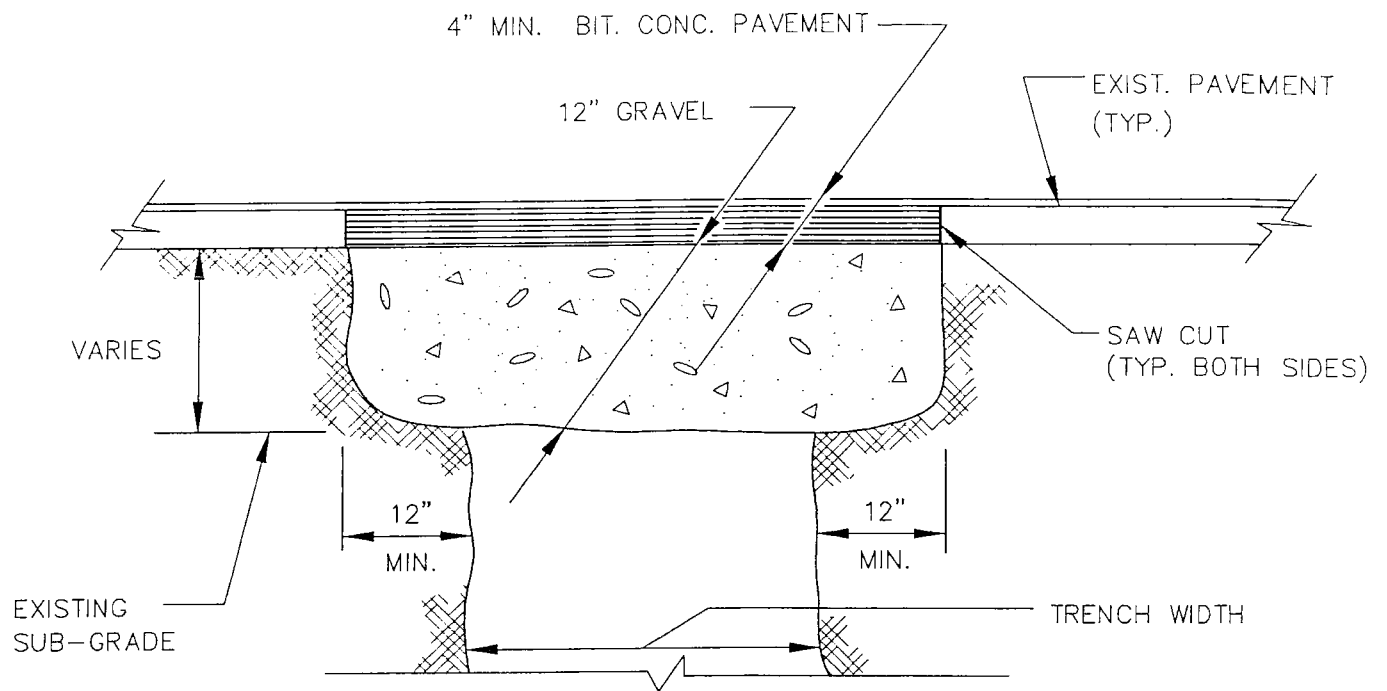


CONCRETE CRADLE

NOT TO SCALE

NOTES:

1. CONCRETE CRADLE OR ENCASEMENT SHALL TERMINATE AT PIPE JOINTS.
2. PIPE SHALL BE BRACED TO PREVENT MOVEMENT WHILE CONCRETE IS POURED.



TRENCH PAVEMENT DETAIL

NOT TO SCALE

APPENDIX B

APPLICATION FORM

TOWN OF MILLIS, MASSACHUSETTS

SEWER MAIN EXTENSION APPLICATION

NAME OF
APPLICANT: _____

LOCATION: _____

SEWER AGREEMENT

The undersigned applicant hereby requests approval of its proposal to construct a sewer which shall eventually become a public sewer and herewith submits to the Town for its review, recommendation and approval, the design drawings and specifications of the proposed sewer. The undersigned applicant understands, covenants and agrees that the Board may, in its sole discretion, submit the said design information to its independent professional engineering firm for a review and recommendations, and that the undersigned applicant shall be required to pay the full cost of any such engineering review without any surcharges or add-ons by the Town and that the said payment shall be made by the applicant directly to the engineering firm. Fees listed below shall be charged for in-house review of plans and field inspections during construction. The Town shall not approve, disapprove or otherwise act on the said application until said payment has actually been made.

Applicant Signature Date

Proposed # Gallons per Day Discharge _____

SEWER:

L.F. _____ No. # SMH _____ No.,# Services _____

_____ \$1000 Deposit Fee (For Town's Consulting Engineers)

_____ Extension Fee \$1000

_____ \$1750 per sewer service (paid at time of building permit application)

Classification: Residential Extension _____

Commercial Extension _____

Industrial Extension _____



**TOWN OF MILLIS
DEPARTMENT OF PUBLIC WORKS
SEWER ENTRANCE/CONNECTION APPLICATION & PERMIT**

New Construction () or Existing Building ()

Type of Use: () Residential () Commercial () Industrial () Agricultural () Other: _____

Number of Bedrooms: _____

Estimated Flow: _____
(gallons per day)

Owner's Name _____

Drainlayer/Installer Name _____

Address/Location _____

Drainlayer/Installer Address _____

Owner's Telephone # _____

Drainlayer/Installer 24 hour Telephone # _____

Owner's Signature _____

Drainlayer/Installer Signature _____

CONDITIONS

1. All work must be completed within 60 days of permit issuance.
2. Application must be accompanied by plans for the proposed building connection.
3. All work must be inspected by the Millis DPW. Drainlayer must provide 24 hour notice for inspection requests. Trenches and septic system abandonments must be re-excavated if backfilled prior to inspection request.
4. Owner and Drainlayer agree to abide by all town sewer rules and regulations.
5. Cleanouts must be provided at all bends. Trench tracer tape must be provided.
6. Drainlayer must provide a 24 hour/day access telephone number above.
7. Industrial users should note the specific rules of the Charles River Pollution Control District.

ENTRANCE FEE: \$1,750.00 () PAID

CHECK or CASH RECEIPT No. _____

Approved By: _____

Assistant Director Millis DPW _____

Town Administrator _____

Executive Director, CRPCD _____

**MILLIS BOARD OF HEALTH
SEPTIC SYSTEM ABANDONMENT PERMIT**

Type of subsurface sewage disposal system to be abandoned:

() Cesspool () Septic Tank () Septic Pits/Chambers () Other: _____

Type of tank:

() Single Tank () Multi-Tank () Other: _____

Septic Hauler Name: _____ Phone: _____

Septic Hauler Address: _____

CONDITIONS

1. Town inspector must witness crush and fill (abandonment) of all septic system components.
2. Pump out slip must be sent by septic hauler to Millis Board of Health.
3. The abandonment must be completed in accordance with 310 CMR 15.00 (Title 5).

Approval: _____

Date: _____

Millis Health Director

ABANDONMENT PERMIT FEE: \$50.00 () PAID

CHECK or CASH RECEIPT No.

**TOWN OF MILLIS
SEWER ENTRANCE/SEPTIC SYSTEM ABANDONMENT CERTIFICATE OF COMPLIANCE**

The undersigned certifies that all septic waste has been removed properly from the subsurface sewage disposal system and that the subsurface sewage disposal system has been abandoned in accordance with Title 5 and the sewer connection has been made in accordance with Town of Millis sewer regulations:

Drainlayer/Septic Abandoner Signature

Town of Millis Inspector

Date:

Date:

Inspector Initials: _____ Inspected Trench and Pipe Construction

_____ As-Built tie card provided

RESIDENT/BUILDER COPY

_____ Witnessed crush and fill of septic system

APPENDIX C

RELATED SECTIONS

SECTION 02200

EARTHWORK

PART 1 GENERAL

- 1.01 SCOPE OF WORK
- 1.02 RELATED WORK SPECIFIED ELSEWHERE
- 1.03 SITE INFORMATION
- 1.04 PROTECTION OF EXISTING CONDITIONS

PART 2 MATERIALS - NOT APPLICABLE

PART 3 EXECUTION OF WORK

- 3.01 DESCRIPTION
- 3.02 OPEN EXCAVATION
- 3.03 SEPARATION OF SURFACE MATERIALS
- 3.04 EXCAVATED MATERIAL
- 3.05 DRAINAGE
- 3.06 STRUCTURE EXCAVATION
- 3.07 SLABS ON GRADE
- 3.08 TRENCH EXCAVATION
- 3.09 TRENCH EXCAVATION IN FILL
- 3.10 TRENCH LIMITS
- 3.11 EARTH EXCAVATION BELOW NORMAL GRADE
- 3.12 EXCAVATION NEAR EXISTING STRUCTURES
- 3.13 RELOCATION AND REPLACEMENT OF EXISTING STRUCTURES
- 3.14 CARE AND RESTORATION OF PROPERTY
- 3.15 DUST CONTROL
- 3.16 BACKFILLING - GENERAL
- 3.17 BACKFILLING AROUND STRUCTURES
- 3.18 BACKFILLING IN OPEN TRENCH
- 3.19 MATERIAL FOR FILLING AND EMBANKMENTS
- 3.20 GRADING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall make all excavation of normal depth in earth for sites, structures, roads, and trenches in whatever substance encountered, and shall place and compact backfill to the dimensions and levels shown on the plans or as required by the Engineer. The Contractor shall provide all labor, material, equipment, supervision and incidentals to execute the work in strict accordance with these specifications and applicable drawings. Work under this section includes, but is not necessarily limited to, stripping and stockpiling of suitable topsoil, excavation of all materials encountered, trenching, sheeting, shoring, dewatering, blasting, maintenance of excavation, backfill, fill, providing borrow, compaction, and grading. Layout shall be done by the Contractor.
- B. The Contractor is advised that lines and grades, as shown on plans and profiles, are subject to change. Although it is the intention to adhere to that which is shown on the plans, the Engineer reserves the right to make changes in lines and grades of utilities and locations of manholes when such changes may be necessary or advantageous.
- C. The Contractor's particular attention is directed to the related sections of the specifications. Specific information is provided for stockpiling material on-site or off-site

and disposal of unsuitable material. Special requirements applicable to excavation to remove soft material, site preparation settlement, and timing of construction are identified.

- D. In open trenching on State, County, or local highways and railroad properties, the Contractor shall be governed by the conditions, restrictions and regulations made by the appropriate body. All such regulations shall be in addition to those set forth in these specifications.
- E. Any excavation, dewatering, sheeting, and bracing shall be carried out in such a manner as to eliminate any possibility of undermining or disturbing the foundations of any existing structures or any work previously completed under this Contract, or as specified herein.
- F. The Contractor shall fill or backfill all excavations as indicated on the Contract Drawings and as specified herein, but is advised that some of the excavated material may not be suitable as backfill material.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 02224 - FILL AND BACKFILL MATERIALS
- B. SECTION 02250 - COMPACTION CONTROL AND TESTING
- C. SECTION 02575 - PAVING REPAIR AND REPLACEMENT

1.03 SITE INFORMATION

- A. Existing grades and other site information shown on the applicable Contract Drawings are approximate and have been compiled by field surveys. The Owner does not guarantee that grades shown will not vary from the actual site conditions. The Contractor must make his own field investigations to determine all conditions affecting the work to be done and materials needed and make his bid in sole reliance thereon.

1.04 PROTECTION OF EXISTING CONDITIONS

- A. General: Extreme care shall be exercised to avoid existing trees, shrubs, facilities, utilities, fences, and private property that are to remain and all necessary precautions taken to preclude damage to these items. Any damage to these items as a result of work performed by the Contractor shall be repaired by the Contractor at his own expense.
- B. Utility agencies shall be contacted and advised of proposed work prior to the start of actual excavation. The Contractor shall obtain information from the proper sources and authorities concerning locations of all utilities within the scope of this work, in order that there will be no damage done to such utilities.
- C. If and when encountered, utilities shall be supported and protected, and the Engineer shall be notified. Entrance, opportunity, and ample time shall be allowed for such measures as may be required for the continuance of utility services. Utilities to be abandoned within excavation areas shall be removed, plugged, or capped by the Contractor as directed by the Engineer. Permanent existing utilities near the excavation and/or construction work shall be properly protected during construction work, and any damage to such permanent utilities shall be repaired by the Contractor without expense to the Owner or Engineer.

- D. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs. No separate item is provided for service supports and the Contractor must cover supports in the unit prices bid for the roadway construction.
- E. The Contractor shall not be compensated for any additional work involved whenever a utility or underground structure is so encountered within the work limits.
- F. The Contractor shall not be compensated for any additional work involved if the utilities or underground structures cross the trench line transversely above or below the proposed work.
- G. Rules and regulations governing the respective utilities shall be observed. Active utilities shall be adequately protected from damage, and shall not be removed or relocated except as indicated or directed.
- H. All existing pipes, poles, wires, fences, curbing, and other structures which, in the opinion of the Engineer, must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from injury by the Contractor, and in case of injury, the Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. The Contractor shall at his own expense replace, repair, or restore the affected facilities to their original condition or shall reimburse the owner of said facilities for such expenses as the owner may accrue. When the owners do not wish to make the repairs themselves, all damage shall be repaired by the Contractor, or, if not promptly done by him, the Engineer may have the repairs made at the expense of the Contractor.
- I. Survey markers: Any existing property boundary markers, City bounds, control points, and datum elevations markers or bench marks to be removed and replaced as shown on the Contract Drawings or directed by the Engineer shall be removed and replaced by the Contractor with all expenses for such replacement paid for by the Contractor.
- J. The Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Barricades, etc., shall conform with all codes and regulations, and shall be lighted at night with lanterns, and reflectorized paint as directed or required for safety, and shall be removed upon completion of the Contract.

PART 2 MATERIALS - NOT APPLICABLE

PART 3 EXECUTION OF WORK

3.01 DESCRIPTION

- A. The Contractor shall make excavations in such manner and to such width as will give suitable room for building the structures or for constructing the roadways but complying with the limits shown on the Contract Drawings. The Contractor shall furnish and place all sheeting, bracing, and supports; shall do all pumping and draining and any other work necessary for dewatering and shall render the bottom of the excavation firm and dry and in all respects acceptable.
- B. In no case, except as provided for in Part 3.10 titled "Trench Limits", shall the earth be plowed, scraped, or dug by machinery so near to the finished grade as to result in disturbance of material below said grade. The last of the material to be excavated shall be removed with pick and shovel just before placing pipe, masonry, or other structures.
- C. All excavations shall be braced with steel sheeting or steel excavation boxes as specified in the related specifications or as shown on the Contract Drawings.

3.02 OPEN EXCAVATION

- A. All excavation, except as otherwise specified or permitted, shall be open cut. The length of trench open at any one time will be controlled by the Engineer. The Contractor shall not have more than three hundred (300) feet of trench open at any one time during daylight hours.

3.03 SEPARATION OF SURFACE MATERIALS

- A. From areas within which excavations are to be made, loam, topsoil, sand, and gravel shall be carefully removed and separately stored to be used again as directed; or, if the Contractor prefers not to separate materials, he shall furnish as directed and without additional compensation, clean backfill and loam and topsoil at least equal in quantity and quality to that excavated.
- B. When excavations are to be made in paved surfaces, the Contractor shall machine cut the pavement along the proposed trench lines, with either a pneumatic hammer or mechanical saw in such a manner that the edges of the remaining pavement follow clean, trim, straight lines. If pavement is removed, it shall not be mixed with other excavated material, but shall be disposed of away from the site before the remainder of the excavation is made.

3.04 EXCAVATED MATERIAL

- A. Excavated material shall be so placed as not to interfere with travel on the streets and driveways by the occupants of adjoining property, cause undesirable settlement, or obstruct free access to hydrants and gate valves. Access for emergency vehicles shall be maintained at all times. Excavated material shall not be deposited on private property until written consent of owner or owners thereof has been filed with Engineer. Onsite excavated material stockpiles shall be stored as directed by the Engineer. However, if it is impractical or unsafe to stack suitable, excavated, backfill material adjacent to the work, the material shall be hauled and stored at a location provided by the Contractor at no additional expense to the Owner. Excavated material shall not be deposited in brooks or streams. Excavation shall include the removal of unearthed wooden structures.
- B. It is expressly understood that no excavated materials shall be removed from the site of work or disposed of by the Contractor except as directed or approved by the Engineer. All material designated by the Engineer to be removed from the site shall be immediately removed and legally disposed of according to Federal, State and Local codes and regulations. The Contractor will be required to clean any roads and streets of material that is spilled from his operation of hauling and disposing of unsuitable excavated material.
- C. Suitable excavated material may be used for fill or backfill on other parts of the work.
- D. Upon completion of the backfilling, the streets or property shall be cleaned, surplus material removed, and the surfaces restored to the condition in which they were before construction. All materials left over in public highways shall become the property of the Contractor. If the Contractor fails to promptly remove such surplus material, the Engineer may have the work done and charge the cost thereof as money paid to the Contractor.
- E. Material excavated from private property shall belong to the property owner or his representative, and shall be disposed of by the Contractor, as required by said property owner or representative, but the longest haul requested by the Owner shall in no case

exceed 5 miles. If the Contractor fails to promptly remove such surplus material, the Engineer may have the same done and charge the cost thereof as money paid to the Contractor.

3.05 DRAINAGE

- A. At all times during construction, the Contractor shall provide, place and maintain ample means and devices with which to intercept and/or remove promptly, and dispose properly all water entering trenches and other excavation, or the water may flow along or across the site of work; and keep said excavations dry until the structures, pipes, and appurtenances to be built have been completed to such extent that they will not be damaged. At this time the Contractor shall remove such temporary means and devices.
- B. Every precaution necessary to obtain water-tight construction of all joints in pipe, manholes, wyes, and drop connections must be taken.
- C. All ground water which may be found in trenches or excavations and any water which get may into them from any cause whatsoever shall be removed.
- D. All water pumped or drained from the work shall be disposed of in a suitable manner, satisfactory to the Engineer, without undue interference with other work or damage to pavements, other surfaces, or property.

3.06 STRUCTURE EXCAVATION

- A. The Contractor shall excavate to the elevations shown on the plans, or as directed by the Engineer. If the Contractor excavates below the elevations specified, he shall bring the excavation back to the proper elevation by backfilling with screened gravel (Type 6 material) and tamping in 6" layers to provide a compact base. The backfill material must be approved by the Engineer before being placed. If the Engineer directs any changes in elevation or dimension of the structure excavations from that shown on the plans, the Contractor shall be paid for work performed under the appropriate bid item. Any increase in cost resulting from backfilling, or increasing the size of the excavation or foundations because of overexcavation in depth, shall be borne by the Contractor. Cut slopes shall have a maximum slope of 2:1 if not braced. When excavation has reached specified dimensions, the Engineer shall be notified and he will determine if conditions are satisfactorily met before work is allowed to continue.

3.07 SLABS ON GRADE

- A. Where slabs on undisturbed earth occur, all loams, organic or other undesirable materials shall be removed as required by the Engineer, and the area grubbed to a depth of at least six (6) inches below the finished subgrade elevation or as indicated on the Contract Drawings. Where slabs on fill occur, the fill will also be compacted in accordance with the related section of the specifications.

3.08 TRENCH EXCAVATION

- A. Excavation shall not commence in any section until the pavement covering the proposed excavation has been properly cut.

- B. In general, trenches shall be excavated to such depth as will permit pipe to be laid at elevations, slopes or depths of cover as indicated on the Contract Drawings. Deeper trenches shall be provided where necessary on account of the conformation of the ground and to permit the alignment of the pipe without undue deflection of joints.
- C. Trenches shall be excavated by hand or machinery to the width and depth indicated on the Contract Drawings and specified herein under Paragraph 3.10 "Trench Limits". All loose material shall be removed from the bottom of the trench so that the bottom of the trench will be in an undisturbed condition, and so as to provide a proper foundation for pipe bedding material.
- D. Particular care shall be taken that no stone 6 inches or larger in any diameter protrudes more than 3 inches from the bottom or side of the trench. Suitable bell holes shall be made in the trench at joints as required.
- E. At completion of a workday, all excavations shall be covered by backfilling to existing grade or plating to entirely cover the opening or completely enclosing with a 6 foot high temporary chain link fence.
- F. In earth excavation in sections where bedding is excluded, the bottom of the trench shall be shaped so as to conform to the outside of the pipe, particular care being taken to recess the bottom of the trench in such a manner as to relieve the bell of all load.

3.09 TRENCH EXCAVATION IN FILL

- A. If pipe is to be laid in embankments or other recently filled material which are more than 1 foot below the invert of the pipe, the fill material shall be placed and properly compacted to final grade or to a height of at least 3 feet above the top elevation of the pipe, whichever is the lesser, before laying pipe. Particular care shall be taken to ensure maximum consolidation of material under the pipe. The pipe trench shall then be excavated as though in undisturbed material.

3.10 TRENCH LIMITS

- A. The limits of normal trench excavation shall be as shown on the Contract Drawings or specified herein. Trenches shall be excavated to the required depths, adding, however, to such depths the thickness of the pipe and, where applicable, the thickness of the bedding. The width of the trench at the bottom shall always be wide enough to make the joints properly. When, in the opinion of the Engineer, it is necessary to lay a concrete foundation, the excavation shall be made as shown on the details or as ordered by the Engineer.
- B. Where the bottom of the trench, by mistake of the Contractor, has been taken out to a greater depth than above specified, it shall be refilled to the proper grade, using screened gravel material by the Contractor who shall receive no additional compensation whatever therefore. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.
- C. The Contractor shall at all times exercise care not to excavate outside the trench limiting lines as shown on the Contract Drawings unless otherwise authorized by the Engineer.
- D. Bedding for pipe will be as detailed on the Contract Drawing and as specified in the related section of the specifications.

3.11 EARTH EXCAVATION BELOW NORMAL GRADE

- A. If in the opinion of the Engineer, the material at or below the depth to which excavation for structures and pipes would normally be carried is unsuitable for foundation, it shall be removed to such widths and depths as directed and replaced with suitable material. Such work shall be paid for under appropriate items.

1. Roadway over-excavations shall be backfilled with compacted Type 3 material.
2. Trench over-excavation shall be minimum of 3 feet or as directed by the Engineer and shall be lined with a geotextile fabric.

3.12 EXCAVATION NEAR EXISTING STRUCTURES

- A. Attention is directed to the fact that there are pipes, drains, and other utilities in certain locations. Some of these have been indicated on the Contract Drawings, and an attempt has been made to show all of the lines and services, but the completeness of accuracy of the information given is not guaranteed.
- B. All pipes and other utility conduits, shall be located on the ground with pipe finding equipment well ahead of the work at all times. All such locations shall be plainly marked by coded paint symbols on pavement or by marked stakes in the ground. All such location work shall be provided by the Contractor in cooperation with the appropriate utility to the satisfaction of the Engineer at no extra cost.
- C. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools, as directed. Such manual excavation when incidental to normal excavation shall be done to the satisfaction of the Engineer at no extra cost.

3.13 RELOCATION AND REPLACEMENT OF EXISTING STRUCTURES

- A. Whenever the Contractor encounters certain existing structures as described below and is so ordered in writing, he shall do the whole or such portions of the work as he may be directed, to change the location or, remove and later restore, or replace such structures, or to assist the Owner thereof in so doing. For all such work, the Contractor shall be paid under such items of work as may be applicable, otherwise as Extra Work.
- B. In removing existing pipes or other structures, the Contractor shall use care to avoid damage to material, and the Engineer shall include for payment only those new materials which, in his judgment are necessary to replace those unavoidably damaged.
- C. The structures to which the provisions of the preceding two paragraphs shall apply include pipes, wires, and other structures which (a) are not indicated on the Contract Drawings or otherwise provided for, (b) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (c) in the opinion of the Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.
- D. When fences interfere with the Contractor's operations, he shall remove and (unless otherwise specified) later restore them to at least as good condition as that in which they were found immediately before the work was begun. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

3.14 CARE AND RESTORATION OF PROPERTY

- A. Excavation machinery and cranes shall be of suitable type and be operated with care to prevent damage to trees not to be cut and overhanging branches and limbs.
- B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. In case of cutting or unavoidable damage to branches, limbs, and trunks of trees, the cut or damaged portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.
- C. Cultivated hedges, shrubs, and plants which might be injured by the Contractor's operations shall be protected by suitable means or shall be dug up and temporarily replanted and maintained. After the construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is reestablished. If cultivated hedges, shrubs, and plants are injured so such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of kind and quality at least equal to the kind and quality existing at the start of the work.
- D. On paved surfaces, the Contractor shall not use or operate tractors, bulldozers, or other power operated equipment, with treads or wheels of which are so shaped to cut or otherwise damage such surfaces. All surfaces which have been damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operation. Suitable materials and methods shall be used for such restoration.
- E. The restoration of existing property or structures shall be done as promptly as practicable and shall not be left until the end of the construction period.

3.15 DUST CONTROL

- A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities so as to minimize the creation of dust. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish the material, load, deliver, and spread it as directed.

3.16 BACKFILLING - GENERAL

- A. In general, and unless other material is indicated on the Contract Drawings or specified elsewhere, material used for backfilling trenches and excavations around structures shall be suitable material which was removed in the course of construction excavation. Backfilling shall not commence until the Engineer gives permission. Where the trench is in an area to be paved, or in an unpaved vehicular or pedestrian traveled way, or the shoulder of a paved roadway, a suitable pavement base shall be provided to a depth of at least that required in the related sections of the specifications.
- B. Suitable backfill material shall be free from cinders, ashes, refuse, boulders, rocks, or stones greater than 6 inches in any dimension, unsuitable organic material, or other material which, in the opinion of the Engineer, is unsuitable.
- C. Frozen material shall not be placed in the backfill, nor shall backfill be placed upon frozen material. Previously frozen material shall be removed, or shall be otherwise treated as required, before new backfill is placed.

3.17 BACKFILLING AROUND STRUCTURES

- A. The Contractor shall not deposit backfill against structures until the structure has obtained sufficient strength to withstand the earth pressure placed upon it and in no case less than seven days, nor before carrying out and satisfactorily completing the tests specified in the related sections of the specifications. Compaction of backfill against concrete structures shall not be carried out by motorized equipment closer to the structure than the depth of the structure below grade. Such backfilling shall be carried up evenly on all walls of a structure simultaneously with maximum allowable variation of 2 feet in elevation at any point. Unequal soil pressures shall be avoided by depositing the material evenly around the structure.
- B. In addition, where pipe is connected to the structure, the backfilling procedure shall be carried out as specified in "Backfilling in Open Trench".
- C. Measurement of fill material under this work will not include any filling made beyond a vertical plan of one foot outside the footings except as directed.
- D. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of the day's operations. Prior to terminating work for the day, the final layer of compacted fill shall be rolled or graded to eliminate ridges of soil left by compaction equipment. No fill shall be placed and compacted on snow, ice, or soil that was permitted to freeze prior to compaction.

3.18 BACKFILLING IN OPEN TRENCH

- A. As soon as practical after pipe has been laid in accordance with the appropriate sections and the pipe joints have been properly made, the backfilling shall begin, and shall continue without delay. However, the trench shall be kept open long enough for the Engineer to locate existing utilities uncovered during excavation and to inspect pipe or structure conditions.
- B. If a screened gravel or concrete envelope is not used, the selected material shall be (see Contract Drawings for additional or superseding information) free from large lumps and stones having any dimension greater than 2 inches, and shall be placed simultaneously on both sides of the pipe, so that there will be no tendency to displace the pipe alignment. In placing the material, care shall be taken that stones do not strike the pipe and geotextile fabric shall be installed to the limits shown on the Contract Drawings at the locations specified on the drawings or as directed by the Engineer.
- C. A sand blanket (Type 2 material) shall be placed at the sides of the pipe up to the top of the pipe and shall be hand-placed and thoroughly compacted using approved hand-operated tampers. Backfilling shall be carried up evenly on both sides of the pipe.
- D. Type 2 material shall be extended up to a level of 1 foot above the top of the pipe shall be placed in 6 inch layers, leveled along the length and width of the trench and thoroughly compacted with approved tampers.
- E. The sand blanket (Type 2 material) may be omitted for cast iron, ductile iron and reinforced concrete pipe provided, however, that no stone large than 2 inches is in contact with the pipe.
- F. The backfill in the remainder of the excavation above the top of the screened gravel or concrete envelope, if used, shall be Type 1, backfilled in approximately 12 inch layers and promptly compacted by mechanical tamping. Material used for backfilling to a point two feet over the pipe shall contain no stones larger than three inches in greatest dimension. Backfilling or tamping with trenching machines is prohibited.

- G. Care shall be taken in the use of mechanical or other tampers not to injure or move the pipe or cause the pipe to be supported unevenly.
- H. Large masses of backfilling material shall not be dropped into the trench in such a manner, in the opinion of the Engineer, as to endanger the pipe.
- I. All backfilled trenches shall be thoroughly surface tamped with a tamping machine approved by the Engineer.
- J. Whatever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material.
- K. No compacting shall be done when the material is too wet to be compacted properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compacting, or such other precautions shall be taken as may be necessary to obtain proper compacting.

3.19 MATERIAL FOR FILLING AND EMBANKMENTS

- A. Approved selected materials available from the excavations and not required for backfill around pipes or under structures may be used for site preparation except as otherwise specified. Material needed in addition to that available from construction operations shall be obtained from approved Type 1, 2, 3, or 4 sources.
- B. All material, whether from the excavations or offsite, shall be such nature that after it has been placed and properly compacted in 12 inch layers, it will make a dense, stable fill. It shall not contain vegetation, roots, stones over 6 inches in diameter, or porous material.

3.20 GRADING

- A. Grading, in preparation for placing of paved walks and drives and appurtenances, shall be preformed at all places to the lines, grades, and elevations as directed by the Engineer. All unsuitable material encountered, of whatever nature, shall be removed and disposed of as directed. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or conditions or the work.
- B. The right is reserved to make minor adjustments or revisions in lines or grades if found necessary as the work progresses or in order to obtain satisfactory construction.
- C. All slopes cut during construction shall be uniformly redressed to the slope, cross-section and alignment existing prior to construction as indicated on the Contract Drawings or as directed by the Engineer.

END OF SECTION

SECTION 02224

FILL AND BACKFILL MATERIALS

PART 1 GENERAL

- 1.01 SCOPE OF WORK
- 1.02 APPROVAL OF MATERIALS
- 1.03 RELATED WORK SPECIFIED ELSEWHERE

PART 2 MATERIALS

- 2.01 TYPE 1 - COMMON BORROW
- 2.02 TYPE 2 - SAND BORROW
- 2.03 TYPE 3 - SAND AND GRAVEL
- 2.04 TYPE 4 - COARSE GRAVEL
- 2.05 TYPE 5 - LOAM BORROW AND TOPSOIL
- 2.06 TYPE 6 - SCREENED GRAVEL MATERIALS
- 2.07 TYPE 7 - CRUSHED STONE

PART 3 EXECUTION OF WORK

- 3.01 PLACING AND COMPACTING

PART 1 GENERAL

- 1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, equipment, fill and backfill material and incidentals for site preparation and to meet finished contours as shown on the Contract Drawing. The use of the fill and backfill material is specified elsewhere. The Engineer may order the use of granular fill materials for purposes other than those specified in other sections, if in his opinion such use is advisable.

- 1.02 APPROVAL OF MATERIALS

- A. The Contractor shall furnish the Engineer with representative samples and a gradation analysis of each type of soil. If the source of materials changes significantly or a different source is used, re-submittals and re-approvals must be made.

- 1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 02200 - EARTHWORK
- C. SECTION 02250 - COMPACTION CONTROL AND TESTING

PART 2 MATERIALS

- 2.01 TYPE 1 - COMMON BORROW

- A. Common Borrow shall be a granular material obtained from approved on-site or off-site natural deposits and unprocessed except for the removal of unacceptable material and stones larger than six (6) inches. It shall not contain vegetation or roots. It shall be free from loam, clay, fine wood, trash, and other objectionable materials or harmful substances.

- B. Common Borrow shall consist of a material satisfactory to the Engineer and not specified as gravel borrow, sand borrow, special borrow material or another particular kind of borrow. This material shall have the physical characteristics of soils designated as group

A-1, A-2 - 4 or A-3, under AASHTO-M145. It shall have properties such that it may be readily spread and compacted for the formation of embankments.

2.02 TYPE 2 - SAND BORROW

- A. Sand Borrow shall consist of clean, inert, hard, durable grains of quartz or other hard durable rock. It shall be free from clay, loam, vegetable or other objectionable matter.
- B. Material for pipe cover, landscaping, or other uses as determined by the Engineer, shall be well graded as follows or as indicated on the Contract Drawings. The allowable amount of material passing a No. 200 sieve as determined by AASHTO-T11 shall not exceed 10 percent by weight.

<u>Sieve Size</u>	<u>Percent by Weight Passing Through</u>
$\frac{3}{8}$ inch	85 - 100
#16	50 - 85
#200	0 - 10

2.03 TYPE 3 - SAND AND GRAVEL

- A. The sand and gravel material for foundation sub-grades or structural fills shall meet AASTHO-M145, for A-1-a, A-1-b, or A-3 soils. The mixture shall consist of clean hard durable particles or fragments. It shall be free from loam, organic or other objectionable matter.
- B. Subgroup A-1-a includes those materials consisting predominantly of stone fragments or gravel, either with or without a well-graded binder of fine material and with 50% maximum passing the No. 10 sieve, 30% maximum passing the No. 40 sieve and 15% maximum passing the No. 200 sieve. The fraction passing the No. 40 shall have a maximum plasticity index of 6.
- C. Subgroup A-1-b includes those materials consisting predominantly of course sand either with or without well-graded soil binder and with 50% maximum passing the No. 40 sieve and 25% maximum passing the No. 200 sieve. The fraction passing the No. 40 shall have a maximum plasticity of 6.
- D. Group A-3 material shall be fine beach sand without silty or clay fines or with a very small amount of non-plastic silt. The group includes also stream deposited mixtures of poorly-graded fine sand and limited amounts of coarse sand and gravel; 51% minimum shall pass the No. 40 sieve, and 10% maximum shall pass the No. 200 sieve.

2.04 TYPE 4 - COARSE GRAVEL

- A. The material shall consist of clean hard, inert, durable particles or fragments. It shall be free from clay, loam, vegetable or other objectionable matter. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used.
- B. Material for foundation under drainage, pavement subbase, or other uses as determined by the Engineer shall be well graded as follows:

SIEVE SIZEPERCENTAGE BY WEIGHT PASSING

3 inch	100
1 ½ inch	70- 100
¾ inch	50- 85
#4	30- 60
#200	0-12 (based on fraction passing No. 4)

- C. The processed material shall be stockpiled in such a manner to minimize segregation of particle sizes. All processed gravel shall come from approved stockpiles.

2.05 TYPE 5 - LOAM BORROW AND TOPSOIL

- A. Material shall conform to related sections of the specifications.

2.06 TYPE 6 - SCREENED GRAVEL MATERIALS

- A. The gravel shall generally conform to ASTM-C33 and shall consist of clean, hard, inert, durable particles or fragments. It shall be free from clay, loam, organic or other objectionable matter. Crushed rock of suitable size and grading may be used instead of screened gravel. The specifications which follow shall apply to whichever material is used.
- B. Material for trench stone fill shall consist of sound angular stones; 50 to 70 percent of which shall weigh at least 500 pounds and the remainder shall weigh not less than 50 pounds each.
- C. Material for trench bedding shall be well graded from ¾ inch to 2 inch.
- D. Material for stabilizing trench base shall be well graded from ½ inch to 1 ½ inch.
- E. Material for pipe bedding, landscaping, or other uses as determined by the Engineer, shall be well graded as follows:

SIEVE SIZEPERCENT BY WEIGHT PASSING

1 inch	100
¾ inch	90 - 100
⅜ inch	20 - 55
#4	0 - 10
#8	0 - 5

2.07 TYPE 7 - CRUSHED STONE

- A. The crushed stone shall consist of clean, hard, inert, durable particles or fragments. It shall be free from clay, loam, vegetable or other objectionable matter.
- B. At least 50% of the material passing a one (1) inch sieve shall have a fractured face. The percent of wear of the crushed stone for pavement base coarse shall not exceed 50.

The stone sizes for the crushed stone shall be as follows:

SIEVE SIZEPERCENT BY WEIGHT PASSING

1 ½ inch	100
1 ¼ inch	85 - 100
¾ inch	10 - 40
½ inch	0 - 8

- C. The equipment for producing crushed stone shall be of adequate size and with sufficient adjustments to produce the required materials without unnecessary waste. The plant shall be capable of removing excess sand. The Engineer may order final screening of crushed stone if flat or elongated pieces are present in objectionable amounts.

PART 3 EXECUTION OF WORK

3.01 PLACING AND COMPACTING

- A. The material shall be placed and compacted as specified in related specification sections.

END OF SECTION

SECTION 02250

COMPACTION CONTROL AND TESTING

PART 1 GENERAL

- 1.01 SCOPE OF WORK
- 1.02 RELATED WORK SPECIFIED ELSEWHERE
- 1.03 SUBMITTALS

PART 2 MATERIALS

- 2.01 TEST METHODS

PART 3 EXECUTION OF WORK

- 3.01 COMPACTION EQUIPMENT
- 3.02 COMPACTION REQUIREMENTS
- 3.03 APPROVAL OF FILL OR BACKFILL MATERIAL
- 3.04 FREQUENCY OF COMPACTION TESTING
- 3.05 FAILED TESTS

PART 1 GENERAL

- 1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials and equipment necessary to place and compact fill or backfill. The Contractor shall furnish all equipment necessary to collect soil samples.
- B. Actual testing of soil samples with the exception of insitu-density determinations shall be done by an independent testing laboratory approved by the Owner. Insitu-density determinations shall be made by the Engineer or his representative. Copies of test results shall be furnished by the test laboratory directly to the Engineer.

- 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 0200 - EARTHWORK
- B. SECTION 02224 - FILL AND BACKFILL MATERIALS

- 1.03 SUBMITTALS

- A. Prior to commencement of filling and backfilling operation, the Contractor shall submit for approval a detailed list six (6) copies unless otherwise specified) of the types of compacting equipment to be utilized in the work, and the number of each.

PART 2 MATERIALS

- 2.01 TEST METHODS

- A. Contractor shall provide heavy-duty sample bags for fill or backfill material to be tested. Soils shall be classified as in the in the related sections of the Specifications which include AASHTO specifications M145 Recommended Practice for Classification of Soils as Soil-Aggregate Mixtures for Highway Construction Purposes.
- B. Soil samples shall be prepared for testing according to ASTM D42 Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.

- C. Gradation testing shall be done according to ASTM D2216 Particle Size Analysis of Soils and ASTM D1140 test for Amount of Materials in Soils Finer than the No. 200 sieve.
- D. Moisture content of soil shall be determined by ASTM D2216 Laboratory Determination of Moisture Content of Soil.
- E. Liquid Limits and Plasticity Index shall be determined ASTM D423 Liquid Limit of Soils and ASTM D424 by Plastic Limit and Plasticity Index of Soils.
- F. Maximum dry density for each type of fill shall be determined by ASTM D1557 Method D Moisture - Density Relations of Soils using 10-lb. Hammer and 18-in. Drop.
- G. In-place field unit weight shall be determined by ASTM D- 1556 Density of Soil in Place by the Sand-Cone Method.
- H. Maximum dry density may, at the discretion of the Engineer, be determined in accordance with ASTM D-2049 test for Relative Density of Cohesionless Soils.

PART 3 EXECUTION OF WORK

3.01 COMPACTION EQUIPMENT

- A. No backfilling shall be done until the compacting equipment list has been submitted and approved as conforming to the Contract requirements. Sufficient compacting equipment shall be available at all times, thereafter while backfilling is being conducted.
- B. Each layer of fill shall be inspected prior to compaction. All visible roots, vegetation, or debris shall be removed. Stones larger than 6 inches in diameter shall be removed. The water content of each layer shall be determined to be suitable for compaction or shall be brought to a suitable condition. Material incorporated in the fill which is not in satisfactory condition shall be subject to rejection and removal at the Contractor's expense. Placement of fill on frozen ground or placement of fill material which is frozen will not be permitted.
- C. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or too great an application of water, to compact it properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.
- D. Filling shall begin in the lowest section of the area. Fill shall be spread in layers as specified. The surface of each layer shall be approximately horizontal but will be provide with sufficient longitudinal and transverse slope to provide for runoff of surface water from every point. Filling shall be conducted so that no obstruction to drainage from other sections of the fill area is created at any time. Sumps, if any, shall be continuously maintained in effective operating condition.
- E. Each layer of material shall be compacted by the use of only approved rollers or other approved means so as to secure a dense, stable, and thoroughly compacted mass. At such points as cannot be reached by mobile mechanical equipment, or where such equipment is not permitted, the materials shall be thoroughly compacted by the use of suitable power-driven tampers.

- F. The compaction equipment shall be operated so as to make a minimum of three passes over each section of each layer of fill. Each successive pass shall overlap the adjacent pass by not less than 10%. Additional passes shall be made to obtain the required compaction, if necessary.
- G. Compaction by water-jetting will be allowed only if the Engineer deems the conditions suitable for this method. Wherever the material contains excessive amounts of clay or loam to prevent satisfactory drying, water-jetting shall not be used.
- H. If the material is allowed to be compacted by water-jetting, it shall be placed in uniform layers not exceeding 4 ft. deep. Each layer shall be thoroughly saturated throughout its full depth and at frequent intervals until all slumping ceases. For water-jetting, the Contractor shall provide one or more jet pipes, each of sufficient length to reach the specified depth and not less than 1-¼ in. in diameter. The jet pipe shall be equipped with a quick-acting valve and sufficient fire hose to connect to a hydrant or pump having adequate pressure and capacity. A hydrant shall be utilized only upon approval of the local Water and/or Fire Departments.

3.02 COMPACTION REQUIREMENTS

- A. Pipe Bedding: Bedding shall be Type 6 fill placed uniformly in 6 inch layers and compacted unless otherwise specified. Compaction shall be accomplished by 20 lb. hand tampers.
- B. Pipe Sand Blanket: Material shall be Type 2 fill placed uniformly in 6 inch layers and compacted to 90% of maximum dry density of the sand. Compaction shall be accomplished by 20 lb. hand tampers.
- C. Trench Cover: Material shall be Type 1, 2, 3 or 4 fill placed uniformly in 12 inch layers and compacted to 95% of maximum dry density for the type of material used. Compaction shall be accomplished by mechanical tampers. Compaction by water-jetting shall be in accordance with the related sections of the specifications.
- D. Catch Basin and Manhole Base Bedding: Material shall be Type 6 fill placed uniformly in 6 inch layers and compacted. Compaction shall be accomplished by 20 lb. hand tampers or pneumatic tampers.
- E. Structural Fill (foundation sub-grade, foundation under drainage, pavement sub-grade, pavement sub-base): Material for foundation sub-grade or pavement sub-grade shall be Type 3 fill. Structural fills shall be placed in 6 inch layers compacted to 95% maximum dry density for a given type of material. Compaction shall be by mechanical power driven vibratory compactors. Pavement sub-grade in cut areas shall be rolled and compacted to 95% density of the in situ material.
- F. Fill around structures shall be Type 1, 2, 3, or 4 material placed in 6 inch layers and compacted to 95% maximum dry density. Compaction shall be accomplished by mechanical power driven vibratory compactors. Compaction of backfill against concrete structures shall not be carried out by motorized equipment closer to the structure than the depth of the structure below grade.
- G. Non Structural Fill (Landscaping and other uses as designated by the Engineer): Material shall be Type 1, 2, 3 or 4 placed in 12" layers and compacted to 45% maximum dry density for the given type of material used. Compaction shall be accomplished by mechanical power-driven vibratory compactors.

3.03 APPROVAL OF FILL OR BACKFILL MATERIAL

- A. Before placing or compacting any on-site or borrow material, the Contractor shall submit a sample of the material for testing. No on-site material shall be placed until approved by the Engineer.
- B. The Engineer may at any time require additional laboratory testing should he observe any changes in gradation of the material being placed. No additional fill shall be placed or compacted until the material has been approved. If the material does not meet the required gradation and Otterburg limits for a given type of fill, the Contractor shall remove it at his expense. The Contractor may use the material for other types of fill providing it meets the required gradation and properties of that type.

3.04 FREQUENCY OF COMPACTION TESTING

- A. The Engineer may perform tests of the degree of compaction obtained, in any area he may select. Payment for performing tests will be made by the Owner. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted material including retesting, shall be borne by the Contractor. If improper compaction methods are used, the Owner shall have the right to discontinue payments from the Contractor for said payment item until the situation is corrected.

3.05 FAILED TESTS

- A. If the percentage compaction at any point is found to be unacceptable, additional compaction with or without modification of the field moisture content as directed by the Engineer, shall be performed and a second moisture-density determination made. This procedure shall be repeated until satisfactory compaction is obtained. If after five (5) tests any fill or backfill material cannot be compacted to the required density it shall be removed and disposed of at the Contractor's expense.

END OF SECTION

SECTION 02575

PAVING AND ROAD CONSTRUCTION

PART 1 GENERAL

- 1.01 CONTRACT DOCUMENTS
- 1.02 DESCRIPTION OF WORK
- 1.03 RELATED WORK SPECIFIED ELSEWHERE

PART 2 MATERIALS

- 2.01 GENERAL CRITERIA
- 2.02 SUBGRADE
- 2.03 SUBBASE
- 2.04 DELETED
- 2.05 BASE COURSE - PERMANENT PAVEMENT
- 2.06 SURFACE COURSE - PERMANENT PAVEMENT
- 2.07 SIDEWALKS AND DRIVEWAYS AND CURBS

PART 3 EXECUTION OF WORK

- 3.01 BITUMINOUS PAVING - GENERAL
- 3.02 CARE AND RESTORATION OF PROPERTY
- 3.03 PREPARATION OF SUBGRADE IN CUT AREAS
- 3.04 PREPARATION OF SUBGRADE IN FILL AREAS
- 3.05 PREPARATION OF SUBBASE
- 3.06 DELETED
- 3.07 PERMANENT PAVEMENT
- 3.08 MAINTENANCE OF PAVING
- 3.09 SIDEWALKS, DRIVEWAYS AND CURB CONSTRUCTION

PART 1 GENERAL

1.01 CONTRACT DOCUMENTS

- A. The general provisions of the Contract, including General and Supplemental Conditions and General Requirements, apply to the work specified in this section.
- B. The Contractor shall be responsible for maintaining all pavements and sidewalks placed as part of the Contract, in a safe and satisfactory condition until the project is accepted as complete. For any pavement or sidewalk area damaged, the Contractor shall remove the entire pavement structure in the damaged area and replace it as directed by the Engineer.
- C. Should the application of the wearing surface be delayed for any reason including bad weather, the Contractor shall provide and maintain the base in acceptable condition until such time as the new pavement is place.
- D. During construction, all existing pavement, not to be removed, shall be protected by the Contractor. Any pavement damaged shall be removed and replaced by the Contractor at the Contractor's expense.

1.02 DESCRIPTION OF WORK

- A. Work under this section consists of furnishing all materials, labor, tools, equipment and supervision necessary to restore existing or construct new pavement subgrades, subbase, bituminous base courses, tack coats and bituminous surface courses for roadways and all curbs, sidewalks, driveways, and parking areas.

B. The materials and construction methods used for this work shall conform to the Massachusetts Highway Department, "Standard Specifications for Highways and Bridges", 1988 Edition, and subsequent revisions and addenda.

C. All temporary construction roads, ditches, and drainage facilities shall be removed and the site restored before completion of the project.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. SECTION 02200 - EARTHWORK

B. SECTION 02224 - FILL AND BACKFILL MATERIALS

C. DIVISION 2 - SITE WORK -As Appropriate

D. DIVISION 3 - CONCRETE - As Appropriate

PART 2 MATERIALS

2.01 GENERAL CRITERIA

A. The Contractor shall be responsible for obtaining any permits and meeting State requirements for all work taking place in State highways.

2.02 SUBGRADE

A. Sub-grade shall be either Type 1, 2, 3 and 4 material in accordance with related specifications.

2.03 SUBBASE

A. Sub-base shall be Type 6 screened gravel material in accordance with related specifications or reclaimed material.

2.04 DELETED

2.05 BASE COURSE - PERMANENT PAVEMENT

A. Base course shall be the first layer of bitumen and aggregate mixture overlying the screened gravel sub-base.

B. Bituminous base course shall be 2 ½ inch thick Class 1 Bituminous Concrete Base Course Type I-1 as given in the Massachusetts Highway Department Standard Specifications for Highways and Bridges.

2.06 SURFACE COURSE - PERMANENT PAVEMENT

A. Surface course shall be Class I Bituminous Concrete Pavement as given in the Massachusetts Highway Department Standard Specifications for Highways and Bridges, Section 460.20 to 460.68.

B. Surface course shall be 1 ½ inches thick for permanent paving.

2.07 SIDEWALKS AND DRIVEWAYS

- A. Cement concrete for driveways and sidewalks shall be in accordance with the appropriate section in the Massachusetts Highway Department Standard Specifications for Highways and Bridges.

PART 3 EXECUTION OF WORK

3.01 BITUMINOUS PAVING - GENERAL

- A. All mixtures delivered to the job site shall be accompanied by a Certificate of Compliance. Deliveries not accompanied by a certificate will not be used in the work.
- B. Construction methods shall conform to the requirements of the Massachusetts Highway Department Standard Specifications for Highways and Bridges, including the following:
1. Mixtures delivered to the job site shall not possess signs of segregation of ingredients or surface crust.
 2. The temperatures of the mixture when delivered to the spreader will be a minimum of 250 F.
 3. Mixtures shall be placed only upon approved surfaces that are clean from foreign material and are dry; and when weather conditions are suitable. No mixture shall be placed when the weather is foggy or rainy, provided, however, that the Engineer may permit, in the case of sudden rain, the placing of mixture then in transit from the plant, if laid at the proper temperature and if the roadbed is free from pools of water. Such permission shall in no way relax the requirements for the quality of the pavement and smoothness of the surface. No materials shall be placed upon a frozen base, or when wind conditions are such that rapid cooling will prevent satisfactory compaction.
 4. Wherever possible material shall be compacted using steel wheeled rollers.
 5. In areas not accessible to a roller, compaction shall be accomplished by using mechanical compactors or hand tampers, approved by the Engineer.
 6. All material place shall receive final compaction before nightfall of the day placed, unless artificial light, satisfactory to the Engineer, is provided.
 7. The density of completed paving shall not be less than 95% of the density obtained from laboratory compaction of a mixture composed of the same materials in like proportions.
 8. The Engineer may require the Contractor to remove and replace at his own expense, any work deemed defective on the basis of sampling and testing for composition and density, or faulty procedures.

3.02 CARE AND RESTORATION OF PROPERTY

- A. All streets, sidewalks, gutters, driveways and curbs which have been damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations.
- B. Suitable materials and methods shall be used for restoration of curbs and other types of gutters, driveways and sidewalks.

- C. Materials and method of all restoration work shall be subject to approval by the Engineer.
- D. All frames, grates, covers, street boxes, manhole rings and other castings removed or damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations.
- E. All frames, grates, covers, street boxes, manhole rings and other castings within the limits of new paving shall be reset by the Contractor such that they are flush with the new surface.

3.03 PREPARATION OF SUBGRADE IN CUT AREAS

- A. If after excavation to the proposed sub-grade elevation the insitu material is determined by the Engineer to be unsuitable, the Contractor shall excavate an additional 1 foot and backfill with Type 3 sand and gravel compacted to 95% of maximum dry density. Changes in the depths and limits of excavations or fills shall be an appropriate bid adjustment item.
- B. The Contractor shall remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas upon which subbase and pavement material will be placed. The subgrade shall be shaped as indicated on the Contract Drawings and shall be compacted to 95% of maximum dry density.

3.04 PREPARATION OF SUBGRADE IN FILL AREAS

- A. The Contractor shall remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas upon which embankments will be built or material will be placed for grading.
- B. After the area has been stripped and grubbed as herein specified, Type 1, 2, 3 and 4 material shall be placed thereon and built up in successive layers until it has reached the required elevation.
- C. Layers shall not exceed 6 inches in thickness before compaction. The layers shall be slightly convex toward the center. Layers shall be compacted to 95% of the maximum dry density of the particular material used.

3.05 PREPARATION OF SUBBASE

- A. Subbase material shall conform to Type 6 Screened Gravel or reclaimed material as described in the related sections of the specifications.
- B. Screened gravel subbase for either permanent paving shall be a minimum of 12 inches in thickness.

3.06 DELETED

3.07 PERMANENT PAVEMENT

- A. Permanent paving is to be placed after at least 8 months has elapsed for required compaction to have occurred as determined by the Engineer.
- B. Prior to Permanent paving, the Contractor shall make all final repairs to the previously installed trench paving, and raise for cause to be raised, all existing, manhole, catch basin, valve box, curb box, and utility covers, etc., to conform to the final pavement

grade. All loose or damaged material in the existing pavement outside of trench pavements, shall be removed and a leveling course, as hereinbefore specified, shall be installed. Leveling course shall also be installed at depths and locations, as directed by the Engineer, to fill existing holes and depressions, or to improve roadway crowns. Leveling course quantities used for permanent paving shall be included for compensation under the paving item.

- C. All surfaces to receive Permanent paving shall be dry and thoroughly cleaned of foreign or loose material; a compatible prime or tack coat, shall be applied to the rate of 0.05 to 0.15 gallons per square yard of pavement, depending upon the condition of the existing surface. All castings and edgestones will be protected from the tack coat.
- D. Where curbing is present, the existing pavement shall be planned such that curb reveal shall be substantially the same prior to and following the application of Permanent paving.
- E. Where sloped bituminous curbing is present, the existing sloped bituminous curbing shall be replaced with new sloped bituminous curbing which shall be installed integrally with the permanent paving.

3.08 MAINTENANCE OF PAVING

- A. The Contractor shall maintain pavement placed under this Contract until the expiration of the one year guarantee period and shall promptly fill with similar material all depressions and holes that may occur so as to keep the pavement in a safe and satisfactory condition for traffic.

3.09 SIDEWALKS, DRIVEWAY AND CURB CONSTRUCTION AND RECONSTRUCTION

- A. All granite curbs, cement concrete sidewalks, and driveways damaged during construction will be reconstructed to their original condition after construction is completed. Granite curbing to be reset shall be removed and reset to proper grade and alignment in accordance with the construction methods of Section 701 of the Massachusetts Highway Department Standard Specifications for Highways and Bridges.
- B. Curbing to be reset shall be carefully removed and stored. The Contractor shall replace any edging damaged or lost due to his negligence. The base upon which the edging is to be set shall be compacted to a firm even surface. Joints shall be pointed with mortar and the exposed portion finished with a jointer. Granite curb inlets shall be set in full mortar beds.

END OF SECTION

SECTION 02729

TELEVISION INSPECTION OF PIPES

PART 1 GENERAL

- 1.01 SCOPE OF WORK
- 1.02 SUBMITTALS

PART 2 MATERIALS

- 2.01 EQUIPMENT

PART 3 EXECUTION OF WORK

- 3.01 INSPECTION
- 3.02 DOCUMENTATION

PART 1 GENERAL

- 1.01 SCOPE OF WORK:

- A. The Contractor shall furnish all materials, tools, labor and equipment necessary to visually inspect the sewers to be rehabilitated by means of a closed-circuit television.

- 1.02 SUBMITTALS:

- A. The contractor will submit log sheets upon completion of the CCTV inspection that will include stationing, manhole numbers, findings and other pertinent data. (see documentation below)
 - B. The contractor will provide one (1) copy of the video inspection tape. The tape will include the pre-rehabilitation pipeline inspection and the post-rehabilitation pipeline inspection results.

PART 2 MATERIALS

- 2.01 EQUIPMENT:

- A. VHS and DVD formats shall be provided.
 - B. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor and other components of the video system shall be capable of producing a minimum 650-line resolution color video picture. Picture quality and definition shall be to the satisfaction of the Town of Millis and, if unsatisfactory, equipment shall be removed and no payment made for the unsatisfactory inspection. The camera head shall be pan-and-tilt type with the ability to rotate 360° to view the entire internal circumference of the pipe. The inspection will provide full view of at least 80% of the pipe internal diameter.

PART 3 EXECUTION OF WORK

- 3.01 INSPECTION

- A. Manual winches, power winches, TV cable and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. The rate of movement through the pipeline shall be no more than 1 ft/sec. If, during the inspection, the television camera will not pass through the entire manhole section, the Contractor shall reset up his equipment in a manner so that the inspection can be performed for the opposite manhole. The Contractor is required to repeat the TV inspection of areas repaired subsequent to the original TV inspection.
- B. Whenever non-remote powered and controlled winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two winches and the monitor control.

3.02 DOCUMENTATION

- A. Printed location records shall be kept by the Contractor, which will clearly show the exact location, in relation to adjacent manholes, of each infiltration point discovered by the television camera. In addition, other points of significance such as locations of laterals, unusual conditions, collapsed sections, and other discernible features will be recorded and a copy of such records will be supplied to the Town of Millis.
- B. Videotapes of the entire inspection shall be provided to the Town of Millis upon completion of the inspection. The tape playback shall be at the speed that is recorded. The contractor shall be required to have all tapes and necessary playback equipment readily accessible for review by the Town of Millis during the project.
- C. The contractor shall furnish printed internal inspection logs and videotapes of the entire inspection to the Town of Millis on completion.

END OF SECTION

SECTION 02730CLEANING OF SEWERS AND DISPOSAL OF SEDIMENTPART 1 GENERAL

- 1.01 SCOPE OF WORK
- 1.02 SUBMITTALS

PART 2 MATERIALS

- 2.01 EQUIPMENT

PART 3 EXECUTION OF WORK

- 3.01 CLEANING
- 3.02 WATER SUPPLY
- 3.03 REMOVAL, TESTING & DISPOSAL OF SEDIMENT
- CONTRACTOR'S RECORDS

PART 1 GENERAL

- 1.01 SCOPE OF WORK:

- A. The scope of work shall include the cleaning of the existing sewer pipes, maintaining sewer flows, de-watering, cleaning of site, and protection of existing facilities. Sewer pipe cleaning for this project will be considered medium cleaning. Medium cleaning is defined as 4 to 6 passes.
- B. This section also includes a description of the furnishing of all equipment, labor, material, and inspection required to clean the existing sewers as shown on the drawings or as directed by the Town of Millis and as specified herein.

- 1.02 SUBMITTALS:

- A. The contractor will provide one (1) copy of the video inspection tape. The pre-rehabilitation portion of this tape shall be utilized to verify the cleanliness of the pipe.

PART 2 MATERIALS

- 2.01 EQUIPMENT:

- A. Cleaning equipment can include buckets, scrapers, industrial vactors, mechanical vactor, and/or hydraulic equipment. Mechanical equipment shall consist of rodding and bucketing machines with buckets, brushes, and scrapers, hydraulic equipment shall consist of high velocity type equipment. No hydraulic equipment that operates under a "head of water" or that would cause excessive internal pressure or cause sewage to "back up" shall be permitted without written approval of the Town of Millis. Selection of equipment shall be based on the condition of the lines at the time other work commences. All equipment used shall be approved by the Town of Millis before work begins.
- B. Mechanical equipment shall be equipped with a belt booster clutch or overload clutch so that the pipe will not be damaged. No equipment of a direct drive type shall be permitted.
- C. During bucketing operations, a suitable watertight truck or container shall be provided to receive materials dumped from the buckets.

- D. The equipment used for the final operation shall be a full size "porcupine" brush, or where a full size brush will not enter through the manhole opening, a collapsible scraper that will open to the full size of the pipe may be used. Equipment used for the final inspection shall be as approved by the Town of Millis.

PART 3 EXECUTION OF WORK

3.01 CLEANING

- A. No sewage or solids removed from the sewer manholes shall be dumped or pumped onto the streets or into ditches, catch basin or other drains or sewers. The Contractor shall legally dispose of all solids and semi-solids removed from the sewers. A suitable weir, dam, or vacuum type induction system shall be constructed in the outfall pipe of the downstream manhole in such a manner that both solids and other material shall be trapped. As buildup in the downstream manhole develops, the Contractor shall cease operation of hydraulic equipment at the direction of the Town of Millis and subsequently clean the debris from the manhole. The passing of material from one section to the next will not be permitted. After each days work, the pavement and sidewalk shall be left in a clean and orderly condition.
- B. All necessary precautions shall be taken to control the flow and protect the sewer structures from damage during cleaning operations. Any damage, including broken frames and covers, due to negligence by the Contractor shall be repaired by the Contractor at the Contractor's expense. The contractor shall note that some of the sewers are expected to be in poor condition and that extra precaution should be taken. Cleaning shall include the removal of all roots, sand, gravel, grease, sludge and other debris. The satisfactory transportation and disposal of such materials so that no objectionable odors will develop, and performing all other related work that becomes necessary thereto as the work progresses.

3.02 WATER SUPPLY

- A. The Contractor may use water from the public supply for construction purposes without charge. The approval, assistance, and supervision of the Town of Millis shall be obtained prior to any such use. When hydrants are to be operated, the Contractor shall take precaution to prevent any damage to either the hydrant or the main. A proper hydrant wrench shall be used for opening and closing the hydrants. Any damage to any part of the water system resulting from misuse by the Contractor's employees or subcontractors shall be repaired at the Contractor's expense. The Contractor shall use water efficiently and avoid waste.
- B. If potable water is utilized in conjunction with hydraulic cleaning equipment, the supply lines from hydrants, or other sources, must be equipped with a suitable backflow prevention device to ensure against pollution of portable water in the event that a negative (suction) head develops.

3.03 REMOVAL, TESTING & DISPOSAL OF SEDIMENT:

- A. All material removed from sewer facilities is considered as unsuitable. It shall be delivered to a disposal site, by the sewer cleaning contractor under this contract. The Contractor is responsible for securing an acceptable disposal location.
- B. The Contractor or his subcontractor shall perform and pay all charges for all laboratory analyses, and prepare all necessary documentation required to allow the selected disposal location to accept the contaminated soil.

- C. The Contractor shall remove the sediment and dump it in a lined container/dumpster for ultimate transport and disposal. The Town of Millis will provide a location for the container/dumpster and assist the contractor with a dirt ramp to permit dumping of the Combination unit.
- D. The Contractor shall extract a representative sample of the sediment to be tested. The Contractor shall make arrangements and pay all charges for laboratory analyses of the sediment.
- E. As a minimum, the sediment shall be tested for the following:

TCLP METALS
VOCs
CBs
VOA & Fingerprint
- F. After testing, the sediment shall be disposed of properly as determined by analysis results. If the debris is found to be hazardous then the disposal of the debris will be considered a changed condition.
- G. The Contractor shall provide the appropriate manifest or forms for the Town of Millis to sign, as necessary.
- H. The Contractor shall submit certified invoices from the disposal facility which indicate the net weight in tons of contaminated sediment delivered and properly disposed of.

3.04 CONTRACTOR'S RECORDS

- A. It shall be the Contractor's responsibility to keep records of all cleaning performed. These records shall be in printed form, showing the Town of Millis name, type of project, Contractor's name, date, manhole location, section cleaned, type of sewer, size of pipe, type of equipment used and any special remarks concerning the condition of the line and manholes, and the material removed there from. A copy of these records shall be given to the Town of Millis.
- B. If areas of structural failure or other obstructions are noted during cleaning operations, The Contractor shall immediately notify the Town of Millis of the approximate location.

END OF SECTION

