

TOWN OF LEE DEPARTMENT OF PUBLIC WORKS  
CONSTRUCTION STANDARDS FOR  
ROADS AND MUNICIPAL UTILITIES  
FEBRUARY 2004

*Note: Portions of these construction standards were formerly promulgated as part of the Lee Subdivision Regulations dated May 1, 1970. The Subdivision Regulations have been revised and reissued by the Lee Planning Board effective February 2, 2004. These Construction Standards are no longer part of the Subdivision Regulations except by reference, and may be amended by the Lee DPW from time to time. Reference to the Lee Subdivision Regulations is still required for matters not covered herein.*

**1. General.**

- A. It is the intent that no street or way shall be constructed in the Town of Lee unless the street or way is constructed in accordance with the Lee Planning Board's Subdivision Regulations, and with the specifications, materials and details contained in this publication, "Construction Standards for Roads and Municipal Utilities." The design and construction standards are subject to change by the Lee DPW, and the standards to be used shall be those that are adopted and in effect at the time the road is designed and submitted for approval.
- B. Except where otherwise specified, required, and approved by the Town, all materials and methods of construction used shall conform to the requirements of the "Commonwealth of Massachusetts, Mass. Highway Department, Standard Specifications for Highways and Bridges," most recent edition, as amended. This is referred to as "MHD Standard Specifications" in both these Construction Standards and the Lee Subdivision Regulations.
- C. Any matters not covered in the MHD Standard Specifications, Lee Subdivision Regulations, or these Construction Standards shall be designed and/or constructed in accordance with other applicable codes, regulations, and accepted engineering and/or construction practice. Design Engineer may propose alternative design and/or construction standards, and provide reference to the alternative codes or standards for consideration by the Lee DPW.
- D. Wherever the MHD Standard Specifications use the following terms, the intent and meaning shall be interpreted by substituting the following:

<u>Term</u>	<u>Substitute:</u>
Commonwealth	Town of Lee, or "Town"
Department	Lee Department of Public Works
Engineer	Lee DPW Superintendent
- E. Any discrepancy between the plans, specifications or construction standards shall be resolved in favor of the stricter requirement, unless the Lee DPW determines it is in the Town's best interest to accept a lesser requirement.

- F. As each construction operation is completed, it shall be inspected and approved by the appropriate Town agency prior to starting work on the succeeding operation.
- G. The Subdivide of the land being improved shall keep an up-to-date set of the approved construction plans available for inspection by the Lee DPW and other approving agencies at the construction site at all times during the work day.
- H. Upon completion of the construction, the construction plans shall be updated, annotated, and labeled as "RECORD PLANS." These must indicate any changes or revisions made during construction, tie measurements to underground structures and utilities, pipes, valves, service connections, and other pertinent information. A hard copy of the Record Plans shall be submitted to the Lee DPW. It is also desirable to submit an electronic digitally formatted copy of the plan. The current digital requirements and formats should be obtained from the Lee DPW.

## **2. Street Construction.**

### **A. General.**

- (1) Geometric Design of Streets is based on the estimated Average Daily Traffic (ADT) expected on the street and the character of the neighborhood. Refer to the Street Hierarchy and Street Design Criteria in the Subdivision Regulations for specific requirements.
- (2) Street Construction Standards also vary according to the type of use and the particular site conditions, as summarized in Table 2.1 below.
- (3) Refer to the Typical Cross Sections of Streets in the Subdivision Regulations.

### **B. Materials. Materials shall conform to the following requirements, unless an acceptable substitute is approved in advance by the Town. (Refer to MHD Standard Specifications and the relevant portions of the Lee Subdivision Regulations, Article IV, Construction Standards.)**

- (1) Bank Run Gravel Borrow M 1.03.0 Type a  
(except max. stone size = 4". Reclaimed Asphalt Pavement may be used for Sub-base provided it meets the grain size and compaction requirements.)
- (2) Processed Gravel Borrow M 1.03.1  
(except max. stone size = 1 ½")
- (3) Dense Graded Crushed Stone for Sub-base M 2.01.7
- (4) Crushed Stone for Subdrains M 2.01.5
- (5) Geotextile (Subdrains) M 9.50.0 Type II
- (6) Geotextile (Subgrade Stabilization) M 9.50.0 Type III
- (7) Slot-perforated Corrugated Plastic Pipe (Subdrains) M 5.03.9
- (8) Bituminous Concrete Pavement M 3.11  
(Native Stone may be allowed in the Top Course, subject to DPW approval)
- (9) Asphalt Emulsions (Tack Coat) M 3.03.0

- C. Construction Methods. Construction shall conform to the following requirements, unless an alternate method is approved in advance by the Town. (Refer to MHD Standard Specifications and the relevant portions of the Lee Subdivision Regulations, Article IV, Construction Standards.)

(1) Clearing and Grubbing	§ 101
(2) Excavation	§ 120
(3) Excavation for Structures	§ 140
(4) Embankment	§ 150
(5) Grading	§ 170
(6) Gravel Sub-base	§ 401
(7) Dense Graded Crushed Stone for Sub-base	§ 402
(8) Gravel Base Course	§ 405
(9) Shoulders	§ 445
(10) Class I Bituminous Concrete Pavement, Type I-1	§ 460
(11) Bituminous Concrete Berms	§ 470
(12) Curb, Curb Inlets, Curb Corners, and Edging	§ 501
(13) Sidewalks, Wheelchair Curb Ramps, and Driveways	§ 701
(14) Top Soil and Seeding	§§ 751 & 765
(15) Erosion and Sedimentation Controls	§ 767

- D. Erosion and Sedimentation Controls shall be installed and maintained throughout the construction period until the entire site is fully stabilized and revegetated. Requirements, materials and construction methods shall conform to other applicable regulations, including Mass. Wetlands Protection Act and U.S. EPA N.P.D.E.S. Stormwater General Permit for Construction Activities.

- E. Inspection. The Owner shall arrange for Town inspections of the street construction and utilities at the following milestones, and the work shall be satisfactorily completed prior to beginning the subsequent operation.

- (1) Completion of clearing, grubbing and stripping;
- (2) Completion of subgrade preparation;
- (3) Installation of storm drainage system;
- (4) Installation of water and sewerage systems, as applicable;
- (5) Completion of gravel base including installation of conduits for underground wiring under and along roadway;
- (6) Base Course Paving, and Curbing if applicable;
- (7) Final Paving, sidewalks, and grassed shoulders;
- (8) Final Completion including established vegetation, street trees, street signs, monuments, and other applicable required improvements.

- F. Testing. The Owner shall arrange for testing of materials and construction as required by the MHD Standard Specifications, including but not limited to:

- (1) Grain Size Analysis of Gravel
- (2) Standard Proctor Test
- (3) In-place Density Testing of compacted subgrade, embankments, and gravel base.

Lee Department of Public Works  
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February 2004

TABLE 2.1 STREET CONSTRUCTION	MINOR RESID. SUBD. Private	MAJOR RESIDENTIAL SUBDIVISION Public or Private Eligible for Acceptance				COLLECTOR ROAD Public or Private Eligible for Acceptance	
	RURAL MINOR LANE-- Private Only Cul-de-sac	RURAL LANE -- Cul-de-sac	RURAL RESIDENTIAL ACCESS STREET -- Through Road	RESIDENTIAL NEIGHBORHOOD ST Through Road	RESIDENTIAL MAJOR ACCESS ST -- Through Road	MINOR COLLECTOR ST Low - Med Intensity	MAJOR COLLECTOR ST Med - High Intensity
SUBGRADE STABILIZATION REQUIRED FOR POOR SUBGRADE CONDITIONS, such as over-excavate and replace, road stabilization geotextile, blanket drain, etc.	As Req'd	As Req'd	As Req'd	As Req'd	As Req'd	As Req'd	As Req'd
SUBGRADE COMPACTION AND CROWNING	YES	YES	YES	YES	YES	YES	YES
SUBDRAINS ALONG STREET SHOULDER(S)	As Req'd	As Req'd	As Req'd	YES	YES	YES	YES
MIN. WIDTH OF PAVED SURFACE (Not Incl Parking Lanes)	20'	20'	20'	24'	24'	24'	28'
CURB OR SHOULDER (note e)	2 GS @ 2' EA	2 GS @ 2' EA	2 GS @ 2' EA	2 MC @ 2' EA	2 VC W/ 2' OFFSET	2 VC W/ 2' OFFSET	2 VC W/ 2' OFFSET
TOTAL TRAVELED WIDTH Incl. Shldr or Mountable Curbs (Not Incl. Parking Lanes)	24'	24'	24'	28'	28'	28'	32'
MIN. TOTAL WIDTH OF GRAVEL BASE	26'	26'	26'	30'	30'	30'	34'
MIN. DEPTH OF GRAVEL BORROW SUB-BASE	8"	8"	8"	12"	12"	12" MIN.	12" MIN.
MIN. DEPTH OF PROCESSED GRAVEL COURSE	4"	4"	4"	4"	4"	8"	8" MIN.
MIN. COMPACTED DEPTH OF BASE COURSE PAVING	NR	NR	NR	NR	NR	3"	YES
MIN. COMPACTED DEPTH OF BINDER COURSE PAVING	2"	2"	2"	2"	3" MIN.	2" MIN.	28'
MIN. COMPACTED DEPTH OF TOP COURSE PAVING	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	3 VC W/ 2' OFFSET
MIN. TOTAL DEPTH OF PAVING	3-1/2"	3-1/2"	3-1/2"	4"	5" MIN.	7" MIN.	32'

### **3. Sanitary Sewer System**

- A. General. The Sanitary Sewer System shall be designed and constructed in accordance with these requirements, and as required by the Lee Subdivision Regulations, good engineering practice, and Mass. DEP requirements for municipal sewer systems.
- B. Materials. Materials shall conform to the following requirements, unless an acceptable substitute is approved in advance by the Town. (Refer to MHD Standard Specifications and the relevant portions of the Lee Subdivision Regulations, Article IV, Construction Standards.)
  - (1) Sewer Pipe: Polyvinyl Chloride (PVC) Gravity Sewer Pipe: ASTM D 3034, Type PSM, SDR 35, integral bell and spigot with push-on joints.
  - (2) Fittings: Wye connections shall be the same material as the sewer main. Saddles shall be used only for connection to an existing main.
  - (3) Sanitary Sewer Manholes, Precast Concrete:
    - (a) General: precast reinforced concrete sanitary manholes complying with ASTM C 478. All precast Sanitary Manholes shall be factory-coated with black bitumastic waterproofing.
      - (i) If precast concrete manhole is not feasible, concrete block manholes may be used with the prior approval of the Lee DPW. Concrete blocks shall be solid, precast segmental concrete masonry units. Entire outside of Manhole shall be parged with two coats of Portland cement mortar, and field coated with two coats of black bitumastic waterproofing.
    - (b) Pipe Connectors: Manholes shall be supplied with flexible, watertight adapters, such as a neoprene "boot" with stainless steel straps, inserts, or gaskets, conforming to ASTM C923, and suitable for the pipe materials used. Field installed (in preformed or field cored hole) with watertight resilient compression fitting, mechanically tightened, may be used when necessary.
    - (c) Top: Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as required. The top riser section shall terminate at least 18 inches below finished grade to provide for proper adjustment of the frame and cover.
    - (d) Base: Precast Concrete, with monolithic base section with integral floor and watertight cast-in neoprene pipe connectors or pre-formed or cored hole with compression pipe connectors. Provide extended base in wet conditions as indicated on the plans or as directed.
    - (e) Riser Sections: Precast Concrete Risers with joint to mate with other sections, in height of 1', 2', 3' or 4' as required.
    - (f) Gaskets: Precast concrete sections shall be installed with round rubber-gasketed joints conforming to ASTM C443.
    - (g) Steps: Ductile-iron, aluminum, or non-metallic, integrally cast into manhole sidewalls. Steps shall be spaced at 12".
    - (h) Frame and Cover: Ductile-iron conforming to ASTM 536, 24" inside diameter, heavy-duty suitable for H-20 loading, indented top design, with lettering cast into top reading "SEWER".
      - (i) Manufacturer: to be approved by Lee DPW.

- (i) Grade Ring for adjusting frame and cover to finished grade: Precast concrete Grading Rings shall be used whenever possible. Manhole Bricks, ASTM C-32, Grade MS, may be used up to 3 courses maximum, well parged and stable.
    - (j) Mortar and Parging: ASTM C-270, Type S, using ASTM C-150, Type 11 Portland Cement.
    - (k) Sewer Brick: Clay or shale brick, hard burned, AASHTO M114, Grade MW, or ASTM C-32, Grade SM.
  - (4) Bedding Material:
    - (a) Crushed Stone for Bedding M 2.01.4
    - (b) Sand for Pipe Bedding M 1.04.00
  - (5) Sewage Pump Systems:
    - (a) Low pressure sewer systems shall consist of individual sewage grinder pump systems discharging through low pressure sewer laterals to a common sewer force main. Each lateral shall have a double check valve and curb stop near the property line. This type of sewerage system is subject to special review and approval by the Lee DPW, with equipment and materials to be selected and approved during the design process.
    - (b) Municipal Sewage Pump Station and Force Main: This type of system is subject to special review and approval by the Lee DPW and Mass. DEP, with equipment and materials to be selected and approved during the design process.
- C. Construction Methods. Construction shall conform to the following requirements, unless an alternate method is approved in advance by the Town. (Refer to MHD Standard Specifications and the relevant portions of the Lee Subdivision Regulations, Article IV, Construction Standards.)
- (1) General.
    - (a) Sewer lines shall be installed true to line and grade using laser beam control.
    - (b) The sewer system shall be constructed to be watertight under all conditions.
    - (c) Sewer pipe shall be installed with at least 10 feet horizontal clearance from a water main. Should conditions prevent this and the Sewer pipe must cross a Water pipe, the pipes shall cross as close to a right angle as possible, and the sewer pipe shall pass under the water main with at least 18" clearance below the invert of the water main. If this is not possible, the water main must be constructed with mechanical restrained joint glands are used for a distance of at least ten feet on each side of the sewer, and one full length of the water main should be centered over the sewer so both joints will be as far from the sewer as possible. Encasement of both the water main and sewer line may also be used in this condition.
    - (d) Install sewer pipe with at least 4 feet of cover over pipe, or the maximum possible. If depth of cover will be less than 3', report to Engineer prior to installation for consideration of alternative pipe materials, bedding, concrete encasement, or other protective measures.

- (e) Sewer pipe shall not be installed when weather conditions are unsuitable. Pipe shall be installed in the dry. De-water trench as required.
- (2) Installing Sewer Mains.
  - (a) Install pipe in accordance with the manufacturer's requirements. All sewer pipes shall be placed on sand bed or crushed stone bed.
  - (b) Both ends of the pipe and the gasket shall be thoroughly cleaned prior to making the joint. The spigot end shall be fully seated in the bell end, taking care to assure that the gasket is properly seated.
  - (c) As soon as possible after the joint is made, place and tamp granular backfill material under the haunches and along each side of the pipe up to the "spring line" to prevent the pipe from shifting off line or grade. Proper line and grade of the installed sewer line shall be verified before placing the next section of pipe.
  - (d) All trenches and excavations shall be backfilled immediately after the pipe is laid therein, unless other protection of the pipeline is directed. Under no circumstances shall water be permitted to rise in unbackfilled trenches after pipe has been placed.
  - (e) No material shall be used for backfilling that contains stones having any dimension greater than four inches, frozen earth, debris or earth with a high void content for backfill up to a level of two feet over the top of the pipe. Only selected materials shall be used, and the backfilling shall be placed in uniform layers not exceeding 12 inches in depth up each side. Each layer shall be placed then carefully and compacted. Puddling or water flooding for consolidation of backfill material is not allowed.
  - (f) Care shall be taken to prevent imposing undue live or impact loads on the exposed surface of the trench. The backfill shall be a non-cohesive material, vibrated or tamped in layers not exceeding 12 inches in depth.
  - (g) Where more than one pipeline is laid in the same trench and the invert elevations are not identical and where no concrete cradle or encasement is provided for the support of the higher pipeline, its foundation shall be considered to be yielding.
  - (h) When bridging is required to support a portion of the pipeline over such yielding trench bottoms, the pipeline itself shall not be considered to provide bridging strength, and supplementary materials for this purpose must be provided. Where pipe connects with the outside face of manhole walls or with the outside face of walls of other structures, there shall be a pipe joint such that slight flexibility or motion can take place in the plane of the wall face.

D. Inspection and Testing:

(1) General

- (a) Perform testing of completed piping in accordance with the requirements of the local authorities having jurisdiction and as specified herein.

- (b) The Contractor shall test all sections of the sewer mains for leakage and furnish all necessary materials, equipment and labor to perform the tests as herein specified and as directed by the Engineer.
  - (c) All sewers shall be cleaned and inspected for major defects before testing.
  - (d) Any section of the sewers, which fail to pass the tests shall have the defects located, and without additional compensation, repaired or replaced and retested until the work is satisfactory to the Engineer.
- (2) Record Survey. Prior to final inspection of the Sewerage System, Contractor shall supply the Engineer with a Record Survey Plan indicating:
  - (a) surveyed As-Built elevation of the invert of each sewer pipe at each manhole, sewer service at building, stub end of service, and other pertinent locations;
  - (b) the measured distance along each sewer line between sewer structures, taps, branches, horizontal or vertical bends, fittings, crossings of other utilities, presence of bedrock or groundwater, and other pertinent features;
  - (c) the computed slope of each pipe run;
  - (d) Tie measurements to all underground sewer structures such as service stubs, cleanouts, etc.
  - (e) The surveyed rim elevation of each manhole.
- (3) Visual Test. All sewer lines shall be inspected visually by the contractor in the presence of the Engineer to verify accuracy of alignment, grade, and freedom from debris and obstructions, and other defects.
  - (a) A "full moon section" or full diameter of the pipe for straight alignments shall be visible when sighting from one manhole to another.
  - (b) The method of test shall be by visually lamping with mirrors and lights.
- (4) Infiltration Test. All sewer lines installed below the groundwater level shall be tested for infiltration by low pressure air testing or by water testing as described below:
  - (a) Isolate test section of sewer from upstream sections using watertight plugs installed in manholes. (Sewer service wye branches shall be capped with watertight end caps during installation.)
  - (b) Measure infiltration flowing out of the test section of sewer line through the downstream test manhole during a 24-hour period by means of a weir or other measuring device acceptable to the Engineer.
  - (c) The maximum allowable infiltration, including gains through intermediate manholes and sewer service stubs, shall not exceed 300 gallons per inch of pipe diameter per mile per day for any section.
- (5) Exfiltration Test. All sewer lines and manholes shall be tested for exfiltration. The method of test shall be by low pressure air test, or by water test as described below:
  - (a) Isolate each sewer pipe run (including the upstream manhole) with watertight plugs.
  - (b) Fill line to the top of the precast concrete manhole or other structure at the upstream end of the sewer run (provided that the lowest point is not under more than 25 feet of head).



- (c) Determine the loss of water over a 24 hour period by measuring the amount of water necessary to refill line to starting level.
- (d) The maximum allowable exfiltration losses through manholes shall not exceed 300 gallons per inch of pipe diameter per mile per day for any section.
- (e) The maximum allowable exfiltration for pipes shall not exceed the requirements set forth in the "UNI-Bell PVC Pipe Association's" UNI-B-6-90 or most recent edition.

#### 4. **Water Distribution and Fire Protection**

##### A. General Design and Construction Criteria.

- (1) The water supply and distribution system shall be adequate to handle the necessary flows, based on the complete development of the tract.
- (2) The demand rates for all users shall be considered in computing the total system demand. Where fire protection is to be provided in accordance with (3) below, the system shall be capable of providing the required fire demand plus the required maximum daily residential demand. The maximum daily demand shall be calculated by multiplying the average daily flow (calculated based on Title 5 flow rates) by a factor of 1.5 (150%).
- (3) The design of the water distribution system shall be adequate to provide fire protection calculated as per ISO standard, "Fire Suppression Rating Schedule," or per AWWA M31, "Manual of Water Supply Practices – Distribution System Requirements for Fire Protection," National Fire Protection Association (NFPA) Standard 24, "Installation of Private Fire Service Mains and their Appurtenances," latest edition, or by other calculation using accepted engineering methods approved by the Lee DPW in advance.
- (4) The design and construction of the water distribution system shall comply with all applicable state and local laws and regulations, including but not limited to Mass. DEP "Drinking Water", 310 CMR 22.00, and Mass. Uniform Plumbing Code, 248 CMR 2.00.
- (5) Design capacity of water mains shall be sufficient to maintain a minimum pressure of 20 pounds per square inch (psi) at street level under all flow conditions in the water main.
- (6) Water mains shall be a minimum diameter of eight (8) inches except at the end of a permanent cul-de-sac or approved dead end water main. A six (6) inch main may be used only when it serves not more than 10 dwelling units and only one fire hydrant.

##### B. Materials. Materials shall conform to the following requirements, unless an acceptable substitute is approved in advance by the Town. (Refer to MHD Standard Specifications and the relevant portions of the Lee Subdivision Regulations, Article IV, Construction Standards.)

- (1) Pipe:

- (a) All water mains shall be Ductile Iron Cement Lined, 6 inch minimum diameter, 8 inch diameter preferred.
  - (b) All material to be 250# rated, Class 52
- (2) Hydrants:
  - (a) Kennedy: 5.25" dry barrel, open left, breakaway flange.
    - (i) Threads: (1) 4" NST-7LP1 w/cap  
(2) 2.5" NST-7LP1 w/cap
  - (b) Hydrant valve: restrained tee and valve at main, with corresponding valve.
- (3) Valves:
  - (a) Kennedy: open left; Resilient seated, epoxy coated, retainer glands
- (4) Valve Boxes:
- (5) Service Connections:
  - (a) Curb stop to house connections shall conform to AWWA standards. Confirm Manufacturer and style with Lee DPW.
  - (b) Corporation Stop as per AWWA standards. Confirm Manufacturer and style with Lee DPW.
  - (c) Pipe:
    - (i) Type K Copper
    - (ii) if not copper, install tracing wire.
    - (iii) Compression fittings on all service lines (to curb stop)
    - (iv) Size water services lines based on number of housing units
  - (d) Meter horns: with two valves on all installations. Confirm Manufacturer and style with Lee DPW.
- (6) Cross-connection controls and backflow preventers as required (e.g. for swimming pools, irrigation systems, sprinkler systems, etc)
- (7) Pressure reducing valves where required by Lee DPW. Confirm Manufacturer and style with Lee DPW.

C. Methods of Construction.

- (1) General:
  - (a) Do not operate any valves on the Public Water System without the prior approval of the municipal Water Department.
  - (b) Coordinate with municipal Water Department before performing any operations on the Public Water System, including tapping water main, flushing lines, flow testing, excavation, backfilling, and pavement repair.
- (2) Water Mains:
  - (a) Minimum cover 6 ft in paved areas; minimum 5 ft cover in unpaved areas; maximum 7 ft cover all areas unless otherwise approved.
  - (b) Pipe bedding and backfill and installation methods shall conform to the pipe manufacturer's recommendations.
  - (c) Ductile Iron water main pipe joints shall be gasketed push-on joints or mechanical joints.
  - (d) Disinfect and flush water mains and appurtenances as described below.

- (3) Valves:
  - (a) Install line valves at maximum of 750' intervals, and at both ends of bridges, railroad tracks and other applicable crossings.
  - (b) Install valves at all main line intersections ("Tees"), hydrants excluded.
- (4) Thrust Restraint: All pipe bends, tees, valves, end caps, hydrant branches, vertical bends, etc. shall be properly thrust restrained for the maximum design pressure of the water main.
- (5) Fire Hydrant Assembly:
  - (a) Comply with AWWA-M17.
  - (b) Maximum 500 ft between hydrants, hydrants on all dead ends, and at high points to expel air.
  - (c) Verify bury depth of existing and proposed water mains in advance of ordering hydrant assembly. Assure that the hydrant length is adequate to provide proper clearance to the bottom of the pumper nozzles.
  - (d) Install hydrant valve anchored to water main tee. Provide proper thrust restraint. Install hydrant branch water line.
  - (e) Set hydrant plumb and to grade, with all nozzles clear above finished grade by at least 18" but no more than 24". Locate pumper nozzle perpendicular to and facing roadway.
  - (f) Provide a drainage pit 36" inches square by 24" deep filled with washed crushed stone to 6" above drain opening.
  - (g) Install thrust restraint for hydrant.
  - (h) Provide 5' radius around all fire hydrants clear of any obstructions and with a slope less than 5%.
  - (i) Paint hydrant with primer and two coats of finish enamel; color per municipal standards.
- (6) Disinfection.
  - 1. Disinfection of the water distribution system shall conform to ANSI/AWWA C651. The completed pipeline is to be disinfected with a chlorine concentration of approximately 50 ppm prior to being placed in service. The introduction of this chlorine may be accomplished using one of the following methods:
    - (1) By sticking calcium hypochlorite tablets to the interior wall of each length of pipe as it is laid; or
    - (2) By pumping or siphoning a calcium hypochlorite solution into the main during the initial filling operations, from the 1.
  - 2. Regardless of the method employed, the chlorinated water is to remain in the new pipeline for a period of at least 24 hours (unless otherwise directed). During this period, proper precautions are to be taken to prevent this chlorinated water from flowing back into the existing system.
  - 3. After all disinfection and leakage/pressure testing is completed, the Contractor shall blow out the new water mains under the direction of the Engineer and/or the water department. Blowing out of the main is to be accomplished at as high a velocity as possible consistent with the ability of the area around the blow-off point to drain the water. After clean water substantially free of

chlorine is obtained at the blowoff point, the flow of water at reduced rates is to be continued for at least one hour.

4. The contractor shall have the water in the main tested by an independent state-registered testing laboratory selected by the owner. Testing shall be done in accordance with AWWA testing and disinfection requirements. Coliform count shall be zero (0). Submit written report of test results to Town, Owner and Engineer. Do not put new main into service until proper disinfection is achieved according to test results.
5. Disinfection of Service Connections:
  - (1) Disinfection of water service connection shall comply with the requirements of the State Plumbing Code, 248 CMR 2.14(15).

D. Inspection and Testing.

- (1) All water mains or service lines shall be flushed clean and inspected for major defects before testing.
- (2) The water main shall be pressure tested and leak tested.
- (3) Contractor shall test all sections of the water mains for leakage and dynamic pressure and furnish all necessary materials, equipment and labor to perform the tests as herein specified and as directed by the Engineer. Pressure testing shall comply with NFPA 24, latest edition.

E. Record Data: Prior to project closeout, submit Record Data of work installed under this Section:

- (1) Tie Measurements and depths at all valves, bends, service connections, curb stops.
- (2) Notation of locations, volume and characteristics of any trench rock excavation or groundwater conditions encountered.
- (3) Notation of locations and characteristics of all utility crossings whether live or abandoned; clearance, condition, etc.

5. **Storm Drainage**

A. General.

- (1) Storm drainage system shall be designed, constructed and maintained with capacity to handle the runoff from a 25 year design storm, and provisions shall be made for overland flow of excess runoff from more severe storms or in case drain inlets or pipes are clogged.
- (2) Drain inlets in a closed drainage system shall be designed with sufficient inlet capacity for the 25 year storm. The capacity shall be determined considering the size and type of the grate openings, curb inlet opening, depth of ponding at inlets, spacing between inlets, pipe capacity, and other factors based on good engineering practices.
- (3) Drain inlets in streets shall have bicycle-safe grates.
- (4) Storm drains shall discharge into a storm drain system that has capacity for the design flow. Free discharge into a watercourse shall be protected from scour and

erosion by means of energy dissipaters, stilling basins, scour aprons, or other method.

- (5) Stormwater runoff from developed sites shall be controlled and increased rates of runoff shall be detained or retained so that the peak rate of runoff under the developed condition (assuming maximum allowable buildout) does not exceed the peak rate of runoff for the pre-development condition. Detention shall be provided for at least the 2 year, 10 year and 25 year storm events. The runoff from the 100 year storm shall be analyzed and shown that it will not increase downstream flooding. The Stormwater Basin shall have an emergency spillway with capacity to handle the 100 year storm without overtopping the embankment.
- (6) Design engineers shall determine pipe size based on the design runoff, conduit inlet conditions, and hydraulic capacity.
- (7) No pipe in the storm drainage system shall be less than 12" diameter. Any pipe handling the flow from two or more drain inlets shall be at least 15" diameter.
- (8) Drain pipes shall have a minimum slope of 1% (2% preferred), and be sufficient to provide scour velocity.

B. Materials.

- (1) Frames and Grates (3 and 4 flange), H-20, bicycle safe if in roadway.  
M8.03.0 and M8.03.2
- (2) Frames and covers for drain manholes, heavy duty H-20, 24" inside diameter, diamond plate cover, marked "DRAIN"  
M8.03.0
- (3) Cement Concrete Bricks and Blocks  
M4.05.1
- (4) Precast Concrete Units  
M4.02.14
- (5) Polyvinyl Chloride (PVC) Drain Pipe and Fittings: ASTM D 3034, SDR-35, with gasketed joints per ASTM F 477, elastomeric-seal gaskets. Perforated or unperforated as per plans.
- (6) Smooth Bore Corrugated Polyethylene Pipe (SBCPE) with high density polyethylene (HDPE), with soil tight O-ring joints. Equivalent to Advanced Drainage Systems, Inc., type N-12, or Hancor. Perforated or unperforated as per plans.
- (7) Reinforced Concrete Pipe (RCP)  
M5.02.1
- (8) Ductile Iron Pipe – Cement Lined (DIPCL)  
M5.05.3
- (9) Geotextile (Subdrains) Non-woven, needle punched, polyester. M 9.50.0 Type II
- (10) Washed Crushed Stone - 1/2" - 3/4" (for weep holes and bedding)  
M2.01.5
- (11) Concrete, Class D, 4000psi  
M4.02.00
- (12) Reinforcing steel, Grade 60 steel bars  
M8.01.0
- (13) Special Pipe Couplings and Fittings: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined, for non-pressure joints.
- (14) Precast Concrete Catch Basins: ASTM C 858, precast, reinforced concrete, designed according to ASTM C 857 for structural loading. Include sump, depth, shape, and dimensions indicated, with provision for rubber gasket joints.
  - (a) Gaskets between riser sections: round rubber gasket joints, ASTM C923.

- (b) Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match a 24-inch diameter frame and grate.
- (c) Steps: Not required
- (d) Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.
- (e) Frames and Grates for Catch Basins, H-20, bicycle safe if in roadway. Consult with Lee DPW for manufacturer and type.
- (15) Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, within provision for rubber gasket joints.
  - (a) Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
  - (b) Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
  - (c) Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top riser section shall end at least twelve (12) inches below finished grade to allow for proper adjustment of frame and cover.
  - (d) Gaskets: ASTM C 443 (ASTM C 443M), rubber.
  - (e) Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match a 24-inch diameter frame and cover.
  - (f) Steps: Fiber glass, individual steps or ladder. Include a width that allows a worker to place both feet on one step and is designed to prevent lateral slippage off the step. Cast steps or anchor ladder into base, riser, and top section sidewalls at 12- to 16-inch intervals. Omit steps for manholes less than 60 inches deep.
  - (g) Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.
  - (h) Frames and Covers: ASTM A 536, Grade 60-40-18, heavy-duty ductile iron. Include 24-inch inside diameter by 7- to 9-inch riser with 4-inch minimum width flange, 26-inch diameter cover. Include indented top design the lettering cast into cover.
- (16) Wood Post and Rail Safety "Awareness" Fence M9.05.3
- (17) Concrete: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
  - (a) Cement: ASTM C 150, Type II
  - (b) Aggregates: ASTM C 33

C. Methods of Construction

(1) General:

- (a) Stake out the locations and elevations of all existing and proposed piping, drainage structures, and other utilities in the vicinity before proceeding with work on the system to check whether conflicts may exist. Confirm locations of catch basins relative to curb lines. Any discrepancies between the information shown on the drawings and the actual conditions found in the field shall be reported at once to the Engineer for resolution.

- (b) Unless otherwise stated, all pipes shall have sand bedding. Precast concrete structures shall be set on 6" crushed stone bedding.
- (2) Drain Pipes:
- (a) All Storm Drain Pipes shall be laid true to line and grade between structures using laser-beam control.
  - (b) Pipe bedding, installation and backfill methods shall conform to the pipe manufacturer's recommendations. Where the pipe is installed in conditions with poor subgrade or bedrock, shallow depth of cover, deep cover, or other adverse conditions, install special bedding, encasement, and backfill as required to protect the pipe.
  - (c) No changes in drain structure locations, grades or elevations shall be made by Contractor without prior approval.
  - (d) Pipes located within 10 feet of areas subject to vehicular traffic shall be backfilled with select granular borrow and compacted in accordance with the applicable section of these specifications.
  - (e) When using flexible pipe materials such as corrugated polyethylene, Contractor shall take special precautions to protect against crushing or deflection of pipe. Any such crushed or deflected pipe shall be removed and replaced.
- (3) Catch Basins and Drain Manholes:
- (a) Construct in accordance with MHD Standard Specifications Section 201.
  - (b) Set Catch Basins and Drain Manholes on crushed stone bed.
  - (c) Install structures to line and grade.
  - (d) Install weep holes at each catch basin. Install drain pit outside of weep holes with 1/4 cubic yard of crushed stone completely surrounded by a filter fabric envelope.
  - (e) Connect subdrains and other pipes into catch basins.
  - (f) Catch Basins shall have minimum 2' deep sumps, or deeper where required.
  - (g) Where required, catch basin outlets shall be equipped with oil and grease hoods.
  - (h) No more than two catch basins shall be connected together. Outlets from two or more catch basins shall discharge to daylight or be connected to a Drain Manhole.
  - (i) Any existing storm drains, area drains, roof leaders, subdrains, tile drains or other drainage pipes which are encountered in the excavation, whether or not they are shown on the plans, shall be protected, repaired, replaced, abandoned or connected into the new storm drainage system as directed by the Engineer.
  - (j) No sanitary sewer drain shall be connected into the storm drains. Any storm drains, which are found to tie into sanitary sewers, shall be disconnected and re-piped into the storm drain.

(4) Drainage Castings

- (a) Frames for grates and covers of basins, manholes and inlets shall be set in accordance with Section 201 of the MHD Standard Specifications.
- (b) The final setting of frames shall be performed after the binder course paving has been placed so as to match the finished grade of the top course. At the option of the Contractor, binder course may pave over the structure, which shall be protected with a steel plate. Pavement shall then be removed and the frame reset to proper line, square to the curb line, and at the proper grade relative to finished grade. A concrete collar shall be poured completely around the frame to the top of binder course.
- (c) Set Catch Basin Frames and Grates 1" below adjacent finished grade to assure proper flow to inlet. Set concrete collar to accept full thickness of top course at frame. Rake out the top course pavement to form a "hopper" approximately two feet on each side of the casting. Do not allow a "feather edge" of pavement.

(5) Subdrain

- (a) Install Subdrain at the locations shown on the plans or directed by Engineer.
- (b) Install subdrain cleanouts with end caps at finished at the upstream end of the subdrain run.

(6) Stormwater Basin

(a) General:

- (i) Construct the stormwater basin as early in the construction as possible for use as a temporary sedimentation basin.
- (ii) Stormwater Basin shall be constructed and operational for stormwater storage prior to construction of the piped storm drainage system.
- (iii) Remove Accumulated sediments shall be removed from the sediment basin during the construction period before they accumulate to 50% of the sediment storage capacity.
- (iv) Prior to final completion of the project, and after the site is stabilized with permanent vegetation, all sediments shall be removed from the stormwater basin (and other sediment traps, catch basin sumps, pipes, and other portions of the storm drainage system).

(b) Earthwork and Outlet Structures:

- (i) Construct the excavation and form the embankment using suitable soils (low permeability), placed and compacted in accordance with MHD Standard Specifications.
- (ii) Construct the basin to the lines and grades shown on the plans, taking care to assure the elevations and volumes are achieved. The top elevation of any embankment shall be crowned approximately 6" above the design grade to allow for settlement.
- (iii) Detention basins with a permanent pool deeper than 18" and an embankment height of six (6) feet or more, shall have a "safety shelf" at



least four feet wide built into the water-side embankment approximately one (1) to one and a half (1 ½) feet above the normal water level.

- (iv) Design and construct other components of the detention basin in accordance with applicable codes, requirements, and good engineering practice; such as: sediment forebay, water quality devices, outlet structures, trash racks, anti-vortex devices, emergency spillways, stilling basins, pipe outlets, anti-seep collars.
- (v) Where appropriate, install an “awareness fence” (such as wood post and rail) around the perimeter of the stormwater basin to alert people that the basin is subject to rapid water rise, and may have slippery slopes.
- (vi) The Subdivider’s engineer shall review the construction for conformance to the plans, and arrange for compaction testing and other quality control measures to assure proper construction in conformance with the approved plans.

D. Inspection and Testing.

- (1) Storm Drainage system shall be inspected for conformance to the approved plans, and for proper function, prior to final paving.
- (2) Remove accumulated sediments from all Catch basins, Drain Manholes, drain pipes, sediment traps, and stormwater basins prior to final inspection.
- (3) Test earth embankments of stormwater basins for proper compaction.
- (4) Conduct As-built Survey to verify critical elevations and grades.
- (5) Inspect drain pipes visually for proper line and grade between structures.
- (6) Prepare Record Plan indicating locations and elevations of underground structures, tie measurements, and other features.