

## SECTION 5

### SPECIFICATIONS FOR CONSTRUCTION OF REQUIRED IMPROVEMENTS

#### A1. General

- (1) All improvements specified or implied on the Definitive Plan shall be constructed or installed by the applicant's contractor (The Contractor) in accordance with the provisions of this Section of the Rules and Regulations or as directed by the Hingham Planning Board (The Board). The applicant, at his own expense, shall furnish all necessary materials, labor and equipment which may be required to complete the work called for or implied on the Definitive Plan. Items not specifically mentioned herein shall be constructed in accordance with the most recent version of the Massachusetts Highway Department Standard Specifications (hereinafter referred to as MassDOT Standard Specifications) unless specifically directed otherwise by the Board.
- (2) All work performed by the applicant as a consequence of these Rules and Regulations will be subject to the review and acceptance or approval of the Board. Prior to the commencement of construction, including clearing of the site, the applicant shall meet with the Planning Board to discuss construction inspection procedures. The applicant shall present to the Board a construction schedule which may be modified by written notice providing a minimum seven calendar days to allow for proper inspections. Therefore, the Board will employ a Registered Professional Engineer for purposes of inspecting the work. In order that the Board's engineer may properly inspect the work as it progresses, the applicant will keep the Planning Board informed of the progress of the work on a timely basis and shall provide safe and convenient access to all parts of the work for inspection by members of the Board or its engineer or such persons as the Board may designate. No work will be approved which has been covered prior to inspection by subsequent work. Reference should be made to Section 6 for specific inspections required by the Board. The Board's Professional Engineer may also be referred to as the Project Inspector in this document.
- (3) Nothing in these specifications should be interpreted as placing the onus for safety and quality onto the Town of Hingham, its employees or its representatives. The Town will not be responsible for any cost implications associated with remedial action that may be required as a result of the inspections. The applicant/contractor is directly responsible for the overall safety in accordance with state and federal standards and quality of the project; and as such they shall indemnify the Town of Hingham, its employees or its representatives (quality is defined by final acceptance by the Board).

## B1. Subdivision Layout

- (1) Prior to starting any land clearing activities, a registered land surveyor shall stake the limit of work. The work may proceed in phases, in which the initial clearing limits will be staked in a manner and frequency such that the Planning Board, a Registered Professional Engineer employed by the Board (The Project Inspector) or their representative can walk the clearing limits prior to the commencement of work. A plan shall be submitted to the Board that identifies the stake number and includes sufficient existing conditions information to be able to identify the location of the stake on the ground relative to other site features. All trees to be preserved shall be flagged. At times it may be feasible to adjust clearing limits slightly to preserve significant trees and other site features.
- (2) Prior to the start of other construction activities, a registered land surveyor shall set offset grade stakes along the roadway right-of-way, centerline, sidelines, and sidewalks at fifty-foot (50') intervals or at a frequency directed by the Project Inspector. These horizontal and vertical control stakes must be laid out to conform to the lines and grades shown on the approved Definitive Plan or any approved amendment thereto.
- (3) Further, permanent bounds as specified herein in Subsection 82 shall be placed so as to delineate the boundary lines between the property to be subdivided and adjacent Town property, including a Town right-of-way. All required Permanent Monuments are to be set where the property abuts Town property.
- (4) Any work, which in the opinion of the Project Inspector has not been properly laid out or does not conform to the Plans, may be checked by a Registered Land Surveyor employed by Town. If it is determined that such work does not conform to the Plan and that the Plan was based upon erroneous data or calculations provided by the applicant, or which was correctly laid out upon such erroneous data or calculations, the applicant shall pay all costs which the Town incurs as a consequence of checking the work. The Project Inspector or the Board may require the removal and correct replacement of any work which has been incorrectly laid out.

## C1. Clearing, Grubbing and Excavation

- (1) Land shall be cleared and developed in increments of workable size which can be completed during a single construction season. Erosion and sediment control measures shall be coordinated with the sequence of grading, development, and construction operations. Control measures such as hydroseeding, berms, interceptor ditches, mulching, temporary sodding, terraces, and sediments traps shall be put into effect prior to the commencement of each increment of the development/construction.

- (2) The entire area of each way within its exterior lines shall be cleared of all trees not intended for preservation, stumps, brush, roots, rocks or boulders and all perishable or unsuitable material.
- (3) Trees intended to be preserved shall be protected from injury by suitable fencing at or beyond the drip line or by wells if in fill. The Project Inspector will make an inspection when this phase of the work is completed.
- (4) The contractor shall satisfactorily dispose of all trees, stumps, shrubs, roots, branches, dead wood and other litter in areas outside of the right-of-way or outside the subdivision and at approved disposal facilities when required. If requested by the Planning Board or the Board's Engineer, the disposal location shall be provided to the Board for approval. Reuse of processed vegetation on-site may be allowed subject to approval by the Planning Board or their Engineer.

D1. Excavation/Backfill

- (1) The entire area to be occupied by the roadway plus an additional four (4) feet or extending outward to the toe of slopes in fill areas, whichever is greater, shall be excavated a minimum of twenty-four (24) inches below finished grade, or as necessary to remove the topsoil and subsoil, or to such greater depth as may be required by the Project Inspector if soft or yielding material, clay, peat, silt, sand pockets, boulders or rocks, organic material, or other material detrimental to the subgrade is encountered. In cut sections excavation shall be to suitable depth to remove the topsoil and subsoil or to such greater depth as may be required by the Project Inspector if soft or yielding material, clay, peat, silt, sand pockets, boulders or rocks, organic material, or other material detrimental to the subgrade is encountered. Unless otherwise approved "detrimental subgrade" shall be defined as material with more than 10% passing the #200 sieve or material containing more than 1% organics. Materials encountered may be subject to in-situ sieve testing as directed by the Planning Board's Engineer.
- (2) All excavation will be to such width and depth as shown on the drawings, specified herein, or ordered by the Project Inspector. Such excavation may be for the laying of pipes or appurtenances, the removal of pipes or appurtenances, the capping or plugging of pipes to be abandoned, test pits to locate existing utilities, or any other purpose for which excavation may be needed.
- (3) Wherever a percentage of compaction for backfill is indicated or specified, it shall be the percent of maximum density at optimum moisture as determined by method D of ASTM Standard Methods of Test for Moisture - Density Relations of Soils Using 10-lb. rammer and 18-inch Drop, Designation D 1557-78.

- (4) No backfilling of pipes, culverts or appurtenances shall be done until the installation has been inspected and approved by the Project Inspector. Backfilling shall be in layers not exceeding eight (8) inches, with each layer compacted by an appropriately sized plate vibrator, regardless of the method of final compaction at the sub-base or gravel base level. The minimum cover will be that specified on the plans and approved by the Project Inspector. The backfill fill material will be subject to compaction testing.
- (5) All excavations shall be sheathed or braced to the satisfaction of the Project Inspector for construction adequacy and not safety. All excavations shall be kept free of all water entering by dewatering. The Contractor shall submit the method for dewatering at the pre-construction meeting for approval by the Board and its Project Inspector. Flowable (CLSM) fill may be required for backfill if satisfactory compaction cannot be attained do to the limits of the work area.
- (6) The contractor shall conform to those requirements of the Department of Public Safety and OSHA. The contractor will be required to obtain a Trenching Permit under “Jackie’s Law” at the Hingham Department of Public Works prior to commencing work.
- (7) As excavation approaches known underground structures, the structure should be exposed by means of hand tools as a normal part of trench excavation.
- (8) All existing gas pipe, electric conduit, telephone conduit, cable TV conduit, water, sewer or drain lines and any other structures, which are uncovered by the excavation, shall be carefully supported and protected from injury by the Contractor. The Contractor shall restore any items damaged by him to as good a condition as they were found and or to the satisfaction of the Project Inspector or respective utility purveyor, and they shall be kept in repair during the life of this contract. The restoration of existing utility lines shall be done as promptly as practical and shall not be left until the end of the construction.
- (9) Where determination of the exact location or elevation of a pipe or other structure is necessary, the Contractor shall excavate test pits, as part of normal trench excavation, to determine such locations far enough ahead of the work so that the pipe alignment can be properly determined.
- (10) Excavating equipment shall be operated with care to prevent damage to trees, overhead branches and other structures. Wherever work will disturb existing trees in the public right-of-way, the Contractor will notify the DPW before cutting any roots or branches of existing trees. Branches and roots shall not be cut except by permission of the Project Inspector. All cutting shall be done neatly without splitting or crushing.

- (11) Plantings and trees shall be adequately protected or removed and later re-established in their original position. Where injury is significant enough as to diminish their beauty or usefulness, they shall be replaced by items of the same kind and quality at least equal to the preexisting condition.

E1. Disposal of Surplus and Unsuitable Materials

- (1) All suitable surplus excavated materials not required for immediate re-use on the project shall remain on the property of the Owner and stockpiled by the Contractor on the site at such location or locations as directed by the Project Inspector or as specified by the SWPPP. Surplus material stockpiles shall be protected from erosion with appropriate sedimentation barriers.
- (2) All other unwanted materials not required or suitable for re-use shall be disposed of in accordance with local rules governing such disposals. Should unsatisfactory subgrade material be encountered, the Project Inspector may direct that excavation be carried to satisfactory material and be backfilled with gravel borrow or special borrow. The location of any off-site disposal shall be reported to the Planning Board.
- (3) The Contractor shall, periodically or as directed during the progress of the work, remove and legally dispose of all surplus excavated materials and debris, and keep the Project Area and public rights-of-way reasonably clean. Upon completion of the work, he shall remove all temporary construction facilities, debris and unused materials for the work, and re-establish the whole site of the work and public rights-of-way in a neat and clean condition.
- (4) The excavated topsoil shall be neatly stacked within the project limits at such location or locations as directed by the Project Inspector and/or as indicated on the SWPPP. Topsoil stockpiles shall be stabilized with a cover material as soon as practicable. If the conditions are not suitable for establishing a vegetative cover other means of stabilization will be required.
- (5) All excavated rock shall be removed and disposed of unless otherwise directed by the Project Inspector.

F1. Test Pits

- (1) Test pits for the purpose of determining subgrade geo-technical conditions and locating underground pipelines or structures in advance of construction shall be excavated and backfilled by the Contractor prior to start of construction at the locations of conflict shown on the Approved Plans or at the direction of the Project Inspector. Geo-technical investigations shall be excavated only in the presence of the Project Inspector. Test pits shall be backfilled immediately after

their purpose has been satisfied and maintained in a manner satisfactory to the Project Inspector and as outlined in this document.

- (2) Unsuitable foundation material in the opinion of the Project Inspector below the normal depth of construction shown on the drawings for pipes, structures or roadway sub-base shall be removed and disposed of at the Project Inspector's discretion.

#### G1. Excavation for Structures

- (1) The Contractor shall furnish all materials and equipment and perform all work required to install and maintain the dewatering and drainage systems he proposes for handling groundwater or surface water encountered.
- (2) If suitable material is encountered during excavation, estimated depths may not be realized. However, if unsuitable materials are encountered during excavation, depths may be greater than estimated. In all cases, excavation will be performed only to the depths authorized by the Project Inspector.
- (3) Any excavated or natural area below the subgrade shall be filled to the subgrade with suitable granular material, to be approved by the Project Inspector prior to its installation.

#### H1. Trench Excavation

- (1) Prior to excavation of all trenches in paved areas, the Contractor shall cut through the existing pavement and base course in neat straight lines with a minimum amount of vibration. Pavement including sidewalks shall be cut using a mechanical saw, or a machine mounted hydraulic or mechanical tool fitted with a rotary-type blade, and shall result in sound vertical edges, thus avoiding any damage to the pavement or base course to remain. Where the contract requires a permanent trench repair, pavement shall be cut twelve' (12) inches beyond the width of the trench along each side of the trench, or as allowed in writing by the Project Inspector. Should these edges crack or become damaged during excavation the contractor shall re-cut the edges to a uniform and undisturbed line just prior to paving.
- (2) Trench excavation shall be carried out to the lines and grades as specified herein and shown on the plans. Trenches may be excavated to their full depth by machinery if the material remaining at the bottom of the trench is no more than slightly disturbed.
- (3) The Contractor should anticipate that due to existing utility lines, hand excavation might be required.

- (4) Trench excavation shall result in a flat or shaped trench bottom, true to grade so that the pipe will have uniform and continuous bearing on a firm support. Trenches shall be made as narrow as practicable within the limits specified and required to lay all pipes and appurtenances as shown on the plans or ordered by the Project Inspector, and every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling and compaction are completed.
- (5) Normal depth of trench excavation shall be six inches (6") below the bottom of the pipe in earth.
- (6) Normal width of trench excavation in sheathed trenches up to 12' deep shall be measured between vertical planes which are a distance apart equals to the sum of the outside diameter of the pipe, the total width of the sheathing including walers and 2 feet. Such trench width shall not be less than 4 feet 2 inches or 5 feet if walers are used as part of the sheathing system.
- (7) Normal trench widths for trenches supported with approved trench boxes or hydraulic shoring systems shall be the sum of the outside diameter of the pipe, 1 foot on either side of the pipe, the width of the wall shield (no greater than 8 inches), and 1 foot of additional space to allow for Installation of the trench box.
- (8) Such trench width shall not be less than 3 feet except trenches for building services shall be a maximum of 2 feet 6 inches wide but always wide enough for compaction equipment. However, excavate-able flow-able fill will/may be used instead of compaction equipment, when the trench does not provide the necessary width, work area or when directed by the Project Inspector.
- (9) Trench widths for deeper excavations or special conditions may be specified in the contract drawings and will supersede limits outlined here as required to complete the work. The Contractor in all cases will include with his plans a copy of trench support and maximum trench width, for approval by the Project Inspector.

## II. Miscellaneous Trench Excavation

- (1) This excavation shall be carried out in a similar manner to trench excavation, but to limits beyond the established limits for normal trench excavation including test pits ordered or approved by the Project Inspector.

## J1. Below Grade Excavation

- (1) This excavation shall be carried out in a similar manner to trench excavation, but to depths below the established lower limit of trench excavation. All

unsuitable materials shall be removed from the job site and shall not be used for any backfill purposes.

#### K1. Rock Excavation

- (1) Rock in pipe trenches shall be excavated to be not less than 6 inches from the pipe. Before the pipe is laid, the trench below the pipe, where rock excavation has been made, shall be backfilled and compacted with suitable material specified for bedding the pipe.
- (2) The Contractor shall observe all state, federal and municipal laws, ordinances and regulations relating to the transportation, storage, handling and use of explosives. In the event that the regulations require a licensed blaster to perform or supervise the work, said licensed blaster shall have his license at the site and shall permit examination thereof by the Project Inspector.

#### L1. Drainage and Stormwater Management

- (1) The Definitive Plan shall provide adequate drainage facilities within the subdivision for collecting, conveying and disposing of storm water in a manner, which will ensure proper protection of the roadway and the areas adjacent thereto. The Definitive Plan shall provide for recharging groundwater with pre-treated (if applicable) storm water in an amount equal to or exceeding pre-development conditions.
- (2) No catch-basin-to-catch-basin connections will be allowed, without the written approval from the DPW and the Planning Board.
- (3) The construction of the drainage system, including methods of construction and quality of materials, shall conform to the applicable sections of the Massachusetts Highway Department's Specifications except as modified hereafter or as approved by the Planning Board as a waiver of its Rules and Regulations.
- (4) All storm drains shall be laid with a minimum of two and one-half (2 1/2) feet of cover. All joints shall be sealed by caulking and cement mortar, or by use of approved rubber gaskets or equivalent connections for HDPE pipe. Shop drawings for materials shall be supplied to the Board for approval prior to any materials being delivered or installed on-site.
- (5) All catch basins shall be constructed of precast concrete and shall have a standard twenty-four (24) inch square frame and crossed grate cover appropriate for the passage of bicycles. A MassDOT vaned grate may be used on slopes over 3%. A granite gutter mouth curb shall be furnished and set where vertical or sloped granite curbing is utilized. Where Cape Cod Berms are used,



the catch basin and cover shall be laid so as to be slightly below the roadway pavement, which shall be suitably tapered toward the cover, and direct surface water flow to the catch basin. Even with cape cod berm a gutter mouth stone shall be used with two transitional sections of curb, from gutter mouth to face of berm. When approved the omission of gutter mouth stone shall be substituted by placement of catch basin frame and grate in relationship to roadway gutter-lines six (6) inches into a Cape Cod berm. Granite curbing is not required for catch basins on a Private Local Street.

- (6) No pipe shall extend into a catch basin more than three (3) inches beyond the inside face of the wall. Gas traps shall be utilized over outlet pipes within a catch basin. All catch basins shall have an inside diameter of at least four (4) feet, shall be constructed with a minimum depth of four (4) feet below the invert of the outflow pipe, and as otherwise shown in accordance with the Construction Standards of the Massachusetts Highway Department.
- (7) All manholes shall be constructed of the same materials as permitted herein for catch basins except that a standard heavy (LeBaron, Neenah or approved equal) twenty-six (26) inch diameter cover and frame shall be furnished and set, and all other details shall be as shown in the MHD Standards for manholes.
- (8) If required due to groundwater conditions, or as directed by the Board' Engineer, a subdrain or system of subdrains for collection and removal of groundwater from the roadway shall be installed. Such system, as shown on the approved Definitive Plan, or as ordered by the Board during construction, shall be constructed of not less than 6-inch diameter perforated Schedule 80 PVC pipe with all joints firmly clamped, perforations turned up, and laid to line and grade. All subdrains shall be a minimum of four feet deep to the top of the pipe and be installed in  $\frac{3}{4}$  to 1  $\frac{1}{2}$  inch crushed stone wrapped in filter fabric. Note that a minimum of six (6) inches of topsoil is required for seeded areas. (Details as per MHD Construction Standards 209.1.0)
- (9) All drainage pipes shall end in a concrete or masonry headwall having dimensions as specified in the Department's Standards and constructed in accordance with the Department's Specifications. The concrete shall have a minimum compressive strength of 3000 pounds per square inch after twenty-eight days curing. Headwalls for pipes over 18" in diameter shall be fitted with a stainless steel or aluminum grate. Shop drawing approval of grates is required.
- (10) All tide gates shall be of standard manufacture, of the same size as the outfall pipe, cast-iron frame and flap each fitted with bronze seat and subject to the approval of the Project Inspector.

- (11) The Project Inspector will inspect the completed drainage system or sections thereof prior to placing any backfill.
- (12) All trench backfill for the storm and subsurface drains and other backfill within the limits of the way shall conform to the base course requirements and shall be deposited to required subgrade in not more than six (6) inch layers and compacted to 95% of the maximum dry density as determined by modified Proctor Test, in accordance with ASTM D-1557-70, Method "D".

#### M1. Culvert Piping

- (1) The drainage pipe shall be reinforced concrete or approved equal, with bell and spigot gasket joints. The pipe shall be Class III in accordance with ASTM C-76. The gaskets shall be O-ring type in accordance with ASTM C-443. The minimum diameter shall be twelve (12) inches. The pipe shall be laid in undisturbed trenches below the grade of pipes, starting with the downstream end on firm bedding. All bells shall be facing upstream. Reference benchmarks shall be clearly marked to enable the Project Inspector to check the grade and invert elevations. The joints of all concrete pipes shall include a pre-molded neoprene continuous O-ring flexible compression gasket. No backfilling of pipes or culverts shall be done until the installation has been inspected and approved by the Project Inspector or a Planning Board Representative. Backfilling shall be in layers not exceeding eight (8) inches, with each layer compacted by an appropriately sized plate vibrator, regardless of the method of final compaction at the subbase or gravel base level. The minimum cover is forty-two (42) inches above the top of the pipe.<sup>2</sup> If required by the Project Inspector, side under drains shall be installed on both sides of all streets, except in Fill sections, and connected to the surface drainage system. In circumstances where the groundwater table is not within four (4) feet of the finished grade and each linear foot of under drain would serve a surface drainage area of not more than twenty (20) square feet, or in other circumstances which would render such under drains superfluous, the Project Inspector may waive such requirement. The side drains shall be shown in cross-section detail.
- (2) At each outfall of a drain line, a winged headwall of reinforced concrete shall be constructed according to the details shown in the plans.

#### N1. Stormwater Management Structures

- (1) Stormwater Management structures used for treatment of runoff shall be approved by the DPW. Structures shall be located in an accessible location and be compatible with available maintenance equipment if the system is to be accepted by the Town for maintenance.

- (2) Shop drawings for all special stormwater structures, including outlet structures for stormwater basins, etc. shall be provided to the Board for approval prior to ordering the structures.

O1. Fine Grading and Compacting Subgrade Area

- (1) The contractor will be required to establish grade markers to the elevations specified on the plans. Using the machinery designated for this type of work and necessary to complete the task, such as a (Rubber Tired Excavator) Gradall or a Road Grader, the contractor will create the required roadway profiles for features specified such as drainage. The Contractor will be required to compact these areas to 95% of Maximum Dry Density as determined by ASTM D-1 557.
- (2) Street grades shall be designed in relation to existing grades such that the volume of cuts and fills made within the right-of-way approximately balances, except to offset peat, boulders or other unusable materials to be removed.
- (3) Final grading shall be inspected by pulling a string line from “finish grade” grade stake to grade stake and measuring from the transverse line to the prepared road-base. Grading shall be within plus or minus ½” of desired overall pavement thickness. The contractor shall provide the necessary labor to perform the aforementioned. The Project Inspector shall be present to witness the measurements.

P1. Lot Grading/Drainage

- (1) Lots shall be prepared and graded in such a manner that development of one shall not cause detrimental drainage on another. If provision is necessary to carry drainage to or across a lot, an easement or drainage right-of-way of a minimum width of twenty (20) feet and proper side slope of at least three to one (3:1) shall be provided. Storm drainage shall be designed in accordance with these specifications. Where required by the Planning Board, the applicant shall furnish evidence as to any lot or lots for which adequate provision has been made for the proper drainage of surface and underground waters from such lot or lots. Unless specifically approved private drainage shall not be allowed to connect to the existing Town drainage structures. Unless specifically approved, private drainage will not be allowed in the Town R.O.W.

Q1. Catch Basin And Drain Manholes

- (1) No more than four (4) pipe openings shall be allowed in any one (1) manhole. Four-foot-diameter manholes will be used for drains up to thirty- (30") inches in diameter. Five-foot-diameter manholes are necessary for pipe diameters between thirty-six (36) and forty-eight (48) inches. All flows into a manhole shall be in the same direction (no reverse flows or sumps allowed), with a

maximum angle between the main and any connecting line of ninety degrees (90°). All connecting lines shall have bricked inverts rounded into the direction of flow.

- (2) Manhole casting shall be set flush with the designed finish grade of the pavement. Catch basin grates shall be set half (1/2) inch below the finished gutter grade and shall be of the egg box variety (square openings). Manhole castings and catch basin grates shall be raised at the earliest thirty days prior to final paving. If paving does not occur within said thirty days, they shall be lowered immediately. Ramping is prohibited.
- (3) Pre-cast catch basin and manhole bases, risers, eccentric cones, and slab tops shall conform to the latest requirements of ASTM Designation C 478. Where the shallow grade will not allow for standard manhole and catch basin installations, the construction including flat top slabs shall conform to the detail drawings for shallow catch basins and manholes.

#### R1. Pre-Cast Manhole and Catch Basin Materials

- (1) New manholes, catch basins and other structures shall be pre-cast concrete unless approved as a change by the Planning Board and the DPW.
- (2) Catch basins shall have a minimum sump of forty-eight (48) inches.
- (3) Pre-cast concrete manholes and catch basins shall conform to the ASTM Standard Specifications for pre-cast reinforced concrete manhole sections, Designation C478-77 or latest version, except as modified herein.
- (4) Type II cement shall be used unless specifically authorized in writing.
- (5) Joints between pre-cast sections shall be sealed with a preformed flexible joint sealant conforming to the requirements of ASTM Designation C990-92. The manufacturer of the pre-cast units shall supply the joint sealant. The joint sealant shall be produced from blends of butyl rubber, refined hydrocarbon, resins; and, plasticizing compounds reinforced with inert mineral filler that are solvent free. The sealant shall have an approximate cross section of 3/8-inch by 3-1/2 inch' for single strip application or 3/8-inch-by-3/8-inch square or 3/8-inch diameter cord for multiple cord usage application. Use six (6) cords minimum for multiple cord applications.
- (6) Manholes shall be four (4) feet in diameter (inside) unless otherwise noted on the plans or in the Special Conditions. Catch basins shall be 5 feet in diameter (inside) and 8 feet 6 inches deep as shown on the standard drawings. The manhole base shall be pre-cast concrete and shaped to receive the pipe sections and manhole sections.

- (7) Catch basins shall have a pre-cast slot and opening suitable for mounting the hood and discharge pipe.
- (8) Manhole sections shall contain manhole steps accurately positioned and imbedded in the concrete when the section is cast.
- (9) No more than two lift holes will be cast or drilled in each section.
- (10) The date of manufacturer and the name or trademark of the manufacturer shall be clearly marked on the inside of the barrel.
- (11) Brick shall be sound, hard and uniformly burned, regular and uniform in shape and size, of compact texture, and satisfactory to the Project Inspector. Brick shall comply with the ASTM Standard Specification for Sewer and Manhole Brick (made from clay or shale), Designation C32-73. Grade SS brick shall be used for paved inverts and shelves, and grade MS shall be used for walls. Concrete brick will not be allowed.
- (12) Concrete masonry block shall be machine-made, solid, pre-cast concrete masonry units. Block shall comply with the ASTM Standard Specification for Concrete Masonry, Units for Construction of Catch Basins and Manholes, Designation C139-73, except as modified herein.
- (13) The width of the units shall be six (6) inches. The inside and outside surfaces of the units shall be curved to the necessary radius (5 foot inside diameter) and so designed that the interior surfaces shall be cylindrical, except the top batter courses shall be designed to reduce uniformly the inside section of the structure to the required size and shape at the top.
- (14) Blocks shall be designed so that only full-sized units are required to lay any one course.
- (15) Type II cement shall be used unless otherwise authorized in writing.
- (16) Sand shall be well graded and with no grain larger than will pass a No. 8 sieve.
- (17) Hydrated lime shall form type M mortar (2500 psi) conforming to the ASTM Standard Specification for Hydrated Lime for Masonry Purposes, Designation C207-79.
- (18) The mortar shall be composed of Portland cement, hydrated lime, sand and water in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime. In general, mortar for Grade SS brick shall be mixed in the proportions of 1:1/2:4 1/2 (Cement: Lime: Sand).

- (19) Drain manholes shall have rung manhole steps fifteen (15) inches on center built into the vertical side.
- (20) Steps for manholes shall be non-skid raised edge-front steel reinforced polypropylene plastic type, with at least a 14-inch wide stepping surface, and grade-60 steel. Placement into pre-cast walls shall be by a method recommended by the 'supplier of the pre-cast manhole sections. Steps shall protrude no less than 6-inches from the wall and are to be installed per the manufacturer's specifications. Details of the steps and methods of placement shall be submitted for approval.
- (21) Steps shall not be mortared into place after the concrete has set.
- (22) All new catch basins shall be constructed with a new section of granite curb with a gutter mouth as shown on the standard details.
- (23) Any concrete block or brick used shall be skim coated with Type M mortar.

S1. Catch Basins (Built)

- (1) Details of standard manhole, catch basin, frame and grate and curb inlet should be shown in the plans.
- (2) Unless specifically noted otherwise, or approved by the Project Inspector, all catch basins shall be as shown on the standard drawings. Basins that cannot be built due to conflicts with existing structures shall be reevaluated by the project Inspector and approved by the Board.
- (3) Concrete-block-masonry may be used in lieu of pre-cast catch basins and manholes structures only when approved by the Project Inspector, catch basins may be constructed with brick or concrete masonry blocks, and reinforced concrete base, as an alternative to pre-cast concrete units.
- (4) Catch basins and drain manholes shall be constructed of concrete-block masonry eight (8) inches in thickness with an inside diameter of four (4) feet or more. They shall be built with horizontal and vertical mortared joints. The arch or cone section shall be twenty-four (24) inches in height consisting of a first row, second row, third row and a ring row (either round or square as appropriate). The cone section shall be mortared on the exterior and interior. The faces of all pipes shall be flush with or extend not more than three (3) inches into the basin or manhole. Flat-topped structures are not allowed, unless approved by the Project Inspector.

- (5) Drain manholes shall have a four-inch-thick concrete base. At least one (1) row of blocks shall be set on the base to allow the construction of a brick table within the manhole. Arched inverts of one-half (1/2) the pipe diameter shall be sloped upward to the sides of the manhole. The elevations of the main drain lines entering and leaving a manhole shall be matched.

#### T1. Manhole Construction Methods

- (1) Barrel sections (walls) shall be set to be vertical, with steps in alignment.
- (2) For Sewer Manholes the invert channel within the structure shall be an inverted arch with bricks laid as stretchers and on edge and constructed as to conform in shape to the lower half of the pipe. In addition, in these structures an arch shall be constructed over inlet and outlet pipes with bricks laid as headers and on edge. The shelf in manholes shall consist of bricks laid flat and the top of the shelf shall be at the elevation of the top of the pipe, as indicated on the drawings, and shall be sloped to drain toward the channel.
- (3) An approved grade ring shall be placed between the cone section and the cast iron frame for purposes of setting the frame to match the roadway grade. More than one ring may be necessary to match the required grade but in no case shall the rings exceed 16" in height.
- (4) Special manholes for 36 inch pipe and larger shall have reinforced concrete bases and pre-cast concrete or brick chimneys as detailed on the drawings.
- (5) Manhole stubs, where indicated on the drawings, shall be short pieces (maximum length 3.5 feet) cut from the bell ends (retaining bell end) of the appropriate size and class of pipe. PVC stubs shall be plugged with a PVC stopper and RCP stubs shall be plugged with brick masonry or approved plug.
- (6) Inverts shall conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of 'the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipelines.
- (7) Preformed flexible joint sealant shall be placed over the entire horizontal-mating surface of adjoining pre-cast section, and installed in accordance with the manufacturer's recommendations.
- (8) All holes in sections used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose or hydraulic grout.
- (9) For Sewer manholes, the exterior surfaces of pre-cast manholes shall be given two heavy coats of bituminous waterproofing material. The waterproofing

material shall be applied by brush or spray and in accordance with the instructions of the manufacturer. Time shall be allowed between coats to permit sufficient drying so that the application of the' second coat has no effect 'on the first coat.

- (10) All connections between pipe and manholes shall be made with a positive seal connector manufactured for this purpose. The type of connector proposed shall be subject to review and. approval by the Project Inspector.
- (11) Openings for pipe and materials to be embedded in the walls of the manhole for those joints shall be cast in the barrel sections or base at the required locations during the manufacturing process. Only with approval from the DPW will any modifications to the structure be allowed, and if so, only by coring. Chipping an opening into the structure will not be allowed.
- (12) All materials, accessories, and construction methods used in making the joints shall be supplied or approved by the manufacturer of the pre-molded elastomeric-sealed joint.

#### U1. Drop Inlets

- (1) Drop Inlets shall be pre-cast or where approved, constructed with brick or concrete masonry block walls and poured concrete bases as detailed on the standard drawings.
- (2) When concrete masonry units are used 1) each block shall be dry and laid in a full bed of mortar; 2) vertical keyways shall be completely filled with mortar; 3) catch basins shall be fitted with a standard hood and a 12-inch outlet pipe; 4) the connection between the pipe and catch basin or drop inlet shall be made with an approved positive seal flexible connector.

#### V1. Dry Wells /Leaching

- (1) Drywells shall be pre-cast concrete with dimensions and details as shown on the Contract plans; Drywells shall be constructed using 5,000 psi concrete and ASTM GR.60 steel reinforcement and shall be manufactured to support AASHTO HS20-44 live load.
- (2) The installation of a dry well will require the Contractor to excavate a square hole, which will be four (4) feet wider than the outside dimension of the dry well and two (2) feet deeper than the proposed bottom of the Dry Well. The excavation shall be lined with geo textile fabric and a two (2) foot layer of crushed stone shall be placed as bedding surface. An adequate length of 12" RCP pipe shall connect the proposed catch basin to the dry well. The space between the dry well and the sides of the excavation shall be backfilled with the



crushed stone placed and compacted in 6” lifts. The crushed stone shall be placed flush with the top of the structure and the filter fabric shall be folded over to the center of the structure. A standard frame and cover shall be placed over the structure to the proposed roadway grade and profile. (See adjusting structures and frames)

- (3) All holes shall be cored and connections shall be made in accordance with the specifications for manholes. Frames and covers shall be the specified standard and set in accordance with the plans and these specifications.

#### W1. Raising Casting Construction

- (1) The contractor shall locate with a metal detector each buried casting. After receiving permission to excavate, the contractor will expose the casting to determine whether the existing casting is useable. If not, the contractor must install a new frame and cover.
- (2) The Contractor will adjust to grade any service box, gate box, or meter box, as shown on plans, or where directed by the Project Inspector. Any service box, gate box, meter box, and/or covers damaged due to the Contractor’s operations will be replaced by the Contractor at his own expense.

#### X1. Construction Method for Frame and Cover Construction

- (1) Catch basins and drain manholes shall be constructed with cast-iron frames and covers or grates. Frames must be set in a full bed of cement mortar. Bricks shall be used between the frame and top course for grade adjustment. They shall be laid in a radial fashion with full bearing on the ring row. A maximum of four (4) and a minimum of two (2) brick courses will be allowed. Frames shall be at least two hundred sixty-five (265) pounds and shall be of North American manufacture. Covers or grates shall be no less than two hundred ten (210) pounds, in accordance with the Standard Specifications and shall be of North American manufacture. The word “drain” shall be cast into the solid cover in letters at least three (3) inches in height.
- (2) The frame and grate shall first be set to binder grade using a bituminous concrete collar as soon as possible after the roadway binder course has been placed. No sooner than one week prior to final paving, the frame and grate shall be reset to proposed finished grade using a concrete collar flush to the binder grade.
- (3) All mortar used shall be mixed only in such quantity as required for immediate use and shall be used before the initial set has taken place. Mortar shall not be retained for more than one and one-half hours and shall be constantly worked over with a shovel until used. Anti-freeze mixtures will not be allowed. No

masonry shall be laid when the outside temperature is below 40°F unless special provisions are made and accepted by the Project Inspector.

- (4) All mortar used shall be mixed only in such quantity as required for immediate use and shall be used before the initial set has taken place. Mortar shall not be retained for more than one and one-half hours and shall be constantly worked over with a shovel until used. Anti-freeze mixtures will not be allowed. No masonry shall be laid when the outside temperature is below 40°F unless special provisions are made and accepted by the Project Inspector.
- (5) Each frame and cover shall be Le-Baron Foundry Model No. LK1 10, or equal and shall have a clear opening of 24-inches and the word, “SEWER” or “DRAIN” cast in 3-inch letters on the surface. Double grate catch basins shall be cascade-type grates, LeBaron Foundry Model LK 120-A, or equal.
- (6) Bricks for building up and leveling manhole and catch basin frames shall conform to ASTM C32, Grade MS.
- (7) Mortar used in the brickwork shall be composed of one part Type II Portland Cement conforming to ASTM C150 to two parts sand to which a small amount of Hydrated Lime conforming to ASTM C207, mortar proportions will be mix so as to produce type M (2500 psi mortar).
- (8) Sand used shall be washed, cleaned, screened, sharp and well graded with no grain larger than will pass a No. 4 sieve. It shall be free of all foreign matter as to render it unsatisfactory.

#### Y1. Concrete Materials for Adjusting Sewer or Drain Castings Collars

- (1) Cement shall be American made Portland Cement conforming to ASTM Standard Specification for Portland Cement, Designation C 150. Where concrete is used for sewerage works, Type II cement shall be used.
- (2) Aggregates for concrete shall conform to ASTM Standard Specifications for Concrete Aggregates, Designation C33 and the additional requirements specified herein.
- (3) Fine aggregate shall be clean screened sand with not less than 15 percent nor more than 30 percent, by weight, passing the No. 50 sieve and shall not contain more than 2 percent silt with an F.M. of 2.5 to 3.0.
- (4) Coarse aggregate shall be washed screened gravel or crushed stone having not more than 5 percent, by weight of deleterious and soft substances, well graded for nominal size 1 inch to No. 4 aggregate and shall not contain more than 1 percent of silt.

- (5) Concrete shall have a minimum 28-day compressive strength of 4000 psi shall be used unless otherwise specified or indicated on the drawings.
- (6) Materials for concrete shall be proportioned to produce a workable mixture resulting in a dense watertight concrete. Slumps shall generally not exceed 4 inches, and air contents of 4-7 percent. Mixtures must be from a MHD approved production facility and an approved MHD mix design.

#### Z1. Construction Methods for Concrete Placement

- (1) Small Quantity batcher mixed concrete shall be mixed in a suitable batch mixer except for small quantities that, by permission, may be hand mixed. The minimum mixing time shall be (1 ½) one and a half minutes for mixers of 1 cubic yard or less and the time shall be increased by 30 seconds for each additional half cubic yard. The entire batch shall be discharged before the mixer is recharged.
- (2) If the concrete is mixed by hand, it shall be done on a flat nonporous surface, the cement and aggregate being mixed dry until an even and uniform color has been attained. The proper quantity of clean water shall then be added and the entire mass turned until it has become intimately mixed.
- (3) When using larger quantity ready-mixed, at the time of delivery of each load of concrete, the Project Inspector shall be given a slip stating the actual quantity of each ingredient of that load and the design strength. The work shall be planned such that the concrete is discharged at the site within 1 ½ hours after water was first added to the mix and shall be mixed at least 5 minutes after all water has been added. Each batch shall be air entrained with a minimum air content of 5 to 7 percent when used where there are exposed surfaces to prevent spalling. (Concrete may be subject to testing as outlined in this document)
- (4) No concrete shall be placed on frozen subgrade or in water. Concrete shall be deposited in layers, one quickly following another, until placement is complete, while avoiding cold joints. While being installed, the concrete shall be thoroughly compacted by rodding, spading or by mechanical vibration. The concrete will be placed within the target slump +/- 1" and air +/- 1.5 %. Loads not within these limits will be rejected at the owner's expense. It will be the owner's responsibility to determine how much water will be added on site to achieve the required workability without exceeding the slump and air tolerances.
- (5) Water shall not be permitted to rise on concrete within 24 hours after it is placed, nor shall running water be allowed to flow over it within 24 hours. All concrete

shall be protected for at least 7 days such that the temperature at the surface does not fall below 40 Degrees F.

- (6) Manhole tables and all surfaces shaped without forms and over which liquids will flow, shall be smoothly finished by means of a steel trowel without additional water or cement.

#### A2. Reinforced Concrete Pipe

- (1) Reinforced concrete pipe shall be manufactured in a plant adapted to meet the design requirements of the pipe.
- (2) Each unit of pipe shall have an interior surface, which is free from roughness, projections, indentations, offsets, or irregularities of any kind. The pipe units shall be Class III unless otherwise indicated on the drawings and shall conform to ASTM Standard Specifications for Reinforced Concrete Culvert, Storm Drain, Designation C76-12 or the latest revision with the following exceptions and additions
- (3) Pipe units shall have a minimum laying length of 8 feet, except as otherwise indicated or permitted by the Project Inspector.
- (4) The date of manufacture, class of pipe unit, size of pipe unit, and trademark of the manufacturer shall be clearly and permanently marked on the outside at one end of each pipe unit.

#### B2. Joints on RCP

- (1) Pipe joints for all reinforced concrete pipes shall be of the rubber gasket type in which the gaskets are in compression and which will permit both longitudinal and angular movement. Each unit of pipe shall be provided with proper ends made of concrete formed true to size and formed on machined rings to ensure accurate joint surfaces. Joints and gaskets for pipe 36 inches or less in diameter shall be the O-ring gasket type and shall conform to the requirements of ASTM Standard Specifications for Reinforced Concrete Low-Head Pressure Pipe, Designation C 361-11 and the additional requirements specified. Joints and gaskets for pipe larger than 36 inches in diameter shall be O-ring or ribbed gasket type and shall conform to the requirements of ASTM Standard Specifications for joints for Circular Concrete and Culvert Pipe, Using Rubber Gaskets, Designation C 443-11 and the additional requirements specified. The DPW will consider other types of gaskets that conform to ASTM C 443-11.
- (2) Joints shall be of such design that when tested under an average internal hydrostatic pressure of 10 p.s.i. (ASTM C 76 & C 361) no visible leakage will result. The diameters of the joint surfaces which compress the gasket shall not

vary from the true diameters by more than 1/16 inch or the amount permitted by the appropriate above-mentioned ASTM Standard Specifications, whichever is less.

- (3) Gaskets shall be of a composition and texture which is resistant to common ingredients of sewage, industrial wastes, and groundwater, and which will endure permanently under the conditions likely to be imposed by this service. Gaskets shall be the product of a manufacturer regularly engaged in the manufacture of rubber gaskets for pipe joints.
- (4) The interior joints of all reinforced concrete storm drains in sizes 24 inches and over shall be filled with an approved non-shrinking grout and smooth finished after partial backfilling. The grout shall be a specially prepared, pre-mixed, ready for use formulation, which eliminates settlement shrinkage, and driving shrinkage and, when mixed with water forms a grout of plastic consistency to develop a good bond to the concrete. Joints to be filled shall be dry, clean and completely free of all foreign matter. After the pipe joints, have been made and the interior surface properly prepared, the joints and adjacent areas and any damaged portion of the previously applied protective coating shall be brought to a continuous surface of coating by means of at least two brush coats of epoxy compound. The thickness of brush coats shall be equivalent to those previously applied by spray. In 24-inch pipe, the Contractor may, if he so elects, incorporate the epoxy compound with the non-shrinking grout prior to filling the pipe joint with the grout rather than epoxy coating the joint after the joint has been grouted. Exterior joints are not to be filled or treated unless directed by the Project Inspector.

## C2. Pipe Manufacture Inspection and Acceptance

- (1) When deemed applicable by the Project Inspector, acceptance will be based on material tests on cement, reinforcement and aggregates, absorption tests, crushing tests on pipe and its material.
- (2) Tests and certified copies in triplicate of test results will be required for the materials as described herein. If less than 100 units of a given size and class of pipe are required, the Contractor may submit certified copies of tests made on identical pipe units made by the same manufacturer within the past year. The Project Inspector reserves the right to have any or all pipe units inspected or tested, or both, by an independent testing 'laboratory at either the manufacturer's plant or elsewhere. Such additional inspection and/or tests shall be the test results of record. All tests shall be made in accordance with the above-mentioned applicable ASTM specifications, and acceptance or rejection shall be based on the test results.

- (3) Where required for more than 100 units, concrete cylinder compression tests shall be made on standard concrete cylinders for the first or test pipe unit and then for every 100 cubic yard of concrete used in pipe manufacture, or for each additional 200 units of pipe, whichever represents the lesser amount of concrete. Four cylinders shall be made for each test, and they shall be broken at 7, 14 and 28 days with one cylinder as a spare to be used in the event of an unsatisfactory break. The reports shall be submitted within three days after each of the compression tests.

#### D2. Polyvinyl Chloride Pipe for Drain

- (1) Polyvinyl chloride pipe and composite polyvinyl chloride pipe and fittings shall conform to ASTM Standard Specification for Type PSM polyvinyl chloride (PVC) pipe and fittings, Designation D3034-08. The pipe shall have a pipe diameter to wall thickness ratio (SDR) of a maximum of 35.
- (2) Branches shall conform to the specifications referenced above for pipe material. Saddle branches are prohibited.
- (3) Pipe and fittings shall have bell and spigot (push-on) joints using electrometric ring gaskets. Gaskets shall be made of a composition and texture which is resistant to common ingredients and industrial wastes, including oils and ground water, and which will endure permanently under the conditions of its proposed use.
- (4) Joints shall conform to ASTM Standard Specifications of Joints for Drain Plastic Pipe using Flexible Electrometric Seals.
- (5) All pipe and fittings delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to the above-mentioned ASTM specifications.
- (6) The Contractor shall furnish all labor necessary to assist the Project Inspector inspecting the pipe and fittings. The pipe and fittings shall be inspected upon delivery and any which does not conform to the above specifications shall be rejected and immediately removed from the site by the Contractor.

#### E2. Construction Methods for Polyvinyl Chloride Pipe

- (1) The Contractor's attention is called to the fact that the pipe and fittings are slightly brittle. Care shall be taken in handling and laying to avoid damaging the pipe and fittings. Extra care will be necessary during cold weather construction.

- (2) Any fitting showing a crack, and any fitting or pipe which has received a 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.
- (3) All pipe ends must be square after cutting.
- (4) While stored, all pipes shall be adequately supported from below, in at least 3-foot intervals, to prevent deformation prior to installation. Pipe shall be stacked to a height not exceeding six feet. Pipe shall be stored in a manner, which will keep the pipe at ambient outdoor temperature. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe that allows temperature buildup, when exposed to direct sunlight will not be permitted.
- (5) Pipe and fittings shall be installed in accordance with the latest instructions of the manufacturer, ASTM 2321, as specified herein and as directed.
- (6) When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and surrounding backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, material shall be placed to fill any voids created and the material shall be re-compacted to provide uniform side support for the pipe.
- (7) All concrete for encasements, cradles and saddles shall conform to the detail drawings and as directed.
- (8) All pipes where concrete is required shall be securely braced both vertically and horizontally to restrain it against flotation while pouring concrete. Holes left in the concrete by cross braces during the pouring shall be completely filled with concrete in a manner approved by the Project Inspector.

F2. Construction Methods for Handling and Placing Reinforced Concrete Pipe

- (1) Each pipe unit shall be handled into its position in the trench only in such manner, and, by such means as acceptable to the Project Inspector. Care shall be taken to avoid damaging the pipe and fittings.
- (2) Drainpipe shall be laid at the lines and grades as shown on the plans and specified herein. Whenever encountered within the trench, existing sewer/drain lines shall be removed unless otherwise noted. All existing sewer/drain lines, which are to be abandoned in place, shall be plugged at all open ends.

- (3) Each pipe and/or fitting to be installed shall be subjected to a careful inspection just prior to installation. Each straight length of pipe shall be generally straight. Centerline deviation of more than 1/16 inch per foot of length shall be deemed unacceptable and such pipe shall immediately be removed from the site.
- (4) Pipe shall be supported by compacted-screened gravel. No pipe or fitting units shall be supported on saddles, blocking or stones. Suitable bell holes shall be provided so that after installation only the barrel of the pipe receives bearing pressure from the supporting material.
- (5) All pipe and fittings shall be cleaned of all debris, dirt or other foreign substances prior to being installed and shall be kept clean until accepted.
- (6) Before any joint is made, the previously installed unit shall be checked to insure that a closed joint with the adjoining unit has been maintained and that the inverts are matched and conform to the required grade. Pipe shall not be driven down to the required grade by striking with an unyielding object.
- (7) Immediately before joining the pipe, all joint surfaces shall be cleaned and the bell or groove shall be lubricated in accordance with the manufacturer's recommendations. Each pipe unit shall be pushed into place without damage to the pipe or gasket.
- (8) All open ends of pipe and branches shall be closed with stopper's secured in place in an acceptable manner.
- (9) After each pipe has been properly bedded, enough screened gravel shall be placed between the pipe and the sides of the trench, and, thoroughly compacted, to hold the pipe in 'correct alignment. Bell holes shall be filled with screened gravel and compacted, and then screened gravel shall be placed and compacted to complete the pipe bedding' as indicated on the drawings.
- (10) At all times pipe installation is not in progress, the open ends of 'the pipe shall be closed with temporary watertight plugs, or by other acceptable means.
- (11) If water is in the trench when work is to be resumed, the plug shall not be removed until suitable provisions have been made to prevent water, earth, or other substances from entering the pipe.
- (12) Pipelines shall not be used as conductors for trench drainage during construction.
- (13) All manhole connections shall be as shown on the drawings except that concrete and mortared connections shall be equipped within integral O-ring or other sealant such that a positive watertight seal is established.



## G2. Ductile Iron Pipe

- (1) Ductile iron pipe shall be designed in accordance with general specifications (Ductile iron pipe shall be at least thickness Class 52). It must be installed in accordance with the Local Water Company requirements, and the Planning Board Rules and Regulations for backfilling pipe.
- (2) Push-on joints shall be made up by first inserting the, gasket into the groove of the bell and applying a thin film of non-toxic gasket lubricant uniformly over the inner surface. The chamfered end of the plain pipe shall be inserted into the gasket and forced past it until it seats against the bottom of the socket.

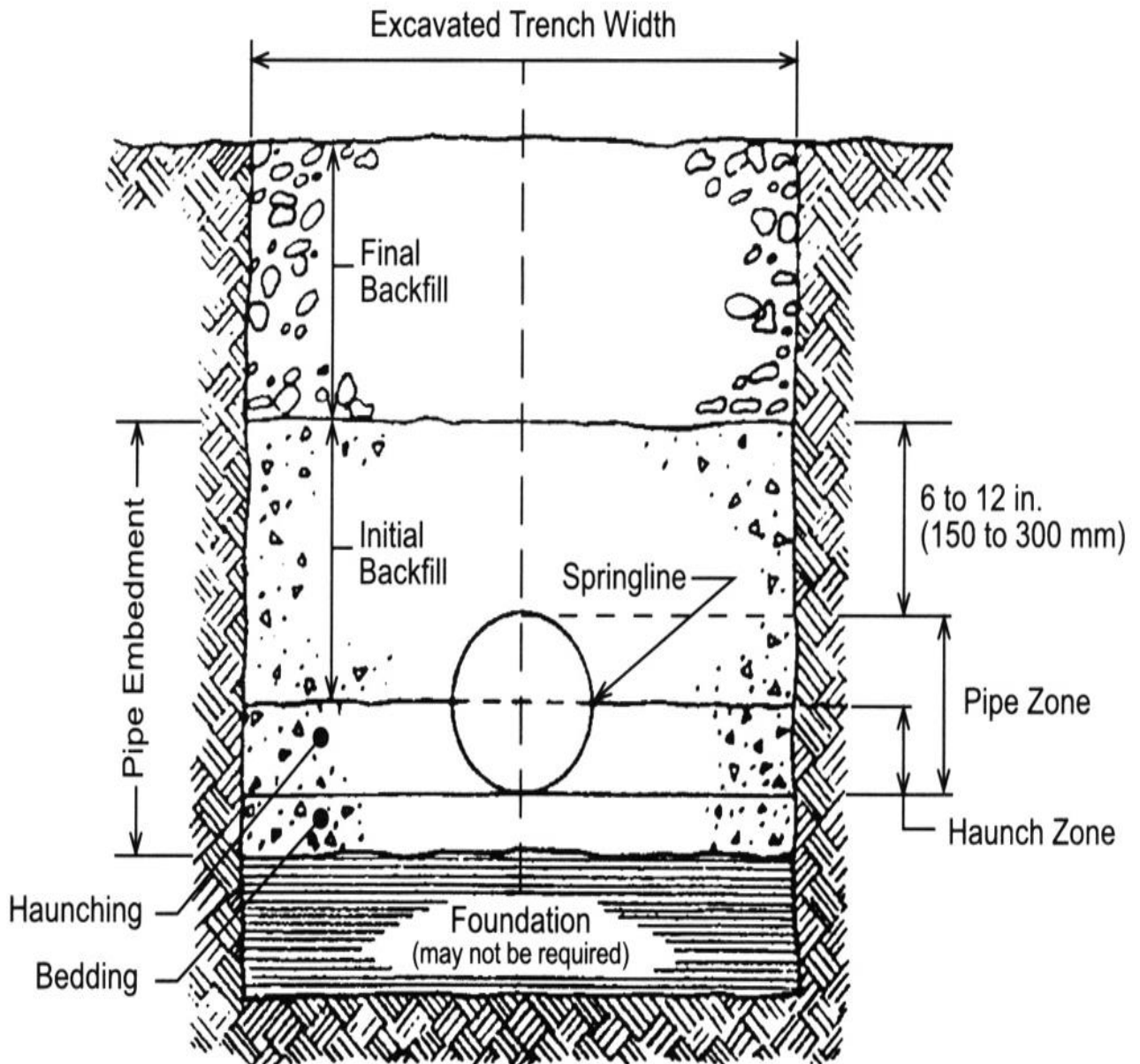
## H2. 4" Corrugated High Density Polyethylene Pipe (Slotted)

- (1) This consists of furnishing and placing 4" Corrugated High Density Polyethylene Pipe for a drainage application.

## I2. Corrugated HDPE Materials

- (1) High Density Polyethylene (HDPE) Corrugated and Smooth-Lined Pipe and / or materials for constructing of culverts, side road pipes, storm sewers, stubs, and all related connections and fittings, all of shall conform to ASTM F 2306, latest edition. The pipes shall be of the sizes, types, and dimensions shown on the plans, and contained in this specification. In addition, it shall include a - 68 -ll connections and joints to new or existing pipes, storm sewer manholes, inlets, headwalls, and other appurtenances as may be required to complete the work.
- (2) High Density Polyethylene (HDPE) Corrugated and Smooth Lined Pipe & Fittings shall be manufactured in accordance with requirements of ASTM F 2306, latest edition. Type S: This pipe shall have a full circular cross section, with an outer corrugated pipe wall and a smooth inner wall.
- (3) High Density Polyethylene (HDPE) Corrugated and Smooth Lined Pipe shall be manufactured from virgin PE compounds which conform to the requirements of cell class 435400C as defined and described in ASTM D 3350.
- (4) Minimum Pipe Stiffness (PS) at five percent deflection shall be as described in ASTM F 2306, Section 6.3 when tested in accordance with ASTM D 2412.
- (5) All HDPE Corrugated and Smooth Lined Pipe shall be certified through the AASHTO National Transportation Product Evaluation Program (NTPEP) 3<sup>rd</sup> Party Certification program.

- (6) Installation shall be in accordance with ASTM D 2321, "Standard Practice for Underground Installation of Pipe and Other Gravity Flow Applications".
- (7) The pipe shall be unloaded and handled with reasonable care. Pipe shall be placed in the bed starting at the downstream end. Trenches shall be excavated in such a manner as to insure that the trench sidewalls will be stable under all working conditions. Trenches with pipe in place shall be backfilled as soon as practicable, but no later than the end of each working day. Trench details, including foundation, bedding, haunching, initial backfill, final backfill, pipe zone, and trench width are shown below.



- (8) Trench width shall be in accordance with ASTM D2321 and shall be sufficient to ensure working room to properly and safely place and compact haunching and other backfill materials. Minimum trench width shall not be less than 1.25 times the pipe outside diameter plus 12 inches, (1.25 x O.D. + 12"). On multiple pipe barrel runs the clear distance between pipes shall be 0.50 times the pipe diameter, ( $\frac{1}{2}$  x Diameter).
- (9) Bedding material shall meet the requirements of ASTM D2321 material. A minimum of 6" of bedding shall be provided prior to placement and shall be loosely compacted. Bedding material size shall be 1½" maximum granular material. Initial backfill material shall meet the same requirements as the bedding material and shall extend to 8 inches above the top of the pipe. Final backfill material shall meet the requirements in these specifications. All initial and final backfill material shall be placed in 8 inch lifts and compacted to a minimum 95% Proctor Density Method "D" of the ASTM D-1557-70,. The contractor shall provide density reports and a Proctor on materials as requested by the project inspector.
- (10) The minimum cover is 18 inches below the bottom of stabilized subgrade for HS-25 Live Loads (from 18" to 42" Pipe Diameters) and 24 inches below the bottom of stabilized subgrade for larger diameter structures (from 48" to 60" Pipe Diameters). It is recommended that all pipes shall be placed a minimum of 24 inches below the bottom of stabilized Subgrade in order to reduce the potential for conflicts with other utility systems. Variances from the minimum cover requirement must be submitted in writing to the Board and approved by the Projects Engineer prior to commencing construction. Extreme care should be taken when heavy construction equipment loads cross the pipe trench during construction. If the passage of construction equipment over an installed pipeline is necessary during construction, compacted fill in the form of a ramp shall be constructed to a minimum elevation of three (3.0') feet over the top of the pipe. Any damaged pipe shall be replaced.
- (11) At the Boards discretion, all pipe exceeding 7.5% deflection (as per AASHTO Section 30) may require replacement or re-compaction at the contractor's expense when measured or inspected not less than 30 days following completion of installation. Deflection is defined per ASTM D 2321. The Contractor shall provide Video Camera (CCTV) inspection on 100% of the pipelines installed. The test shall be conducted at least 30 days after the installation of the pipeline. Mandreling of the pipe may be accepted as a suitable alternative for pipeline inspection and deflection testing, in lieu of CCTV inspection.
- (12) Joints shall be installed such that the connection of pipe sections will form a continuous line free from irregularities in the flow line. All installations shall

require watertight joints that meet a 74kPa (10.8 psi) laboratory test per ASTM D3212 and utilize a bell and spigot design with a gasket meeting ASTM F477.

- (13) In installations where high groundwater is encountered, a soil filter fabric shall be installed, as per manufacturer's recommendations, around the initial backfill material unless sufficient fill cover can be provided over the pipe. In flowable fill or high groundwater installations, pipe shall be restrained as per manufacturer's recommendations to prevent floating of pipe.

## J2. Fill

- (1) All fill material which may be required within the exterior lines of the roadway foundation shall be of clean gravel material or other suitable material as approved by the Project Inspector and compacted to 95% of the maximum dry density as determined by modified Proctor Test, in accordance with ASTM D-1557-70, Method "D".
- (2) All municipal services including but not limited to storm drains, sub-drains and drainage structures and sewers if required within the way lines shall be installed after sufficient lifts of fill have been placed and compacted to provide support for trench excavations to install utilities. Utilities are to be installed in trench excavations at least one pipe diameter over the top of the pipe. This shall include the installation of each service pipe, sleeve or conduit to the front lot line of each lot in the subdivision.
- (3) Upon the completion of the fill and the backfill of all service trenches, the work will be inspected by the Board's Project Inspector. Subsequent work shall not be commenced until the Project Inspector has approved the fill as acceptable for the application of the roadway foundation material.

## K2. Filter Fabric

- (1) Filter fabric shall be installed where indicated on the trench details and shall be polyester, polyvinyl chloride or polyamide fibers, either woven or non-woven. Filter fabric shall meet the following minimum requirements:
  - a) Weight - 4 ounces per square, yard
  - b) Thickness - 15 mils.
  - c) Puncture strength - 70 pounds
  - d) Bursting strength - 210 psi. Elongation - 50 percent
  - e) Permeability - 300 gallons per minute per square foot at four inches of head
  - f) Equivalent opening size shall be no greater than No. 70 U.S standard sieve
- (2) The drainage filter fabric shall be placed in the manner and at the locations

shown in the Contract Drawings. Sharp objects shall be removed from the area before placing fabric to avoid fabric punctures. The fabric shall not be laid in a stretched condition, but laid loosely. The panels shall be overlapped by a length of three feet. Filter fabric damaged or displaced before or during placement of overlying layers shall be replaced or repaired at no additional expense to the Planning Board.

L2. Gravel Material for Backfill or Road Base

- (1) Gravel material shall be placed, spread and compacted as set forth in this document.
- (2) The entire roadway width then shall be rolled with a roller having an effective force of twelve (12) tons, forming the subgrade with a one-quarter-inch-per-foot crown, or as required on the cross-section plan.
- (3) The gravel base of the roadway and sidewalks shall consist of unfrozen, hard, durable stone and coarse sand, free from loam and clay, uniformly graded to the specified tolerances listed in the Massachusetts Highway Department Standard Specifications for each respective gravel type.
- (4) Gradation tests (sieve analysis) shall be performed by an independent testing laboratory on the material to be utilized as gravel backfill and roadway foundation and shall be submitted to the Department of Public Works and Planning Board for review. This analysis, to be done at the expense of the Developer in advance of applying or grading the material, shall certify that it falls within the allowable limits for gravel borrow in accordance with the Standard Specifications. The Project Inspector or DPW Director may, at any time during the roadway construction, require additional in-situ tests including a sieve analyses after each layer of roadway foundation is placed. Test may also be required of backfill material at the discretion of the DPW or Project Inspector.
- (5) The Developer must demonstrate to the Project Inspector that he has sufficient suitable material on site, or he shall have to haul in gravel conforming to the Standard Specifications. His intent shall be made clear to the Director.
- (6) Before the roadway foundation gravel is spread, the roadbed shall be sloped to a true surface, conforming to the proposed cross section of the road, and no gravel is to be spread until this sub-grade is approved by the Department of Public Works Director.
- (7) Gravel for base shall be spread in eight (3) layers of equal thickness, each thoroughly rolled true to lines and grades with a roller having an effective force of at least twelve (12) tons so as to yield a total depth of twenty four (24) inches after thorough compaction. Any depression or soft spots that appear during or after rolling shall be filled with crushed processed gravel and be re-rolled until the surface is true and even. Gradation and compaction tests shall performed and submitted to the Department of Public Works for review. Testing results

should be satisfactory to the Department of Public Works prior to placement of base course of pavement.

- (8) All sidewalk areas shall be provided with a gravel base foundation consistent with that required for roadways, except that the compacted depth shall be twelve (12) inches. The slope of the base shall be to the maximum allowable by ADA requirements (see sidewalks and crosswalks requirements contained in this document) sloping from the back of the sidewalk towards the curb, unless otherwise requested by the Project Inspector. Gradation and compaction tests shall be performed and submitted to the Department of Public Works for review at the expense of the developer. Each layer shall be compacted to not less than ninety-five percent (95%) of the maximum dry density of the material, as provided in the Standard Specifications.
- (9) Before pavement is placed, the rolled gravel base and sidewalk base shall be surveyed by a registered professional land surveyor. As-built plans with an accuracy of one-tenth foot vertical at every 50-foot station along the centerline, sidelines and sidewalks shall be submitted to the Department of Public Works for review. However, depending on the topography of the work area the Planning Board and its Project Inspector may request an as built frequency at every 25-foot station. They shall also include water, sewer, and storm drainage systems, invert, services and service stubs. In addition, the topography of drainage facilities shall be provided at one-foot accuracy. All shall be approved by the Department of Public Works Director prior to paving. Weight slips may be requested by the Project Inspector to verify the source of the Gravel. Such slips shall bear the name of the supplier, date purchased and the weight of the gravel.

## M2. Processed Gravel

- (1) Processed Gravel shall be used as refill material in all trench excavations, rock excavations, miscellaneous trench excavations and any other location where specified herein, shown on the plans or ordered by the Project Inspector. It shall conform to Section M1.03.1 of the Massachusetts Highway Department Standard Specifications for Highways and Bridges and be free of pavement, trash, loam, ice, snow, tree stumps, roots and other deleterious or organic matter.
- (2) Processed Gravel shall consist of inert material that is hard (L.A of not more than 50), durable stone and coarse sand free from loam and clay surface coatings, be well graded and contain no stone having any dimension greater

than three (3) inches. Gravel shall conform to the following requirements:

- |                           |         |
|---------------------------|---------|
| 1. Passing 3 inch sieve   | 100%    |
| 2. Passing 1 ½ inch sieve | 70-100% |
| 3. Passing ¾ inch sieve   | 50-85%  |
| 4. Passing No. 4 sieve    | 30-60%  |
| 5. Passing No. 200 sieve  | 0-10%   |

- (3) New bank run is acceptable but must meet the above requirements. All processed gravel shall come from an approved stockpile. The equipment producing the processed gravel shall be of adequate size and with sufficient adjustments to produce the desired materials. The processed material shall be stockpiled in such a manner to minimize segregation of particle sizes.

N2. Screened Gravel Construction Methods

- (1) Screened Gravel shall be placed, spread and compacted as set forth in Excavation and Backfill, except that Screened Gravel shall be spread in uniform layers of not more than eight (8) inches.

O2. Screened Gravel

- (1) Screened Gravel shall be used as backfill material in all locations and depths as called for in the appropriate pipe specification, as shown on the plans or as ordered by the Project Inspector.
- (2) Screened Gravel shall be uniformly graded with the maximum size of a particle between 3/8 inch and ¾ inch or such other size as may be approved by the Project Inspector. Screened Gravel shall consist of clean, hard and durable particles free from an excess of soft, thin and disintegrated pieces. Crushed rock of suitable size and grading maybe used in place of Screened Gravel at the option of the Project Inspector.

P2. Special Borrow

- (1) Special borrow for subgrade stabilization or in other locations when, in the opinion of the Project Inspector, special borrow is necessary for completion of the work, shall conform to Section M1.02.0 of the Massachusetts Highway Department Standard Specifications for Highways and Bridges and be free of pavement, trash, loam, ice, snow, tree stumps, roots and other deleterious or organic matter.

Q2. Gravel Borrow

- (1) Gravel Borrow for roadway sub-base pavement installation and repair shall conform to Section M1.0.3.0, Type B of the Massachusetts Highway Department Standard Specifications for Highways and Bridges and be free of

pavement, trash, loam, ice, snow, tree stumps, roots and other deleterious or organic matter.

- (2) Gravel Borrow for reinforced concrete pipe bedding shall conform to Section MI .03.0, Type C of the Massachusetts Highway Department Standard Specifications for Highways and Bridges and be free of pavement, trash, loam, ice, snow, tree stumps, roots and other deleterious or organic matter.

R2. Sand Borrow

- (1) Sand Borrow shall conform to Section M.1.04.0 Type A of the 1998 Massachusetts Highway Department Standard Specifications for Highways and Bridges.
- (2) Sand Borrow shall be used for backfilling around water mains or other utilities as shown on the plans and as directed.

S2. Crushed Stone

- (1) Crushed stone shall conform to Section M2.01.5 of the Massachusetts Highway Department Standard Specifications for Highways and Bridges. Stone shall be washed and free from water, ice and snow, stone, dust, sand, clay, loam or other deleterious or organic matter.
- (2) Crushed stone shall be furnished, installed and compacted in areas where the Project Inspector has determined its use necessary for completion of the work.

T2. Concrete Sand General

- (1) The Contractor shall furnish Concrete Sand to be used as backfill material for all locations shown on the plans, specified herein or ordered by the Project Inspector.
- (2) Concrete Sand shall conform to ASTM Designation C33, Standard Specification for Concrete Aggregates. The gradation shall conform to ASTM C33 for Fine Aggregates, which is as follows:

<b>Sieve Size Percent Finer by Weight</b>	
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-30
No. 50	10-30
No. 200	2-10

Concrete Sand shall be free of deleterious, including organic impurities.



## U2. Concrete Sand Construction Methods

- (1) Concrete Sand shall be placed in layers not exceeding twelve (12) inches and adequately compacted.

## V2. Backfilling and Compacting

- (1) Wherever a percentage of compaction for is indicated or specified, it shall be the percentage of the Maximum Density at Optimum moisture as determined by ASTM 1557-78 Method D of the Standard Methods of Test and Moisture –Density Relations of Soils using a 10 – lb. rammer and an 18 inch drop.
- (2) All excavations will be kept free of all water entering by dewatering, the developer shall submit for approval by the Board the method for dewatering.
- (3) As soon as practical the after installing the utility the contractor shall backfill the trench with the specified material to a density of 95% of the proctor value for the specific material used.
- (4) If the material is found to be too wet the contractor shall bring in dry material, however compaction cannot be performed on wet material behaving plastic regardless of compaction test value.
- (5) Backfill shall not be placed on frozen material.
- (6) The trench one foot above level over the top of the pipe shall be backfilled and compacted by mechanical tamping or rolling (maximum weight of roller 1 ton within 3 feet of pipe) in accordance with the nature of the material and as approved by the Project Inspector. Compaction areas that are unattainable by conventional compaction equipment do to the restrictions of a confined space, excavate able Flow-able Fill (CLSM) will be used as back fill in its place.
- (7) Backfilling of the entire trench before the pipeline has successfully passed any specified tests required shall be at the Contractor’s option and risk. The Contractor shall be responsible for removing and later replacing such backfill, at his own expense, should be ordered to do so in order to locate and repair or replace leakage or defective joints or pipe.
- (8) The material shall be deposited in layers of not more than 8 inches in depth before compaction. Each layer shall be tampered or rolled as required to obtain a thoroughly compacted mass. Care shall be taken that the material shall first be wet by sprinkling as directed or approved to achieve approximate optimum moisture. However, no compaction shall be done when the material is too wet, where to wet is described as the material behaving spongy deflecting and rebounding under the weight of the

compaction equipment, regardless of compaction test results. If this condition develops, compaction will cease and the wet material will be allowed to dry otherwise removed so that dry material will be installed in its place prior to re-restarting compaction.

- (9) Common fill shown on the drawings shall be selected from excavated materials. Material for backfill in trench shall be as shown on drawings or as directed.
- (10) Puddling or Water Jetting of trench material will not be allowed. Hand tamping or compaction by mechanical means must be used. Any areas not attainable do to working area restraints, excavate able Flow-able fill (CLSM) will be used.
- (11) If the compaction requirements are not met, the Contractor shall excavate and re-compact the material at his expense.

## W2. Subgrade

- (1) When establishing the roadway subgrade, all existing material shall be removed to the subgrade plane as defined by the typical cross-section for the entire width of the finished roadway. If, however, the soil is soft and spongy or contains undesirable material such as clay, sand pockets, tree stumps, stones over six (6) inches in diameter or any other material detrimental to the subgrade, a deeper excavation below the subgrade shall be made as required by the Project Inspector.
- (2) All utilities, including drainage, water, sanitary sewer and gas (where applicable), shall be installed and brought to the property line in accordance with these regulations while sub base is exposed, prior to the installation of road base.
- (3) Excavation shall be carried out to the lines and grades as set forth above as shown on the plans as ordered by the Project Inspector. Furnishing, placing and compacting suitable backfill material for such over-excavation as directed by the Project Inspector shall be at the Contractors/Developers expense.

## X2. Utilities/Municipal Services

- (1) The applicant shall provide and install all necessary materials, appurtenances and equipment to complete the municipal services as may be required by the Definitive Plan in a manner acceptable to the Planning Board and the officials or agency having jurisdiction of each service as previously mentioned herein. All costs incurred by the applicant as a consequence of installing and maintaining such municipal services as the Board requires shall be paid by the applicant, including all costs which may be incurred for any reasons whatsoever until such time as the Town assumes the responsibility for such service. The

Board will not take any action to have the applicant reimbursed for any costs so incurred.

- (2) All underground utilities shall be installed prior to application of the gravel base.
- (3) All underground utilities shall be installed in a parallel fashion. The sewer line shall be in the center of the road and drainage and water on either side, with at least ten (10) feet separating the water and sewer lines or as deemed by the Planning Board.
- (4) All work in connection with the municipal services shall be left uncovered until such time as the Project Inspector the backfill to be placed. The applicant shall notify all utility companies, with municipal services installed or to be installed within the ways, as to the date and time he intends to place the gravel base course and the paving so that such utility company may properly record the location of pertinent features of the system so that they will not be covered or lost as a result of the paving operation.
- (5) All trench backfill material for the municipal services within the way limits shall conform to the base course requirements and shall be deposited to required subgrade in not more than 6 inch layers and compacted to 95% of the dry density as determined by modified Proctor Test, in accordance with ASTM D-1557-70, Method "D".

## Y2. Water Systems

- (1) All water systems work shall be performed in accordance with the applicable provisions of supplemented and amended to conform with the DPW and Water Company Specifications latest edition and all amendments thereto. In the event of any discrepancy between the aforementioned specifications and the Contract Documents, the Water Company specifications shall govern, unless ordered otherwise by the Water Company Division Superintendent.
- (2) The Contractors attention is directed to the following conditions, which apply to all projects, related water systems work.
- (3) Prior to beginning the water systems work, the Contractor shall notify the Water Company.
- (4) The size and location of all water mains, valves, hydrants, services and appurtenances are subject to final approval by the Water Company and the Planning Board.

- (5) At the completion of construction and prior to final acceptance, the Contractor shall submit to the Water Company and the Hingham Planning Board a set of as-built record drawings showing the location of all water mains, valves, hydrants, and services.

#### Z2. Maintaining Water Service During Construction

- (1) The Contractor is advised that there may exist active water system mains that are located within the limits of the project construction site. This water supply system must be maintained at all times during the project construction, and provisions for the maintenance of this service should be incorporated into the scope of any proposed water system work. Should water service be disrupted through the fault of the Contractor at any time during work on this project, the Contractor will be required to work around the clock as necessary to restore service at no cost. All water system work shall be subject to the approval of the Water Company and the HDPW in addition to the Project Inspector.

#### A3. Water Installation Methods

- (1) Excavation for pipes and underground structures shall be done in accordance with Sections in this document and the Massachusetts Highway Department Standard Specifications or as directed by the Project Inspector.
- (2) The bedding for ductile iron pipe shall be shaped to conform reasonably close to the lower 10 percent of the pipe. All pipes shall be laid true to the specified line and grade, with a firm bearing throughout each length.

#### B3. Construction of Water Supply

- (1) Connection to existing water mains shall be the developer's responsibility but shall be made only under the direction of a Department of Public Works Director and the Water Company. A road opening and water permit must be obtained from the respective entities prior to tapping any main.
- (2) Water mains shall be laid in a dry trench on a twelve-inch bed of sand or approved material. Construction pipe shall be manually tamped with sand the full length of the pipe up to one-half (1/2) the diameter of the pipe to eliminate any voids under the pipe.
- (3) Water mains shall be laid to provide a minimum cover of five (5) feet below the finished grade and a maximum of seven (7) feet.
- (4) The installation of water pipes or related equipment shall not be backfilled until inspected by the Department of Public Works and The Water Company. Backfilling and compaction techniques are the same as those for drainage (See Backfilling).

### C3. Installation of Valve Box Construction Methods

- (1) Valves, valve boxes and appurtenances shall be set in general as indicated by the Drawings. The exact location, however, will be determined in the field by the Project Inspector and the respective Utility.
- (2) Valve boxes shall be set plumb and aligned vertically centered on the operating nut. Valve boxes shall support adequately during backfilling to prevent lateral movement, care will be implemented not to allow soil to fall into the box. The bases will rest on cushions of well-compacted earth placed around the valve or valve gearing and shall not rest upon any part of the valve or pipe.

### D3. Raise Water/Gas Castings

- (1) The buried casting will be located, excavating down to the casting and raising the casting to grade.
- (2) Covers or sleeves found to be cracked or defective will be replaced by the contractor at his own expense and supplied by the respective Utility.
- (3) Concrete for setting castings shall not be leaner than 1- part cement, 2- parts sand and 4-1/2 parts stone and shall have a minimum compressive strength of 3000 psi.
- (4) Finish grade of casting elevations shall be determined by utilizing an 8' straight edge extended over the existing road profile both longitudinally and horizontally, and then measuring down from the edge to establish grade.

### E3. Gas

- (1) Where natural gas service is available, a gas main may be installed in the grass plot, two (2) feet inside the traveled way or at the location approved by the DPW. The depth of the gas main is to be determined by the utility owning the service installed.

### F3. Fire Service

- (1) The type of hydrants and type and size of pipe serving the hydrants shall be as directed or approved by the Fire Chief or Fire Marshal and in accordance with Article 32 Section 9 of the General Bylaws.

### G3. Sewers

- (1) All materials and work in connection with the sewer system shall be as directed and approved by the Hingham Sewer Commissioners or authorized agents.

### H3. Electrical Service

- (1) Hingham Municipal Lighting Plant will provide the design and layout of the plant infrastructure including street light layout.
- (2) Hingham Municipal Lighting Plant requires AutoCAD drawings in advance to design the new electric service.
- (3) Hingham Municipal Lighting Plant requires a 10' Ft wide electric easement in and around HMLP owned electric infrastructure on private roadways and private property.
- (4) Hingham Municipal Lighting Plant will provide the easement documents to be registered at the Plymouth County Registry of Deeds.

### I3. Other Utilities

- (1) Wiring, Electrical, telephone and television community cable conduits shall be placed underground. Size, depth, materials and lateral spacing between conduits shall meet the requirements of the respective utility company and the DPW. The final locations of the utilities shall be approved by the Planning board and the DPW. Poles and any associated overhead structures, of a design approved by the Planning Board, shall be provided for any necessary municipal equipment and for use for street lighting.
- (2) Pull Boxes and Conduit (Hand Holes) will be installed when and where deemed necessary by the Planning Board for future work.

### J3. Roadway Foundation

- (1) A minimum of twenty-four (24) inches of clean gravel, as approved by the Project Inspector, shall be deposited in not more than eight (8) inch layers for the full width of the way so as to form a roadway foundation which shall be at all points parallel to the finished grade of the roadway surface. Each layer of gravel shall be compacted to 95% of the maximum dry density as determined by the modified Proctor Test, in accordance with ASTM D-1557-70, Method "D". The gravel shall conform to the following gradation:

<b><u>Sieve Size</u></b>	<b><u>% of Passing By Weight</u></b>
3"	100
2	95-100
1	60-100
3/4	55-95
1/2	48-85
3/8	44-80
#4	33-68

10	23-55
20	15-43
40	8-34
80	2-22
200	0-10
.02 mm	0-3

The Planning Board's Engineer will inspect the roadway foundation after the completion of each eight (8) inch layer.

**K3. Pavement Material**

- (1) All Hot Mix Asphalt must meet the MassDOT requirements for each mix, as submitted and approved.
- (2) The Developer/Contractor will submit to the DPW and the Planning Board for approval, the intended Job Mix formula from the proposed production facility. The Job Mix formula and the Plant must be currently (annually) approved by the MHD.

**L3. Pavement**

- (1) A two-course bituminous concrete surface shall be applied to residential streets. A three-course bituminous concrete shall be applied to commercial and industrial streets. The first course for residential streets shall be a binder course as defined by the Standard Specifications, which, after compaction is two and one half (2 ½) inches thick. The first course for commercial and industrial streets shall be a base course as defined by the Massachusetts Highway Department Standard Specifications, which, after compaction, is four (4) inches thick. The second course for commercial and industrial streets shall be a binder course as defined by MHD Standard Specifications, which, after compaction is two and one half (2 ½) inches thick. For all roadways that are to remain in binder course over a winter season Massachusetts Dense Binder is required. Gradation (sieve analysis) and asphalt content tests shall be performed on the material utilized as base course and/or binder course after it has been placed, and submitted to the Department of Public Works for review. All pavements shall be machine placed and rolled with a tandem roller having an effective force of not less than twelve (12) tons. An additional finish roller of less weight will be utilized during the installation of the Top Course (wearing surface) to remove all roller marks produced by the intermediate roller and the break down roller.
- (2) If requested by the Department of Public Works Director, compaction and plane of finished surface tests shall be performed on the Base, Binder and/or Top course during installation or once in place. All requested testing should be

performed by an independent testing laboratory at the expense of the Developer.

- (3) Prior to the finished course of pavement being applied, the binder course shall be approved by the Department of Public Works Director. Paving will not be allowed if it is raining or the roadway is wet, if frost is present, or when the air temperature is below forty degrees Fahrenheit (40° F.) and falling. The temperature of the bituminous concrete mixture shall be a minimum of 280° F and a maximum of 320 ° F prior to being placed and a minimum of 170° after intermediate rolling, all in accordance with standard Specifications.
- (4) All frames, grates, manhole covers and water gates shall be adjusted to the proper finished grade by setting in a concrete bed. Only with the approval of the DPW and the Project Inspector, any depressions or irregularities in the binder pavement are to be saw cut out to a depth of twenty-four (24) inches and replaced with compacted Processed Gravel and hot binder at least one (1) week before final paving.
- (5) The base binder course pavement must be swept clean by a Street Sweeper of all loose material prior to being paved. Any areas not accessible by the Street Sweeper will be swept by hand.
- (6) A tack coat of emulsified asphalt shall be applied with a pressure distributor at a rate of five-hundredths (0.05) of a gallon per square yard, immediately preceding the binder and top course paving. All longitudinal and Transverse joints will also be tack coated; inaccessible areas to pressure distributors shall be applied by hand held brushes. An environmentally safe synthetic mat specifically designed for the purpose may be substituted for the tack coat of emulsified asphalt.
- (7) The finished course of Massachusetts Highway Department bituminous concrete top course shall be applied to a one and one half (1-½) inch thickness after compaction on residential, commercial and industrial streets, with a roller having an effective force of not less than twelve (12) tons.
- (8) The developer shall make and maintain all subdivision roadways so that all occupied dwelling units within the subdivision are easily accessible to all municipal and emergency services to the satisfaction of the Hingham DPW, Hingham Fire Department and the Hingham Police Dept.
- (9) All roadways shall be prepared in such a manner that all manholes catch basins, valve gates or other structures in the roadway are installed with bituminous paving around the perimeter of each such structure such that a smooth transition is maintained between the top of each structure and the road surface. The elevation of these structures shall be established by running a eight (8') foot straight edge over the top of structure both longitudinally and transversely to the roadway to a finished height along the straight edge equal to that of the



compacted pavement thickness.

- (10) At the discretion of the Project Inspector, temporary installation of catch basin gates may be required at levels lower than the base coat elevation to make them functional prior to application on the finish coat.
- (11) If requested by the Department of Public Works Director, compaction and plane of finished surface tests shall be performed on the top course paving once in place. All requested testing should be performed by an independent testing laboratory at the expense of the Developer. The Director of Public Works may request remedial repairs or replacement of any portion of the pavement system if it fails to meet these and/or the Massachusetts Highway Department Standard Specifications Latest Edition and the requirements listed in this document.
- (12) Handwork will be kept at an absolute minimum. The paver will pinch the longitudinal joint as tightly as possible to avoid excessive luting, and segregation.
- (13) Care will be taken to avoid end of load segregation by not closing the wings on the hopper excessively and not running out each truck into the paver until empty.

### M3. Pavement Compaction & Testing

- (1) The Developer will provide at their expense an Independent Pavement Inspector that will be responsible for testing compaction, temperature, thickness and overall placement techniques.
- (2) If a plant inspection has not taken place during the installation, then the paving inspector will obtain a field sample at a minimum frequency of one sample per 750 tons. At the Developer's expense, the sample obtained will be set aside, and subject to testing at the Project Inspectors discretion.
- (3) The placement contractor will be responsible for proper installation equipment, which will include pavers that are in good operating order, compaction equipment of suitable size and type, and a sufficient number of trucks so as not to cause major delays between loads that will result in cold joints.
- (4) Roadway will be compacted to 92-97% of the Maximum Theoretical Density. Prior to paving the independent pavement installation inspector will be provided with the Maximum Theoretical Density by the production facility, the pavement surfaced will be tested using a density gauge (nuclear gauge). During the installation, the paving inspector will check to assure the proper thickness and temperature is being provided, he or she will notify the paving contractor and the developers representative of any deficiencies during the installation. He

or she will also notify the Town Project Inspector of any problematic issues.

- (5) At the Developer's expense the town may request that the pavement be cored and the Mix be analyzed for verification of compaction and mix composition which would include the following tests:

- Extraction
- Bulk Density of the Core
- Maximum Theoretical Density of the Core
- Density of the core
- Core Thickness

### N3. Driveway Installations (Pavement)

- (1) Driveway cuts shall not be allowed within sixty- (60) feet of the intersection of the centerline of intersecting streets. In no instances shall catch basins be located along a driveway curb opening. Driveway openings shall be shown on the definitive plan.
- (2) Driveways shall be paved from the curb to the property line. That portion of all driveways within the street right-of-way limits shall be constructed to the same specifications as the roadway: twelve-inch gravel base binder at two and one half (2 ½) inches after compaction and top coat at one and one half (1 ½) inches after compaction. Sidewalk grades shall be continuous across driveway openings. Transition in grade of no more than two inches will be allowed.
- (3) Driveways shall be at least ten (10) feet wide and shall have an opening of at least sixteen (16) feet in the curb at the gutter line.
- (4) At all driveways, the grade at the back of the sidewalk shall be at least six (6) inches higher than the grade at the gutter line.
- (5) The junction of sidewalks, driveways and roadways shall be constructed in such a manner as to prevent recessed areas where puddling may form.

Driveways serving the premises shall provide access through the required frontage of the serviced lot, except in the case of a common driveway.

### O3. Sidewalks

In residential areas, sidewalks shall be five (5) feet wide. In commercial and industrial areas, sidewalks shall be six (6) feet wide. A minimum of five-foot-wide traveled way shall be maintained at all times. In all areas, all materials shall be removed or filled to a depth of twenty-seven (27) inches below the finished design grade. Any soft spots of undesirable materials shall be removed and replaced with gravel. The sidewalk area shall be filled with gravel and rolled or compacted with a vibratory plate of a suitable size to a compacted depth of eight (8) inches at a time with a slope of 1.5% (maximum

of 2%) per the most recent MHD American Disability Act specifications pitched toward the street whenever possible. In areas of high groundwater as previously determined by soil borings or test pits, the compacted depth of gravel shall be increased to twelve (12) inches.

Sidewalks shall extend to the paved roadway at intersections to provide convenient walk-off for crossings and shall be ramped for the handicap accessibility to the gutter with no curb at threshold unless otherwise noted. Handicap ramps shall be shown on the plan and shall be constructed in accordance with the latest revision of the MHD American Disability Act specifications and architectural access codes.

- (1) Sidewalk materials shall be subject to testing as listed in Pavement Compaction & Testing, Backfill, and Compaction for Gravel.

### P3. Paved Sidewalks

- (1) Sidewalks shall have a finished grade in relation to the roadway as shown on the "Typical Road Cross Sections" and shall be constructed of Bituminous Concrete in accordance with the Department's Specifications subject to the approval of the Project Inspector.
- (2) The gravel foundation shall be a minimum of twenty-four (24) inches in compacted thickness and shall otherwise conform to the requirements of the roadway foundation. Sidewalk paving to consist of 2" binder course and 1 1/2" finish course, for a total of 3 1/2".

### Q3. Concrete Sidewalks

- (1) A five-inch-thick Class A [four thousand (4,000) pounds per square inch (psi)] concrete shall be applied to the prepared gravel base. A slump test shall be performed by an independent testing lab for every other truck. The slump shall vary between two and four inches. Department of Public Works personnel shall observe and accept or reject the concrete delivery based on test results.
- (2) Sidewalk grade shall be continuous across driveways openings. Transition in grade will not be allowed. Four-by-four-inch welded wire mesh or equal shall be installed at all driveway aprons. The welded wire mesh or equal shall be supported in place such that a minimum two-inch concrete coverage is maintained in all locations. The concrete shall be a plant mix, placed, floated, trowled and then finished with a broom. Curing and sealing compound shall be applied. Preformed expansion joints shall be installed fifteen (15) feet on center for five-foot-wide sidewalks and eighteen (18) feet on center for six-foot-wide sidewalks.
- (3) Finished sidewalks shall be sloped as specified in this document. Trowled joints shall be installed five (5) feet on center in residential areas and six (6) feet on

center in commercial and industrial areas. Plant mix design data and delivery slips shall be submitted to the Planning Board and Department of Public Works for review. All construction and concrete repair (if necessary) shall be in accordance with MassDOT Standards. Finished concrete sidewalks shall be inspected by the Project Inspector and will not be accepted until the surface is uniform and contains no defects.

### R3. Crosswalks

- (1) The Planning Board shall approve layout of crosswalks prior to the installation.
- (2) All twelve-inch (12") thermo-plastic lines or reflective paint shall be applied in one (1) application; no combination of lines (i.e. two 6" lines) will be accepted.
- (3) All crosswalks shall conform to latest revisions of the Massachusetts Highway Department "Standard Specifications for Highway and Bridges" for reflectorized lines (thermo plastic/paint) and material M7.01.20.
- (4) Any installation of Reflectorized Paint or Thermo Plastic will be contingent upon allowable weather conditions, which will facilitate proper bond.

### S3. Pedestrian Wheel Chair Ramps & Crosswalks

- (1) Pedestrian (wheelchair) ramps shown on plans will conform to Massachusetts Highway Department "Wheel Chair Ramp Standards" revised October 8, 1997 (or latest revision).
- (2) Wheelchair ramps shall be concrete.
- (3) Wheelchair ramps shall contain a detectable tactile "warning strip" installed in the concrete wheelchair ramp. Detectable warnings shall consist of a surface of truncated domes aligned in a square or radial grid pattern and shall comply with R304.
- (4) Manufacturer should be Massachusetts approved. Domes should be set flush with the finish grade of the concrete. Ramp should be constructed so as not to hold water. Utilizing an edger the concrete should be scored allowing water to drain the ramp.
- (5) Detectable tactiles shall be red in color, unless otherwise approved.
- (6) The contractor shall exercise extreme care to construct the ramps with proper sidewalk cross slopes, wheelchair ramp slope, and clearances.
- (7) The Project Inspector must approve any modification to the proposed ramp

designs.

### T3. Curbing

- (1) Except as otherwise required in this section, bituminous concrete curbing (Cape Cod berms), vertical granite, sloped granite, or granite curbing shall be provided along both sides of the roadway.
- (2) Where vertical granite curbing meets bituminous Cape Cod berms, suitable granite transitions shall be constructed.
- (3) Care will be taken when moving curb so as not to damage the curb, any chipped or broken curbing will not be used.
- (4) Concrete shall have a minimum strength of 3000 psi for setting curb.
- (5) Curbing or any other material shall not be left in the roadway(s) without the approval from the DPW.
- (6) Gutter mouth curb will be used at all drainage inlets, except for Private Local Streets.
- (7) 1/2" curb joints will be provided
- (8) Type M mortar will be used at all curb joints once the curb has been set in concrete.
- (9) Curb will be set so the concrete flows under the middle of each section of curbing by 3", so that curb does not shift after construction or during plowing.
- (10) The back of the curb will be backfilled with gravel and compacted as described in "Sidewalks" once the concrete used for setting the curb has been allowed to set for 24 hours.
- (11) Radius curb will be ordered and installed to the length of radius and size of radius specified in the drawings at the specific location, any substitutions that may be considered will be made only with the approval of the Project Inspector.

### U3. Vertical Curbing

- (1) Vertical Curbing shall be VB (Massachusetts Highway Department and Department of Public Works Specifications M9 & Section 500) vertical granite where high-frequency parking is anticipated, such as where multifamily units are to be near the street or at drop-off points in nonresidential development or such curbing is necessary to control surface run-off, or prevent serious erosion,

or for safety or other similar purposes.

- (2) Where vertical granite curbing is installed, all curb inlets for catch basins shall be granite mouth curbing.
- (3) Vertical granite curbing shall be upright four-foot-minimum lengths, finished side facing the traveled way, with a finished reveal of seven (7) inches plus or minus  $\frac{3}{4}$ ". It shall be installed in accordance with the specifications of the Massachusetts Highway Department Standard Specification.
- (4) Curb will be installed so that the face of the curb tilts very slightly ( $\frac{1}{8}$  of an inch from top to bottom) backward toward the sidewalk minimizing damage to tires and damage to curb edge from plows.

### V3. Sloped (Slant) Granite

- (1) Sloped granite curb, Type SB, is to be used on all grades of approximately seven percent (7%) or greater.
- (2) Slant granite curbing shall be of lengths determined by the Department of Public Works to be adequate to serve the situation (Massachusetts Department of Public Works Specification M9 & Section 500). It shall be set on compacted gravel at some angle not less than forty five degrees (45o) and not greater than sixty degrees (60o). In addition, it shall have a reveal of seven (7) inches plus or minus three quarters inches ( $\frac{3}{4}$ "") measured from the top of the granite level to the finished grade. It shall be supported in place by blocks or undisturbed earth. The granite shall be set in a concrete base approximately six (6) inches square, which shall abut against the binder course. The concrete shall be placed in front and under the granite during an initial pour up to  $\frac{1}{2}$ " below the binder grade. The concrete shall be placed in back and under the granite during a second pour, half way up the back of the curb. The top course of paving will cover the concrete and key the granite in place. Joints on the face and top of the granite curb shall be mortared. The angle, alignment and reveal shall be uniformly maintained.
- (3) The back of the curb will be backfilled with gravel and compacted as described in "Sidewalks" once the concrete used for setting the curb has been allowed to set for 24 hours.

### W3. Curb at Driveways

- (1) Two foot vertical granite radius corner pieces may be required at all driveway openings along vertical granite curbing.
- (2) Transition pieces may be required at all driveway openings along slant granite curbing and vertical curbing. The transition shall be a piece of granite curbing (minimum length seven feet) that starts with proper reveal and transitions

downward to be just higher than flush (finish grade elevation plus ½”) with finish grade at the driveway opening to avoid puddling at driveway opening. All other requirements listed in Curbing apply during the installation.

### X3. Street Lighting

- (1) It is the responsibility of the developer of any subdivision within the Town of Hingham to provide for the installation of LED street lights within that subdivision in accordance with Hingham Municipal Lighting Plant standard specifications with The Planning Board approval.
- (2) The developer may be required to install all roadway lighting in those designated locations along the roadway that would be considered the normal path of ingress and egress to that dwelling.
- (3) When required, street lighting shall be installed as follows: within a subdivision each intersection, intersecting way, cul-de-sac, curve with a radius of sixty degrees (60°) or greater over a linear distance of two hundred (200) feet or other road hazard shall be illuminated by a lighting fixture(s) which is to be installed on a structure(s) (pole, post, etc.) nearest the road hazard identified.
- (4) The quantity, type and location of lights within a proposed subdivision shall be subject to Planning Board approval and shown on the definitive plan. The lighting fixture and structure specification is as follows:
- (5) Fixture lumen rating: four thousand (4,000).
- (6) Nominal structure mounting height above street grade: twenty-five (25) feet.

### Y3. Unaccepted Street Lighting

- (1) Where the town has not agreed or is likely not to accept future payment for street lighting, the developer, contractor or association of customers shall: Provide, install and retain ownership of all street lighting equipment, including underground conductors, conduits, foundations, poles and luminaries; and contract directly with the Hingham Municipal Lighting Plant to provide electricity for light operation. Private lights are maintained by owner and metered by the Hingham Municipal Lighting Plant.

### Z3. Accepted Street Lighting

- (1) Where the town has accepted a roadway or is likely to accept street lighting, or itself owns a parking lot or other way, or has otherwise agreed to supply streetlight service to a private way, the developer, contractor or association of customers, or the town in the case of a municipal facility, shall provide and

install all street lighting including underground conductors, conduit and foundations on which poles and luminaries are set. In case of accepted street lighting, the town shall contract with the Hingham Municipal Lighting Plant to provide electricity for light operation and to service and maintain all equipment.

A4. Landscaping (Grass Plot, Side Slopes, Street Trees)

- (1) Planting areas and shoulders shall pitch toward the traveled way not less than one-fourth (1/4) inch nor greater than two (2) inches to the foot.
- (2) Grass seed shall be spread during the growing season at the rate of four (4) pounds per one thousand (1,000) square feet. It shall be a mixture of creeping red fescue and perennial rye grass. It shall be properly fertilized, limed and watered. A guaranty period of one (1) year from full growth and final bond release shall be honored by the Developer.
- (3) All disturbed unpaved areas within the street right-of-way shall be loamed to a minimum of six-inch thickness and seeded.
- (4) A grass plot shall be provided on each side of all roadways between the edge of the roadway and the sidewalk. The finished grade of the grass plot in relation to the finished grade of the roadway shall be as shown on the "Typical Road Cross Sections".
- (5) The area between the sidewalk and traveled way shall have six (6) inches of loam which, when rolled, shall match with the top course of the sidewalk and the top of the front face of the curb.

X3. Side Slopes

- (1) As part of design, the area behind the sidewalk or shoulder shall be sloped at not more than the ratio of three (3) feet horizontal to one (1) foot vertical to a point where it precisely coincides with the surrounding ground or abutter's lawn. Side slopes shall be loamed and seeded or retained in existing vegetation the same as grass strips.
- (2) Terracing and/or sloping of grades to the roadway will be required when the normal runoff from a lot onto another has been made greater by new construction or by man-made land changes.
- (3) Terracing shall be done with earthen embankments, and each terrace shall have no more than a three-foot vertical drop. Natural slopes or terraces will be no greater than one (1) foot horizontal to one (1) foot vertical, although no slopes greater than three (3) feet horizontal to one (1) foot vertical shall be allowed within ten (10) feet of the lot line. "Terrace" shall mean a raised flat mound of



earth with sloping sides.

- (4) The areas of cut or fill outside the traveled way shall be sloped as follows until it intersects the finished grade of the abutting lots, except as may be required for sidewalks and except where, in the opinion of the Board, slopes in excess of the following are warranted to mitigate impact upon wetlands or other natural features:

<b>Depth/height of cut/fill slope</b>	<b>Maximum permissible rate of</b>
Less than 4 feet	6 to 1
feet to 10 feet	4 to 1
More than 10 feet	2 to 1

- (5) Where fill slopes equal or are greater than 3 to 1, a guardrail shall be placed at a distance no less than four (4) feet from the edge of traveled way. The detail should include rail, posts and cable. The guardrail section shall include a 16' approach to begin 16' prior to the 3 to 1 slope. An example of an appropriate guardrail is shown in Figure 4.

#### B4. Street Trees

- (1) Street trees, not less than twelve (12) feet in height and of a species approved by the Superintendent of Public Works, shall be planted on each side of every street in the subdivision wherever, in the opinion of the Planning Board, existing woodlands or individual trees are not retained. Trees shall be located on private property and planted a minimum of (5 feet outside the right of way. Spacing shall be 50' on-center. Upon acceptance, these trees shall be considered privately owned trees by the respective property owner. The plans shall indicate a ten foot offset line from the right of way as the Street Tree planting area.

#### C4. Bounds/Monuments

- (1) Granite monuments with the letters HHB (Hingham Highway Bound) engraved into the top shall be set at all street intersections, at all points of change in direction or curvature of streets, arcs on curves at intervals of 300 feet, all easement boundaries and at other points where, in the opinion of the Board, permanent monuments are necessary.
- (2) Bounds for Private Local Streets shall be installed at all street intersections, at all points of change in direction or curvature of street side lines, arcs on curves at intervals of 300 feet, all easement boundaries, and at other points where, in the opinion of the Planning Board, permanent bounds are necessary. Such bounds shall be pre-cast reinforced concrete not less than thirty-six (36) inches in length and six (6) inches square. Other than bounds that exist, bounds shall be installed at all turning points for parcels designated as open space.

- (3) Each lot shall have at least one (1) sideline marked by a bound.
- (4) Bounds shall be set to the finish grade. A registered land surveyor shall certify to the Planning Board that the location of such bounds has been verified by him, following all earthwork and paving and shown on as-built plans.
- (5) Monuments shall be at least four (4) by four (4) inches and shall extend a minimum of three and one-half (3 1/2) feet below finished grade to not more than six (6) inches above finished grade, except that bounds located in lawns shall be of materials approved by the Planning Board, and shall be set with the top flush or slightly below finished grade and except that bounds set in driveways, sidewalks or other paved areas shall be constructed of a 2" brass rod extending 3' into the ground and shall be set flush to finished grade.

#### D4. Street Signs

- (1) Street signs of the type commonly used on public ways of the Town and bearing the names of the intersecting streets as indicated on the Definitive Plan shall be erected at all intersections of streets in the subdivision. Such signs shall be subject to the approval of the Board.
- (2) Street signposts shall be ten (10) feet in length, three (3) feet of which shall be buried in the ground. An anchor shall be installed with the underground portion to prevent turning or removal.
- (3) The Developer shall furnish and install double-faced extruded-aluminum street signs, mounted on two-inch-diameter posts equal to those in use by the Hingham Department of Public Works.

#### E4. Transformers, Hydrants, Mailboxes

- (1) Transformers and junction boxes for underground wiring and telephone shall be located outside of the right of way in easements permitting access for maintenance purposes.
- (2) Hydrants shall be located according to Article 32 Section 9 of the General Bylaws and the specifications of the Hingham Fire Department either in the grass strip or in easements outside of the right of way.
- (3) Personal mailboxes shall not be located in the Town right of way.

F4. Cleaning Up

- (1) The entire area of the subdivision shall be cleaned up so as to leave, in the opinion of the Board, a neat and orderly appearance free from debris and other objectionable materials. All catch basins and manholes shall be cleaned out.
- (2) The Developer shall remove from the street and adjoining property all temporary structures, debris, tree stumps, loose rocks and surplus materials which may have accumulated during the prosecution of the work, leaving the subdivision in a neat and orderly condition. Prior to completion of work, the applicant shall clean the entire stormwater management system, both on-site and off-site to its point of discharge.