

SECTION 8:00
CONSTRUCTION STANDARDS

All construction shall follow the Town of Williamsburg Standards, the Commonwealth of Massachusetts Department of Public Works (a) "Standard Specifications for Highways, Bridges and Waterways," 1988 Edition, as amended (to be referred hereto as the "Standard Specifications"), (b) "Construction Standards," 1977, as amended (to be referred to hereto as the "Construction Standards") and the following:

8:01 Borings.

The work shall consist of making soil-test borings, obtaining and preserving acceptable samples, preparing a report of the results obtained and delivery of the report and samples in conformance with appropriate provisions of Section 190 of the Standard Specifications and these Rules and Regulations. The report shall be prepared by a civil engineer registered in the Commonwealth of Massachusetts.

8:02 Construction (Stakes) Staking.

Developers shall employ, at their own expense, a professional engineer or a registered land surveyor to set all lines and grades in accordance with the provisions of Section 5:07 of the Standard Specifications.

8:03 Site and Earthwork.

1. All materials and construction methods used for roadway excavation and embankments shall conform to Section 100 of the Standard Specifications.
2. All natural features, such as large trees, watercourses, scenic points, historic plots, and similar community assets shall be preserved. It is the opinion of the Planning Board that this protection and preservation will add to the attractiveness and value of the subdivision.
3. The entire area within the right-of-way lines, except for trees and other vegetation intended to be preserved, shall be cleared and grubbed of all stumps, brush, roots, and like material. Trees intended to be preserved shall be protected by suitable boxes,

fenders, or wells as appropriate.

4. In a cut area all material shall be removed to sub-grade. All unsuitable material, such as peat, highly organic silt or clay, or any other material that is considered to be detrimental to the sub-grade, shall be removed and shall be replaced by bank-run gravel and be brought to proper compaction with a ten-ton roller.
5. Topsoil, defined as fertile, friable, natural material which has demonstrated vegetative growth and found on the site, can be used within the right-of-way, provided it conforms with the relative provisions of Section 751 of the Standard Specifications.
6. In fill areas the embankment shall be ordinary borrow specified and placed as in the relevant provisions of Section 150 of the Standard Specifications.
7. Before the ground base course is spread, the sub-grade shall be shaped to a true surface conforming to the proposed cross section of the road. Where fill is required, it shall be placed in layers not deeper than twelve (12) inches, except the last layer which shall not exceed four (4) inches in depth. The fill shall be ordinary borrow specified and placed as in the relevant provisions of Section 150 of the Standard Specifications. A tolerance of one-half (1/2) inch above or below finished sub-grade will be permitted, provided this difference is not maintained over fifty (50) feet and the required cross section is maintained.
8. The sub-grade shall be classified as follows:
 - a. Poor. Sub-grade soils which become quite soft and plastic when wet. Included in these are soils having appreciable amounts of clay, silt, and fine sand.
 - b. Medium. Sub-grade soils which retain a moderate degree of firmness when saturated. Included are such soils as fine sands, silty sands and sandy gravels with some silts and clays.

- c. Good to Excellent. Sub-grade soils which retain a substantial amount of their load-supporting capacity when saturated shall be classified as good. Included are clean sands and gravels free of detrimental amounts of plastic silts and clays. Sub-grade soils unaffected by moisture shall be classified as excellent. Included are clean and sharp sands and gravels, particularly those that are well graded.
9. Inspections shall be required upon completion of the sub-grade (see Section 10:03).

8:04 Pavement Structure.

- 1. The pavement structure shall be constructed in accordance with applicable provisions of Section 400 of the Standard Specifications and the following:
 - a. Sub-Base. The sub-base shall be gravel borrow meeting MI.03.0 Type a specifications, except that the top three (3) inches shall be screened or crushed gravel with a maximum stone size of one (1) inch. A tolerance of one-half (1/2) inch above or below finished sub-grade will be permitted, provided this difference is not maintained over fifty (50) feet and the required cross section is maintained. The gravel borrow shall be laid to a depth indicated below.
 - b. Binder Course. The binder course shall be asphalt concrete, in accordance with Section 460, Class I Bituminous Concrete Pavement Type I-1 (Top Course Mix). It shall be laid to a depth indicated below.
 - c. Surface Course. The surface course shall be asphalt concrete, in accordance with Section 460, Class I Bituminous Concrete Pavement Type I-1 (Top Course Mix). It shall be laid to a depth indicated below.
- 2. Required Depth of Pavement Sections:

	<u>Sub-grade Support Classification</u>		
	<u>Poor</u>	<u>Medium</u>	<u>Good-Exc</u>
Surface Course	1"	1"	1"
Binder Course	2"	2"	2"
Sub-base	18-24"	12-18"	12"

3. Inspections shall be required upon completion of each layer of sub-base and the binder and surface courses. (see Section 10:03).

8:05 Shoulders.

Shoulders shall be allowed in certain instances in place of sidewalks, curbs and grass strips, as shown in the street cross section (see Appendix A).

8:06 Curbs.

1. Curbing is required according to street classification.
 - a. Major Streets: curbs throughout; granite at intersections, bituminous concrete elsewhere.
 - b. Collector Streets: granite or bituminous concrete at intersections; bituminous concrete on slopes greater than 6%.
 - c. Minor Streets: curbs required only in special situations.
2. Granite curbing shall be Type VB.
3. Bituminous Concrete curb shall be Type 2 (6" reveal).
4. Bituminous Concrete curb around any cul-de-sac island, if required by the Planning Board, shall be "Cape Cod" type.
5. Granite curb inlets (Type VB) shall be build against all catch basin frames and shall be installed true to the horizontal and vertical alignment as shown on the plans.
6. All bituminous berms shall be placed on the bituminous binder.

7. The type and method of installation of bituminous berm, granite curb and granite curb corners shall conform to the relevant provisions of Section 470 and 500 respectively of the Standard Specifications.
8. Curbing at an intersection shall include the full length of the curve, plus six (6) feet of tangent in each direction. Curbs may be required on minor streets where the Planning Board deems that special conditions of topography, soils, drainage, alignment or high density make curbing essential. In all places where curbing is not required, the roadway edge and the adjoining grass plot or shoulder shall be so treated as to provide adequately for the carrying of surface runoff without undue soil erosion. This may require special design of gutters, shoulders, ditches, etc.

8:07 Driveway Approach Areas and Aprons.

The Planning Board may require the developer to construct certain driveway approach areas during the construction of the subdivision, in order to insure that certain physical characteristics, such as swales, steep side slopes, etc. do not get disturbed after the end of construction. Driveways shall be constructed in accordance with Town standards.

8:08 Sidewalks.

1. Sidewalk shall be constructed as follows:
 - a. Major Street: cement concrete, six (6) feet wide.
 - b. Collector Street: bituminous concrete, five (5) feet wide.
 - c. Local Street: bituminous concrete, four (4) feet wide.
2. Sidewalk sub-base shall consist of at least eight (8) inches of thoroughly compacted processed gravel.
3. All sidewalks shall conform to the material and construction methods as specified in Section 701 of the Standard Specifications.

8:09 Grass Strips.

1. Grass strips shall be provided on each side of the roadway, between the curb and the sidewalk, where sidewalks are required.
2. The finished grade of such grass strips shall have a slope of one-half (1/2) inch per foot towards the roadway. Where unusual physical land characteristics of topographic conditions exist, and where no sidewalk is to be constructed, the Planning Board may approve the construction of a grass strip of a greater slope with the finished slope not projecting above a plane sloped four (4) horizontal to one (1) vertical from the back of the curb.
3. No trees or other obstructions shall be placed or retained within the grass strip, except those approved by the Planning Board.
4. The top six (6) inches of grass strips shall consist of good quality loam extending to the right-of-way, screened, raked, and rolled with lawn grass seed applied in sufficient quantity to assure adequate coverage and rolled when the loam is moist. Spreading of loam and seed shall be in accordance with Sections 751 and 765 of the Standard Specifications.
5. The minimum width of any grass strip shall be seven (7) feet.

8:10 Side Slopes.

1. The area in back of the required grass strip, or behind the sidewalk, when one is required, shall be graded to a point where it coincides with the finished grade of abutting lots in such a manner that no portion thereof within the right-of-way lines of the street will project above a plane sloped four (4) horizontal to one (1) vertical.
2. The top six (6) inches of side slopes shall consist of good quality loam extending to the right-of-way, screened, raked and rolled with at least a 100-pound roller to grade. The loam shall be seeded with lawn grass seed applied in sufficient quantity to assure

adequate coverage and rolled when the loam is moist. Loam and seed shall be spread in accordance with Sections 761 and 765 of the Standard Specifications.

8:11 Street Name Signs.

A street sign shall be provided at every intersection of roads in a subdivision. The design, location and construction of street signs shall conform with the usual practice in the Town and shall be approved by the Highway Superintendent.

8:12 Monument and Markers.

1. Granite or reinforced concrete monuments four (4) feet in length, dressed to four (4) inches at the top with a three-eighths (3/8) inch drill hole in the center, and not less than four (4) inches square at the bottom shall be set to finish grade as shown on the plans.
2. No permanent monuments shall be installed until all construction which could destroy or disturb the monuments is completed.
3. Monuments shall be installed at all street intersections, at all points of change in direction or curvature of streets and at other points as shown in the Definitive Plan and where, in the opinion of the Planning Board, permanent monuments are necessary. A Massachusetts Registered Land surveyor shall certify in writing to the Planning Board that all monuments have been properly set in accordance with the final plan.
4. All monuments shall be installed prior to any release of the performance guarantee.
5. All monuments shall be set flush with the ground.

8:13 Landscaping, Street Trees, and Tree Belts.

1. Tree belts a minimum of six (6) feet wide shall be provided on each side of the roadway. Tree belts shall be between the curb or shoulder and the sidewalk, if required, or the edge of the right-of-way when there are no sidewalks. Trees shall be planted along the center line of the tree belt.

The finished grade of such tree belts shall have a slope of one-half (1/2) inch per foot toward the roadway. Where unusual physical land characteristics of topographic conditions exists, and where no sidewalk is to be constructed, the Planning Board may approve the construction of a tree belt of a greater slope with the finished slope not projecting above a plane sloped four (4) horizontal to one (1) vertical from the back of the curb or edge of the shoulder.

2. The top six (6) inches of tree belt shall consist of good quality loam extending to the right-of-way, screened, raked, and rolled with lawn grass seed applied in sufficient quantity to assure adequate coverage, rolled when the loam is moist. Spreading of loam and seed shall be in accordance with an industry standard acceptable to the Planning Board.
3. Street shade trees shall be on both sides of subdivision streets, within the right-of-way, but with a minimum setback of ten (10) feet from the edge of the pavement. There shall be one tree planted an average of every thirty (30) feet of street frontage along each lot and not less than two trees per lot. Any mature deciduous shade trees preserved may be applied toward this average.
4. Trees shall be mature deciduous trees or newly planted trees no less than three inch (3") caliper at time of installation. Clumping is permitted in order to frame or enhance a view.
5. Street trees shall be deciduous shade trees, including, but not limited to, those listed in the table below. No more than 35% of any one species shall be used throughout the subdivision, randomly distributed.
6. Street trees shall have a minimum caliper of three inches (3") measured six inches (6") above soil root ball. They shall be single-stemmed with a single, straight leader. All tree species must meet American Association of Nurserymen Standards for the types and sizes specified. These standards shall be included on the detail sheets.

7. The developer shall install on each lot the street trees specified on the approved plans prior to the issuance of the final Certificate of Occupancy. Trees must survive one year after planting prior to the release of warranty performance guarantees.
8. Planting operations and requirements for street trees shall be in accordance with the American Association of Nurserymen Standards for Planting and shall have a two (2) year growth warranty. These standards shall be indicated on detail sheets.

A Selection of Approved Street Tree Species

Botanical Name	Common Name	Notes
<i>Acer rubrum</i>	Red Maple	Low salt areas
<i>Acer saccharum</i>	Sugar Maple	In special circumstances, low salt, wide root zone areas
<i>Fraxinus pennsylvanica</i>	Green Ash	
<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Thornless Common Honeylocust	
<i>Nyssa sylvatica</i>	Black Gum, Tupelo	Moist soils
<i>Quercus coccinea</i>	Scarlet Oak	
<i>Quercus robur</i>	English Oak	
<i>Quercus rubra</i>	Red Oak	Will tolerate poor, sandy soils
<i>Platanus x acerifolia</i>	London Plane Tree	
<i>Tilia cordata</i>	Littleleaf Linden	
<i>Ulmus Americana</i> 'Valley Forge'	Valley Forge Elm	
<i>Ulmus Americana</i> 'Princeton'	Princeton Elm	
<i>Ulmus parvifolia</i> 'Allee'	'Allee' Lacebark Elm	

8:14 Intersection Plantings.

No small trees, shrubs or plants that tend to obstruct visibility at street intersections shall be permitted within fifty (50) feet of the point of intersection of the

curb or exterior roadway lines along both sides of the corner lot at the intersection.

8:15 Underground Utility Systems.

All utility systems, public or private, shall be placed underground.

8:16 Utility Installation.

The installation of public utilities shall conform to the standards in the following sections:

1. The applicant shall employ, at his own expense, an engineer to set all lines and grades in a manner satisfactory to the Planning Board.
2. All utility lines shall be installed with the minimum cover as shown in Appendix A.
3. Sewers and drains shall be laid to true line and grade.
4. Electric, telephone, cable TV and fire alarm conduits shall be installed underground beneath the grass strip with a minimum cover, as shown in Appendix A.
5. Width of trench at the pipe or conduit shall be at a minimum equal to four thirds (4/3) diameter of the pipe or conduit, plus eighteen (18) inches.
6. Sheet piling shall be used, whenever necessary, in conformance with relevant provisions of Section 950 of the Standard Specifications.
7. Pipe and conduits shall be surrounded by six (6) inches of compacted screened gravel if set in earth, and twelve (12) inches if set in rock. In rock, clay, or peat excavation, trenches shall be excavated to a depth of twelve (12) inches or more below the bottom of any water pipe, storm drain, or sewer and filled with bank-run or select gravel, whichever is approved by the engineer.
8. Back-fill shall be compacted to ninety five (95) percent of the maximum dry density of the material as

determined by the American Association of State Highway Officials, Designation T-180D.

9. The water and sanitary sewer systems shall be tested and approved prior to installation of base course(s) and pavement.
10. All lot connections shall be installed to the right-of-way line, and marked or surveyed so as to be easily located in the future.

8:17 Drainage.

1. The construction of the drainage system, including methods of construction and quality of materials used, shall be in conformity with the Definitive Plan and Section 200 of the Standard Specifications.
2. The design capacity of the drains (closed drainage systems and pipes) shall be determined by the rational method, unless the engineer exhibits satisfactory evidence that another approach is more appropriate for the specific case. The engineer shall design the drainage system in accordance with natural drainage boundaries of the total contribution drainage area, using a minimum of a ten (10) year design frequency storm. Where, in the opinion of the Planning Board, flooding would produce property damage or a safety hazard, the design frequency storm shall be increased to twenty five (25) years. A one hundred (100) year design frequency storm shall be used for all bridge openings and major culverts, and detention or retention ponds. Drainage calculations shall be submitted with the Definitive Plan.
3. Drainage systems, including detention and retention, must be designed to prevent any increase in peak flows for the one (1) or two (2), ten (10), and one hundred (100) year Soil Conservation Service design storms. TR-55 (or TR-20 with all inputs and outputs shown) should be used for calculating drainage systems.
4. Pipe drains, where used, shall have a minimum diameter of twelve (12) inches and shall be laid to true line and grade.

5. Where feasible, stormwater should be directed to enter the nearest stream channel. Stormwater shall not be permitted to cross any roadway upon the surface but must be either piped underground or enter swales located parallel to and adjacent to the roadway pavement. Stormwater runoff shall not be permitted to flow upon the road surface for a longer distance than three hundred (300) feet before it enters the underground system. Catch basins shall be located on both sides of the roadway on continuous grades at intervals of not more than three hundred (300) feet, at all sags in the roadway, and near the corners of the roadway at intersecting streets.
6. Proper connections shall be made with any existing public drainage system within four hundred (400) feet of the subdivision, if the system has the capacity to absorb the flows from the project area. Where no public drain is within four hundred (400) feet, adequate provisions shall be made for the retention/detention of surface drainage within the boundaries of the subdivision.
7. Where open stream channels exist within a subdivision, adequate provision shall be made for properly maintaining them or for properly enclosing them if absolutely necessary. It is the Town's intent to preserve and maintain the natural features of such streams and any development should be planned accordingly.
8. Manholes and catch basins shall conform to Section 200 of the Standard Specifications and a typical detail showing materials, dimensions and construction details shall be shown on the Definitive Plan.
9. Iron casting for manhole frames and covers and catch basin frames and grates shall be in accordance with Massachusetts Department of Public Works Standards.
 - a. Manhole frames and covers shall be of good quality, strong, tough, even-grained cast iron per ASTM A48, Class 30, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Before shipment, castings shall be given one coat of coal tar pitch varnish.

- b. Manhole covers shall have a diamond pattern, pickholes and the word "DRAIN" cast in 3-inch letters. Manhole frame and covers shall be LeBaron Foundry; Mechanics Iron Foundry; Neenah Foundry or equal. The following model numbers refer to Neenah Foundry products:

Manhole Frame and Cover - R-1720.

- c. Catch basin grates shall be square, type F, as manufactured by LeBaron Foundry Company, Box 746, Brockton, MA 02403, or other approved equal.
- 10. Drain manholes shall be located at every change in grade or direction of the drainage line, at catch basin connections, and shall not be placed further than three hundred (300) feet apart in a continuous system.
 - 11. All catch basins shall connect directly to drain manholes.
 - 12. All catch basins shall have three (3) foot sumps. All catch basins in the Town's Water Supply Protection District shall have gas traps with removable hoods.
 - 13. If roadway sub-drainage is required, rigid perforated PVC or ACCM pipe of appropriate size shall be used. Installation and materials shall conform to the provisions of Section 260 of the Standard Specifications and the sketch shown in Appendix A.
 - 14. If lot sub-drainage (i.e., foundation drains) is required, rigid six (6) inch PVC or ACCM pipe shall be used within the public layout. The method of connecting said sub-drainage to the public drainage system shall be approved by the Planning Board prior to construction.
 - 15. The maximum depth of any portion of the storm system shall be ten (10) feet.

8:18 Sanitary.

1. All gravity sanitary sewer main line pipe and service pipe shall be PVC pipe with a minimum rating of SDR 35. Minimum diameter of the main line pipe shall be 8 inches. Minimum diameter of service pipe shall be 4 inches.
2. Minimum slope for 8-inch diameter pipe shall be .005 ft/ft. Minimum cover shall be 4 feet to the top of the pipe. Minimum slope for 4-inch service pipe shall be 1/4 inch per foot. Minimum slope for all other pipe sizes shall be as determined by the Board of Water & Sewer Commissioners.
3. Manhole spacing - maximum of 300 feet and at the upstream end of the pipe.
4. Service connections made directly to manholes shall be provided with a channel in the manhole shelf.
5. Main line pipe and service connection pipe with a drop of greater than 2 feet at a manhole shall be provided with a chimney. Drops of less than 2 feet shall be avoided by installing the inlet pipe to meet the manhole outlet invert. Service drops shall be installed inside the manhole. Main line drops shall be installed outside the manhole.
6. A separate service connection pipe shall be provided for each house and/or building.
7. Pipe and fittings - per ASTM D3034.
8. Precast Concrete Manhole Sections - per ASTM C478 with the following exceptions:
 - a. Wall thickness (min)

5-inch for 48-inch diameter
6-inch for 60-inch diameter
7-inch for 72-inch diameter
 - b. Precast concrete barrel sections with precast top slabs and precast concrete transition sections

shall be designed for a minimum of H-20 loading plus the weight of the soil above at 120 pcf.

- c. Bases shall be monolithically constructed with a 6-inch extended base.
- d. Knock out panels shall be provided in precast manhole sections at the locations shown on the Drawings. They shall be integrally cast with the section, 2 1/2-inch thick and shall be sized as shown on the Drawings. There shall be no steel reinforcing in knock out panels.
- e. Side wall height of the base section shall be a minimum of 12 inches above the top of the pipe coming into the manholes.
- f. Exterior of all sections shall be coal-tar epoxy coated.
- g. Channel invert height = .75 pipe diameter.
- h. Step spacing shall be 12 inches.

9. Brick Masonry.

- a. Brick.

Bricks for the channels and shelves - per ASTM C32, Grade SM.

Bricks for building up and leveling manhole frames - per ASTM C32, Grade MS.

Poured concrete inverts will not be allowed.

- b. Mortar - one part Type II Portland cement per ASTM C150 to two parts sand to which a small amount of hydrated lime not to exceed 10 lbs. to each bag of cement shall be added.
- c. Sand - Washed, cleaned, screened, sharp and well graded with no grain larger than will pass a No. 4 sieve, free from vegetative matter, loam, organic or other materials of such nature or of such quantity as to render it unsatisfactory.
- d. Hydrated lime - per ASTM C207.

10. Manhole Frame and Cover.

- a. Manhole frames and covers shall be of good quality, strong, tough, even grained cast iron per ASTM A48, Class 30, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Before shipment, castings shall be given one coat of coal tar pitch varnish.
- b. Manhole covers shall have a diamond pattern, pickholes and the word "SEWER" cast in 3-inch letters. Manhole frame and covers shall be LeBaron Foundry; Mechanics Iron Foundry; Neenah Foundry or equal. The following model numbers refer to Neenah Foundry products:

Manhole Frame and Cover - R-1720.

11. Jointing Precast Manhole Sections.

Tongue and groove joints of precast manhole sections shall be sealed with either a round rubber "O"-ring gasket conforming to ASTM C443, or a preformed flexible joint sealant.

12. Manhole Rungs.

Manhole rungs shall be either of cast aluminum alloy 6061-T6, drop front design, 14-inches wide with an abrasive step surface or of steel reinforced copolymer polypropylene plastic. Manhole rungs shall conform to OSHA requirements.

13. Pipe Connections to Manhole.

P.V.C. pipe connections may be accomplished in the following way:

A waterstop gasket and stainless steel clamp shall be attached to the pipe prior to grouting. Void between pipe and manhole wall inside manhole shall be filled with non-shrink waterproof grout after the pipe is set.

14. Manhole Chimney.

- a. Pipe and fittings for manhole chimney shall be of the same size and material as the influent line.
- b. Concrete for manhole chimney encasement shall be 3,500 psi.

15. Dense Graded Stone Borrow for PVC Pipe Bedding.

Crushed stone for the pipe bedding and haunching shall be a dense graded mixture and conform to the following gradation requirements:

<u>Size of Sieve</u> (Square Openings)	<u>% by Weight Passing Through</u>	
	<u>Minimum</u>	<u>Maximum</u>
5/8"	100	100
1/2"	85	100
3/8"	15	45
Pass #4	0	15
Pass #8	0	5

All bedding and haunching shall be compacted to a minimum of 95% of Maximum Dry Density as determined by a Standard Proctor Compaction Test.

16. PVC sewer pipe shall be installed on a minimum 6" thick foundation of crushed stone, and uniformly supported throughout the entire length from the crushed stone foundation to the springline of the pipe with crushed stone for the entire width of the trench. Crushed stone for 4" house connection pipe shall extend from the stone foundation up over the 4" pipe at least 6" for the entire width of the trench.

17. Manholes shall be installed:

- a. Manhole shall be constructed to the dimensions shown on Drawings and as specified in these Specifications. All work shall be protected against flooding and flotation.
- b. Precast concrete barrel sections shall be set so as to be vertical and with sections in true alignment with a 1/4-inch maximum tolerance to be allowed.

Precast sections shall be installed in a manner that will result in watertight joint.

- c. Holes in concrete barrel sections shall be plugged with a non-shrinking grout and finished flush on the inside.

18. Manhole Rungs shall be installed:

- a. Aluminum manhole rungs shall be cast into precast sections, on 12-inch centers, by the manufacturer that casts the precast sections. Those parts of the rungs which are embedded shall receive a heavy coating of zinc chromate or other approved paint.
- b. Steel reinforced copolymer polypropylene plastic steps shall be press fitted by hand driven hammer into preformed holes in cured precast sections of 12-inch centers, by the manufacturer that casts the precast sections.

19. Brickwork shall be installed:

- a. Channels and shelves shall be constructed of brick. The brick channels shall correspond in shape with the lower half of the pipe. The top of the shelf shall be set at the elevation of the crown of the highest pipe and shall be sloped 1-inch per foot to drain toward the flow through channel. Brick surfaces exposed to sewage flow shall be constructed with the nominal 2-inch x 8-inch face exposed (i.e., bricks on edge).
- b. Manhole covers and frames shall be set in a full mortar bed and bricks, a maximum of 12 inches thick for conical tops and 6 inches thick for flat top sections.

20. Dampproofing shall be installed:

Outer surfaces of precast manholes shall be given two coats of bituminous dampproofing at the rate of 30-60

sq. ft. per gallon in accordance with manufacturer's instructions.

21. Chimneys shall be installed:

- a. Construct chimney by carefully placing the pipe and fittings forming the manhole chimney so that the 90° bend at the bottom of the chimney is at the elevation shown on the Plans.
- b. The entire chimney from the bottom of the concrete base of the manhole to the centerline of the sewer line shall be encased in a concrete envelope which shall extend a minimum of eight inches on all sides of the chimney pipe. The concrete envelope shall extend to the exterior wall of the manhole.

22. Relationship to Water Mains - Per TR-16.

23. Testing - Air/Water, for Pipelines. Per TR-16.

24. Vacuum Test for Manholes - Gravity Lines (not hydrostatically tested).

- a. After manhole has been constructed, the Contractor shall conduct a Manhole Acceptance Test using the following vacuum test procedure:

Plug all lift holes with an approved no-shrink grout.

Plug all pipes entering the manhole, taking care to securely brace the plug from being drawn into the manhole.

The test head shall be placed at the inside of the top section and the seal inflated in accordance with the manufacturers' recommendations.

Draw a vacuum of 10 inches of mercury and shut off the vacuum pump. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than:

1 min. 0 sec. for 0'-10' deep manholes
1 min. 15 sec. for 10'-15' deep manholes
1 min. 30 sec. for 15'-25' deep manholes

If manhole fails initial test, necessary repairs shall be made with non-shrink grout. Retesting shall proceed until a satisfactory test is obtained.

25. Allowable Deflection Test - Go/No-Go Gauge

- a. Pipe deflection measured not less than ninety days (90) after the backfill has been completed as specified shall not exceed five (5.0) percent.
- b. Deflection shall be measured with a rigid mandrel (Go/No-Go) device cylindrical in shape and constructed with a minimum of nine or ten evenly spaced arms or springs. The mandrel shall be hand pulled through all sewer lines.
- c. Any section of pipe not passing the mandrel shall be uncovered at the Contractor's expense and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested.

8:19 Water.

1. Ductile Iron Pipe and Fittings-General.

Ductile iron pipe and fittings shall meet as, a minimum, the following American Water Works Association (AWWA) standards as most recently amended:

AWWA C104. Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

AWWA C110. Ductile Iron and Gray Iron Fittings, 3 In. through 48 In., for Water and Other Liquids.

AWWA C111. Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.

AWWA C150. Thickness Design of Ductile Iron Pipe.

AWWA C151. Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water and Other Liquids.

AWWA C153. Ductile Iron Compact Fittings, 3 In. through 12 In., for Water and Other Liquids.

2. Pipe.

All ductile iron pipe shall be Class 52 ductile iron pipe in accordance with AWWA C150 and C151 and shall have push on joints, furnished in accordance with AWWA C111 unless otherwise specified or shown on the drawings.

All pipe shall be lined with a double thickness cement mortar in accordance with AWWA C104, and shall be asphalt seal coated twice. Outside of pipe to be bituminous coated in accordance with AWWA C151. Inside seal coat to be such as not to impart taste or odor to the water contained therein.

Each pipe shall have cast on it or stamped on it by means of a hand dye stamp, the maker's name or mark, and the year in which the pipe was cast. Also, the weight, thickness class and sampling period shall be painted on each pipe.

3. Fittings.

All fittings shall be new, American made, and in accordance with AWWA C153 or AWWA C110, Class 350, unless otherwise specified or modified herein. No foreign made fittings will be accepted.

All fittings, except sleeves, caps and plugs shall be lined with a double thickness cement mortar in accordance with AWWA C104, and shall be asphalt seal coated twice. Outside of fittings to be bituminous coated in accordance with AWWA C151.

Inside seal coat to be such as not to impart taste or odor to the water contained therein.

All fittings shall have mechanical joints in accordance with AWWA C111, except as provided for in AWWA C153.

The branch of trees for hydrants or stubs shall be mechanical joint anchoring trees.

All bends shall be provided with integrally cast lugs for attachment of harnessing, strapping, and other types of restraint.

4. Sleeve Type Couplings (Flexible Connection).

Sleeve type couplings shall be equal to Style 153 cast couplings for cast iron pipe and asbestos cement pipe, made by Dresser Mfg. Div., Bradford, Pennsylvania or approved equal. The couplings shall be furnished with the pipe stop removed. Couplings shall be provided with plain, Grade 27, rubber gaskets and with black, steel, track-head bolts with nuts.

When buried in the ground, the bolts and nuts shall be corrosive resistant.

To ensure correct fitting of pipe and couplings, all sleeve type couplings and accessories shall be furnished by the supplier of the pipe.

5. Valves, Hydrants and Appurtenances- General.

Valves, hydrants and appurtenances shall meet, on a minimum, the following American Water Works Association (AWWA) standards as most recently amended:

AWWA C111. Ductile Iron and Gray Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.

AWWA C500. Gate Valves for Water and Sewerage Systems.

AWWA C502. Dry Barrel Fire Hydrants.

6. Gate Valves.

Gate valves shall comply with AWWA C500 and shall be

rated for 200 psi minimum working pressure and a minimum 300 psi test pressure.

Valves shall be of the iron body, bronze mounted, solid wedge resilient seat, non-rising stem type, fitted with "O-Ring" seals. Valves shall have mechanical joints equal to AWWA C111. All external nuts and bolts shall be stainless steel.

The operating nut shall be standard AWWA 2 inch square and shall be attached by a nut; pinning is not acceptable. Gate valves shall OPEN to the LEFT or counter-clockwise.

All ferrous parts of the valves, except finished or bearing surfaces, shall be given two coats of asphaltum varnish. After the valves are assembled and tested, a third coat shall be free of any asphalt solution.

The design of the valve shall be such that the seal plate can be fitted with "O" rings while the valve is under pressure in a fully open position.

Gate valves shall be as manufactured by Waterous, M & H, Kennedy, American-Darling, or approved equal.

7. Tapping Sleeves and Valves.

The tapping sleeves shall be mechanical joint where possible or of the bolted sleeve type caulked with a poured lead connection to the existing mains and flanged end outlets for connection to the tapping valves. The outlet flanges shall conform to the 125 pound American Standard. The tapping sleeve and valve shall have an oversized opening to allow use of full size cutters. Tapping sleeve pressure rating shall be a minimum 200 psi. The tapping valve shall conform to the specifications for Gate Valves.

8. Valve Boxes.

Unless otherwise specified or required, each buried valve shall be provided with a valve box. Valve boxes shall be of tough even grain cast iron and of the

adjustable, slip, heavy pattern type with bell type bottoms. They shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valve.

The upper or sliding section of the box shall be provided with a top flange having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve and shall have a minimum 8 inch inside diameter and maximum 9 inch diameter. Valve boxes shall have a minimum 6 inch overlap between top and bottom sections.

The valve boxes shall have a nominal inside diameter of 5 inches and the lengths shall be as necessary for the depth of the valves with which the boxes are to be used.

Covers shall be close fitting and substantially dirt tight. The top of the cover shall be flush with the top of the box rim. The word "water" shall be cast in the top cover.

9. Hydrants.

Hydrants shall open by turning the operating nut to the LEFT or counter-clockwise and shall be marked with an arrow and the word "open" to indicate the direction to turn the stem to open the hydrant.

Hydrant seat ring shall be bronze to bronze. All internal parts shall be removable through the bonnet. Seals shall be of the dual o-ring type and bonnet shall be provided with leak free lubrication. Hydrants shall employ a nylon anti-friction thrust bearing to reduce operating torque and it shall not require lubrication. Stem stop nut shall protect components below from excess torque. Hydrants shall be able to be rotated to 360 degrees. Nozzles shall be threaded in and pinned. They shall have a positive closing, self cleaning drain valve and drainage area shall be completely bronze or brass lined.

After being thoroughly cleaned, all iron work set below ground shall be painted with two coats of

asphalt varnish specified in AWWA C504. All iron work left above ground shall be shop painted with two coats of paint of quality and color to correspond to the present standard of the Owner.

Hydrants shall conform to National Standard Specification sizes in threads and nuts. Caps shall have retainer chains and rubber gaskets. Hydrants shall be traffic models (break flange) and shall have a minimum bury of 5 feet - 6 inches.

Hydrants shall be the make and model used by the Williamsburg Water Department at the time of construction. (The Water Department currently uses a Kennedy hydrant, but would like to maintain the flexibility of changing their standard and having the developer meet the standard being used at the time of construction).

10. Water Services- General.

All work and materials shall be as specified herein and as required and approved by the Town Water Department. All brass goods shall be as manufactured by the Red Hed Manufacturing Company or approved equal.

11. Water Service.

All pipe for Water Services shall be seamless copper water tubing and shall conform to the provisions of ASTM B-88, Type K annealed (soft) AWWA Specification 7S-CR or Federal Specification WWT-799.

12. Corporation Cocks.

Corporations shall have a C.C. thread with compression fittings.

13. Fittings.

Unless otherwise approved, only compression end type fittings will be used except where connections to existing services require special fittings.

14. Curb Cocks.

Curb cocks shall open to the LEFT or counter-clockwise. Curb cocks shall have no "waste". Curb cocks shall have a preattached operating rod.

15. Service Boxes.

Curb boxes shall be non-screw Buffalo type, tar coated, cast iron, sliding type arch pattern base with inlaid covers. Covers shall be held in place with bronze bolts and the word "Water" shall be cast into the cover. Curb boxes shaft shall have a minimum inside diameter of 2-1/2 inches.

16. Water System Installation.

- a. The water main shall be designed with a minimum depth to the top of the pipe of 5 feet.
- b. Air release shall be provided at all local high points. Air release device shall consist of either a) a 3/4" corporation, copper tubing, curb stop and box, and a second box for enclosure of the discharge end of the copper tubing; or b) fire hydrant assembly.
- c. Fire hydrants shall be spaced a maximum of 500 feet and at the end of a main.
- d. Individual service connections (3/4" minimum) shall be provided for each house and/or building.
- e. All water mains shall be a minimum of 8 inches in diameter and shall be ductile iron pipe.
- f. All service connections shall be copper tubing from the main to the building.
- g. Ductile iron pipe joints shall be assembled with bronze wedges to ensure electrical continuity. A minimum of 2 shall be provided for each joint, including mechanical joints.
- h. Whenever possible, solid sleeves shall be used. Alternatively, the use of a cast coupling is acceptable.

- i. The Curb Stop box cover shall be held in place with a brass pentagon bolt.
- j. All pipe shall be disinfected in accordance with AWWA C651 and tested prior to placement into service.
- k. The allowable leakage for rubber joints shall be based on the formula:

$$L = (ND) / (3,700P)$$

8:20 Other Utilities.

Materials and construction methods shall be in accordance with the requirements of the involved utility company after said requirements have been approved by the Planning Board and the Highway Superintendent.

8:21 Cleaning Up.

The entire area must be cleaned up within thirty (30) days of the completion of construction so as to leave a neat and orderly appearance free from debris and other objectionable materials. All catch basins shall be properly cleaned.

8:22 Easements.

- 1. **Utility Easements.** Utility easements shall be provided wherever utility lines must be located outside the lines of roadways. Such easements shall be a minimum of thirty (30) feet wide. A utility line shall be located at the center of the easement.
- 2. **Drainage Easements.** Where a subdivision is traversed by a watercourse, drainage way, channel or stream, the Board may require provision of a storm water easement or drainage easement of adequate width to conform substantially to the high water lines of such watercourse, drainage way, channel or stream and to provide for construction or maintenance of drainage structures and systems, or other purposes.

3. **Slope Easements.** Where a cut or fill embankment incidental to the road in a subdivision extends beyond the sideline of the road, the Board may require a slope easement to permit access to the whole embankment by those responsible for the maintenance of the roadway.