



City of Fredericksburg

*Construction Specifications
& Standards For*

Water & Sewerage Facilities

*Public Works Department
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CONSTRUCTION SPECIFICATIONS AND STANDARDS FOR WATER FACILITIES

Section 20. GENERAL REQUIREMENTS

20.01. Standard construction details, specifications, and materials standards approved by the Director of Public Works shall be followed unless the Director of Public Works there from authorizes specific deviation, in writing. In no case shall deviations be allowed from the Virginia Waterworks Regulations without prior written approval of the Virginia Department of Health.

20.02. Minimum Sizes. The minimum size of water mains shall be at least 8-inches nominal diameter. Water lines shall be of sufficient size to convey peak design flows, or 3 gallons per minute per connection, whichever is greater while maintaining a 20 PSI minimum pressure at all points in the distribution system.

20.03. Water Line Materials. Water lines 4-inch and larger shall be ductile iron as specified herein. Other approved pipe materials may be used to repair existing pipelines of that material.

20.04. Fire Hydrants. Fire hydrants shall be located only on those systems capable of supplying fire flows, and on lines at least 6-inch nominal size. In general, fire hydrants shall be located at distance between fire hydrants shall be 400 feet as measured along the street centerline or as determined by the Director of Public Works or the Fire Chief . Water distribution systems shall be designed to supply the magnitude of fire flows as determined by the Fire Chief of the while maintaining a minimum residual of 20 PSI at all points in the distribution system during peak demand periods.

20.05. Dead-ends. Dead-ends within a distribution system shall be minimized by looping of water mains. Where dead-ends do occur a blow-off assembly for water lines up to 4 – inch or fire hydrant for water lines larger than 4-inch shall be installed.

20.06. Valves. Valves within the distribution system shall be located as required by the Director of Public Works. At tees at least 2 valves shall be provided; at crosses at least 3 valves shall be provided; but in no case shall the distance between valves exceed 500 feet as measured along the pipeline. Valves up to 12-inch nominal size shall be AWWA C509 resilient seat gate valves and valves larger than 12-inch nominal size shall be AWWA C504 butterfly valves. All valves shall open left.

20.07. Minimum Cover. All pipe shall be installed with at least 36 inches minimum cover as measured from finished grade to the top of the pipe.

20.08. Separation of Water Lines and Sanitary Sewers. There shall be no physical connection between any part of the public or private potable water supply system to any sanitary or storm sewer facility. No portion of any water supply facility shall pass through or be in contact with any sewer manhole. The

minimum horizontal distance between any water supply line and a septic tank shall be 10 feet, and 3 feet between any septic tank tile lines.

A. Parallel Installation. Whenever possible, water lines shall be laid at least 10 feet horizontally measured edge to edge, from any sewer or sewer manhole. When unusual local conditions prevent a horizontal separation of 10 feet, the water line may be laid closer provided that:

1. The bottom of the water line shall be at least 18 inches above the top of the sewer line.
2. Where 18 inches of vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfilling.
3. The sewer manhole shall be of water-tight construction and tested in place.

B. Crossing. Water lines crossing sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible. When unusual local conditions prevent a minimum vertical separation of 18 inches the construction shall be used:

1. The sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfill.
2. Water lines passing under sewer lines shall, in addition, be protected by providing:
 - a. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line,
 - b. Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line,
 - c. That the length of the water line be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

20.09. Water Supply Interconnections. There shall be no physical connection between the 's water system and any private water supply system or any sewer system.

20.10. Cross-connection and Backflow Prevention Control Devices. Any cross-connection or backflow prevention control devices shall be in accordance with the City's Cross-connection Backflow Prevention Control program.

20.11. Separation of Water Lines and Gas Lines. Water lines, fittings and appurtenances thereto. Any disturbances of the gas line facilities including scratching, marring, or damage of any kind or extent shall be reported to the Director of Public Works and the gas company prior to backfilling.

20.12. Surface Water Crossing. Water lines crossing surface aerially shall conform to Section 22.12 of these standards and specifications. Water lines crossing underwater shall have easily accessible valves and permanent sample taps as shown in the standard details on each end of the crossing. The valves and sample taps shall not be subject to flooding. Pipe for underwater crossing shall have flexible joints with integral joint restraint.

20.13. Easements. Permanent easements at least 15 feet in width centered about the water line shall be provided on all water lines which are not otherwise located within a public right-of-way. During construction or reconstruction of the water line, the easement shall increase to a width of not less than 40 feet centered about the water line. All appurtenances to the water line shall be located within the permanent easement. All easements shall be granted to the City of Fredericksburg in a form approved by the Director of Public Works.

Section 21. WATER MAIN PIPE, FITTINGS AND ACCESORIES

21.01. General Requirements. Unless otherwise approved in writing by the Director of Public Works, or as specifically indicated on plans approved by the Director of Public Works, all pipe, fittings, and accessories used within water transmission and distribution systems shall be as defined in this section.

21.02. Water Main Pipe Materials.

A. Ductile Iron Pipe. Ductile iron pipe 4-inch and larger shall be centrifugally cast and manufactured in accordance with ANSI/AWWA C151/A21.51 or ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Cast iron pipe and fittings shall be cement-mortar lined in accordance with ANSI/AWWA C104/A21.4. Both the interior and exterior of the pipe and fittings shall have standard coating of bituminous material. Ductile iron pipe shall be at least class 52.

Joints for ductile iron pipe and fittings shall be one of the following:

1. Push-on Joints with Rubber Gaskets. Push-on joints and jointing materials shall comply with ANSI/AWWA C111/A21.11.
2. Mechanical Joints. Mechanical joints and jointing materials shall comply with ANSI/AWWA C111/A21.11.
3. Locked Type Mechanical Joints. The locked type of mechanical joint shall only be used when integral joint restraint is required. No locking system involving set-screws or field welding shall be used when the locked type of joint is the sole means of joint restraint.
4. Flanged Joints. Flanged joints shall be used in meter and valve vaults and where required by the Director of Public Works. Flanges and jointing materials shall comply with ANSI/AWWA C115/A21.15.

5. Gasket Lubricant. Gasket lubricant shall be a tasteless, non-toxic, non-bacterial supporting grease. Gasket lubricant shall not be supplied by the pipe manufacturer.

6. Gaskets. Gaskets shall be supplied by the pipe manufacturer. Transition gaskets shall be labeled with a "T" or the word, "TRANSITION".

B. HDPE Pipe. High Density Polyethylene pipe shall be used only with written permission of the Director of Public Works.

C. ASTM 2241 PVC Pipe. PVC pipe 2 and 3 inch per ASTM 2241 shall be used with trace wire only when approved by the Director of Public Works. When approved, the pipe shall conform to ASTM D2241 and D1784 and shall be class 200 SDR 21 with integral bell joints. Pipe shall be clearly marked with Class, Size, Manufacturer's name, and NSF-PW. Jointing lubricant shall be tasteless, odorless, non-toxic, and non-bacterial supporting. Gaskets and lubricants shall be supplied by the pipe manufacturer. Solvent weld joints are prohibited.

21.03. Main Line Fittings.

A. Cast or Ductile Iron Fittings. Tees, bends, reducers, sleeves, plugs, and caps shall have ANSI/AWWA C111/A21.11 mechanical ends. Fittings shall be manufactured of cast or ductile iron and shall comply with ANSI/AWWA C110/A21.10. Compact or short-body ductile iron fittings shall comply with ANSI/AWWA C153/A21.53. Fittings shall have the same interior and exterior coatings as ductile iron pipe.

B. Bolted Cast Couplings. Bolted cast couplings including expansion joint couplings, flanged coupling adapters, cut-in couplings, insulating couplings, end cap couplings, bell joint repair couplings, etc. shall be as manufactured by Rockwell International Corporation, Ford Meter Box Company, Dresser Manufacturing, JCM, or approved equal. Nuts and bolts shall be stainless steel.

C. Fittings for Welded Steel Pipe. Fittings for welded steel pipe shall be approved on case by case basis by the Director of Public Works.

21.04. Service Connection Piping. In addition to water main pipe materials the following shall be used.

A. Copper Pipe. Copper pipe 3/4" and 1" to be type K soft copper and 1 1/2 and 2- inch for service connections shall be rigid type K in accordance with ASTM B88 and shall be used with standard waterworks fittings.

21.05. Valves.

A. Gate Valves Smaller Than Three-Inch.

1. For non-buried installations the gate valves shall be solid bronze, traveling stem, screwed ends and shall be rated at 250 PSI working pressure. Valves shall open left.
2. For buried installations gate valves smaller than two-inch shall not be used.
3. For buried installations bronze bodied gate valves and valves with hand wheels or operating levers are prohibited.

B. Gate Valves Three-Inch and Larger.

1. Buried gate valves three-inch and larger shall conform to AWWA C500 and shall be iron-bodied, bronze mounted resilient seat gate valves, non-rising stem with dual O-ring seals. Valves shall open left and shall have a 2-inch square operating nut. Valves shall be rated for 200 PSI working pressure and shall have mechanical joint ends.
2. Non-buried gate valves three-inch and larger shall conform to AWWA C500 and shall be rated for 200 PSI working pressure. Valves shall be iron bodied, bronze mounted, outside screw and yolk with bronze stem. Valves shall open left.

C. Resilient Seat Gate Valves. Resilient seat gate valves shall conform to AWWA C509 and shall be designed for double tight closure (no leakage) at 200 PSI working pressure. Buried valves shall have non-rising stems with 2-inch square operating nuts and mechanical joint ends. Non-buried valves shall have outside screw and yoke and flanged ends. Valves shall open left.

D. Butterfly Valves. Butterfly valves shall be cast or ductile bodied with mechanical joint ends if in buried installations and flanged ends if non-buried. Butterfly valves shall be rubber seated, bubble-tight closure Class 150B conforming to AWWA/ANSI C504. Valves shall be suitable for buried service and buried valves shall include traveling nut or worm gear operator with 2-inch square operating nut opening left. The valve operator shall be sealed, gasketed, and lubricated for underground service and all valves shall utilize full Class 150B underground service operator torque rating throughout entire travel.

E. Ball Valves. All ball valves two-inch and smaller shall be bronze ball curb stops. The bronze shall conform to AWWA standards, have dual rubber O-rings, and be keyed into the ball. The valves shall have tee-head operating nuts and female IPS threaded ends.

F. Miscellaneous Valves. Miscellaneous valves such as air release valves, vacuum valves, combination air/vacuum valves, globe valves, check valves, automatic control valves, pressure relief valves, etc., shall be approved by the Director of Public Works.

G. Valve Boxes. All buried valves shall be provided with an adjustable cast iron valve box with a flared base section of a size suitable for the valve on which it is to be used. The shaft of the box shall have a minimum diameter of 5.25 inches. The covers shall be round and have the word “WATER” cast upon it. Covers shall not bear the name of other localities or utilities. Boxes shall be given a heavy bituminous coating.

21.06. Fire Hydrants. Fire hydrants installed within the distribution system shall conform to AWWA C502 in every respect and shall be approved by the Virginia State Inspection Bureau and the National Board of Fire Underwriters. Hydrants shall be designed for 150 PSI working pressure and 300 PSI test pressure. Fire hydrant shall be located 2 feet behind back of curb.

The hydrant main valve shall be removable from above ground. The hydrants shall be dry barrel, non-flooding, frost-proof, and AWWA compression type with waste orifices for draining the barrel of water when the main valve is closed.

Hydrants shall be traffic models in which the barrels are equipped with a safety or break-away flange and in which the stems are equipped with breakable stem couplings so that neither the shoe, stem, nor barrel will break if struck by a vehicle. The safety flange and stem couplings shall be repairable and replaceable without having to unearth the hydrant.

Hydrants shall have 6-inch mechanical joint inlet shoes. Hydrants shall have two 2.5 inch hose nozzles with National Standard hose threads and a 4.5 inch pumper nozzle with National Standard threads. Nozzle caps and hydrant operating nuts shall be standard 1.5 inch pentagons. Hydrants shall open left and the direction of opening shall be cast on the hydrant. Hydrants shall have 5.25 inch main valve openings or be able to meet the AWWA flow and pressure drop requirements for 5.25 inch valve openings.

Hydrants shall be painted as shown in Standard Details (W-3A). Neither the primer nor the paint shall foul nozzle threads, nozzle cap chains, or any lubrication fittings.

21.07. Service Connection Materials. Service connection materials shall comply with the Uniform Statewide Building Code and with the following:

A. Corporation Stops. Corporation stops shall be used at each service connection for sizes up to 2-inch and tees shall be used at each service connection for sizes 2-inch and up. Corporation stops shall be made of AWWA approved waterworks tapered bronze. Corporation stops shall be either ground key or ball type valves. Inlet threads shall be Mueller CC (AWWA) threads. Corporation stops shall have pack joint couplings.

B. Service Saddles. Service saddles shall be bronze with double bronze straps or stainless steel straps. Service saddles shall have cemented in place neoprene gaskets and Mueller CC inlet threads. Saddles shall be used on all taps to PVC mains and for all 2-inch taps. Saddles shall be completely double wrapped and taped 18 inches in all direction with 8 mil polyethylene. Service saddles shall be used on existing mains

C. Service Connection Piping. Service connection piping shall be as specified in Section 21.04 above.

D. Meter Settings. Meter settings shall be as shown on the standard details.

1. Meter settings up to and including 1-inch nominal meter size shall have iron riser yokes with an expansion connection which is removed when the meter is removed from the yoke. A close-coupled inverted key angle valve shall be provided at the inlet and single check valve or angle valve on the outlet installed in custom setter. Both inlet and outlet valves shall have pack joint coupling copper connections.
2. For 1 ½ and 2- inch meter settings, the setter shall be provided by the City after all required payments have been made by the owner
3. For meters 3-inch and larger settings, shop drawing or details shall be provided to the City for review and approval.

F. Meter Barrels. Meter barrels shall be the size, material, and configuration as shown on the standard details.

Section 22. WATER LINE CONSTRUCTION.

22.01. General Requirements. The water lines shall be laid and maintained to the required lines and grades with all appurtenance set at the required locations as shown on the approved plans for the project or as directed by the Director of Public Works. All valves and fire hydrants shall be set plumb.

Whenever, during the progress of the work, obstructions or conditions not shown on the plans are encountered which interfere to such an extent that an alteration in the plans is required, the Director of Public Works shall be advised and approval given before such alterations are made.

All pipe shall be laid with a minimum cover of 36 inches measured from the finish grade to the top of the pipe.

All pipe and appurtenances shall be installed according to the manufacturer's recommendations and in accordance with AWWA C600.

22.02. Work Within Highway or Street Rights of Way.

A. Work performed within or requiring utilization of any Virginia Department of Transportation's (VDOT) rights of way shall comply in every aspect with the latest edition of VDOT's Road and Bridge Specifications, the applicable subsections of Section 2. General provisions of the VDOT's Land Use Permit Manual dated January 1, 1984, and with any special provisions attached to any VDOT approved permit.

B. All work performed within or requiring utilization of any 's right of way must be approved in writing by the Director of Public Works in advance of the work.

C. Within any street or highway right of way, no trees or tree roots larger than 3 inches in diameter shall be cut without written authorization of the director of Public Works.

D. Any measures necessary or as may be required by the Director of Public Works shall be taken to safely accommodate pedestrian and vehicular traffic. The unnecessary obstruction of streets and/or sidewalks shall not be allowed. At least one traffic lane shall be kept open at all times and streets and sidewalks shall be kept clear and clean during all phases of construction unless authorized by the Director of Public Works.

22.03. Protection of Existing Underground Facilities. All work shall be performed in compliance with the "Underground Utility Damage Prevention Act", Title 56, Chapter 10.3, Sections 56-265.14 through 56-265.29 of the Code of Virginia, as amended.

22.04. Disruption of Water Service During Construction. Prior to any planned disruption of existing water service, the Director of Public Works shall be notified at least two full working days prior to the disruption. The Director of Public Works may require rescheduling of disruption.

Should an unplanned but intentional disruption be unavoidable, the Director of Public Works shall be notified as soon as possible. The Director of Public Works may reschedule the disruption.

Should an accidental or unintentional disruption occur, the Director of Public Works shall be notified immediately. The Director of Public Works may issue specific instructions which the contractor shall implement as required.

22.05. Occupational Safety and Health. All work shall be performed in accordance with the "Occupational Safety and Health Regulations" of the U.S. Department of Labor's Occupational Health and Safety Administration.

22.06. Excavation. All excavation shall be performed in a manner to minimize the effects of sedimentation and erosion. The work shall be done in accordance with all applicable sedimentation and erosion control ordinances. The trench shall be excavated to the alignment, depth, and grade as shown on the plans or as required by the Director of Public Works. The maximum length that a trench can be open including backfilled trenches which are not suitable for traffic shall be 200 feet. Trench widths shall be sufficient to allow for proper jointing of the pipe, for proper installation of backfill and bedding, and for installation of valves or other appurtenances.

Where conditions dictate, the trench shall be stabilized by sheeting, shoring, or bracing or the width of the trench shall be increased in order to insure the safety of workmen, existing structures, and the surrounding area.

Ledge rocks, boulders, and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and appurtenances for pipes up to 24 inch nominal distance which will be permitted between any part of the pipe or rock, boulder, or stone.

The bottom of the trench shall be at the required depth so as to provide a continuous and uniform bearing and support for the pipe. Bell holes shall be provided at each joint. Trenching below specified grade shall be backfilled with approved materials and shall be thoroughly compacted.

Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workmen, obstruct nor endanger traffic, obstruct sidewalks, driveways or other structures.

Discharge from any trench dewatering pump shall be conducted to natural drainage channels or storm sewers in such a manner not to create a nuisance or endanger traffic or workmen.

Should the trench pass over or through any previous or existing trench, the new trench bottom shall be sufficiently compacted to provide support equal to that of the native soil.

When the sub-grade is found to include unsuitable materials such as ashes, cinders, refuse, organic material, or other unsuitable material, the unsuitable material shall be removed as directed by the Director of Public Works and replaced with approved suitable backfill. Should the sub-grade be found to be unstable and cannot be removed or replaced, then a suitable foundation for the pipe and appurtenances shall be provided as directed by the Director of Public Works.

Unless otherwise shown on the plans or otherwise required by the Director of Public Works bedding for pipe shall be AWWA C600 Type 1 for ductile iron pipe; all other pipe line materials for water mains shall be laid using the standard gravel bedding shown in the standard details.

Where pavement has to be excavated, the pavement shall first be cut with mechanical pavement cutting equipment along a straight line with a vertical face.

When the removal of ornamental trees or shrubs is required during the work, they shall be removed so as not to harm their viability, and shall be stored, relocated, or replanted as directed by the Director of Public Works.

22.07. Backfill. Unless bedding type dictates otherwise, backfill material shall consist of selected material from the excavation, and shall be free of large clods, cinders, ashes, refuse, vegetable or organic material, boulders, frozen or excessively wet soil, stones, rocks, or broken concrete rubble.

The backfill from the trench bottom to at least one foot over the top of the pipe shall contain no stones larger than two inches in its largest dimension and shall be hand placed and thoroughly compacted in layers not to exceed six inches in depth. The remainder of the backfill may be placed in one foot layers and shall be thoroughly compacted by mechanical means.

Where the excavation has been made through pavement, curbs, driveways, and sidewalks the backfill shall consist entirely of graded aggregate VDOT No. 21 or other approved select backfill material and shall be compacted in six inch layers to a minimum of 95% theoretical density at optimum moisture content.

Where the excavation has been made in roadway shoulders or other traveled portions of the roadway which are not paved, the top ten inches of trench shall be backfilled with good bank gravel or crusher-run stone with a capping of crusher-run material over the entire shoulder.

22.08. Pipe Installation. Pipe, fittings, valves, hydrants and other accessories and appurtenances shall be loaded and unloaded by lifting with hoists or by skidding so as to avoid shock or damage. Under no circumstances shall these materials be dropped or skidded or rolled against any pipe already on the ground or already installed. Pipe and fittings shall be handled so that fittings, valves, hydrants, or other accessories and appurtenances shall be installed.

All lumps, blisters, and excess coating shall be removed from the socket and plain end of each pipe and fitting. All jointing surfaces including gaskets shall be wiped clean and dry and shall be free of dirt, sand, grit, and any foreign material before the pipe or fitting is installed. Every precaution shall be taken to keep the interior of the pipe free of dirt, cement, or other foreign material. No debris, tools, clothing, or other materials shall be placed in the pipe at any time.

During pipe laying, the trench shall be kept free of water. If the main is flooded by storm or accident during construction, it shall be cleared of the flood water by draining and flushing with potable water until the main is clean. The section of main and appurtenances exposed to flood water that, at the end of a 24 hour holding period, will have a free chlorine residual of at least 25 mg/l. The chlorinated water shall then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous feed or slug method.

The pipe may be strung prior to installation, if conditions allow, and with the approval of the Director of Public Works.

As each length of pipe is placed in the trench, each joint shall be assembled according to the manufacturer's recommendations, and the pipe shall be brought to the specified line and grade. When hydraulic equipment is used to push home the pipe, a block of wood shall be placed between the pipe being pushed and the pushing device to prevent damage to the pipe. When pipe materials other than ductile iron are used, the use of lifting or hydraulic equipment to push home the pipe is prohibited. Once the joint is made, the pipe shall be secured in place with the approved backfill material.

At times when the work is not in progress, the open ends of the pipes and fittings shall be closed by a water-tight plug.

Cutting of the pipe shall be done without damage to the pipe or linings and shall be done only by experienced workmen. All cuts shall be made at the right angles to the axis of the pipe. All cutting

debris shall be removed from the pipe. Tapping bits, drills, and saws shall be the type of pipe material being tapped.

When deflection of the pipe alignment in any plane is required, the deflection shall not exceed that required for satisfactory jointing of the pipe, as specified by the manufacturer or by the appropriate AWWA standard.

Full circle repair clamps shall not be used to make any pipe joint.

22.09. Valve, Hydrant, and Fitting Installation. Prior to installation, valves, hydrants, and fittings shall be inspected for defects, direction of opening, number of turns to open, freedom of operation, tightness of pressure containing bolting and test plugs, and cleanliness of all valve ports and seating surfaces. Hydrants shall be filled with manufacturer's lubricant as in accordance with manufacturer's recommendations. Valves and hydrants shall be closed prior to installation. Valves and hydrants shall be set plumb. Valve operating nuts shall be at least one foot but no greater than three feet beneath finished grade. Stem extensions shall be installed, if required. Valve boxes shall be set plumb, shall be centered over the valve operation nut, shall have the box lids flush with finished grade, and shall not be set so as to transmit shock or stress to the valve. In no case shall valves be used to bring misaligned pipe into alignment. Until ready for use, hydrants which have been installed shall be securely covered with a burlap bag or other suitable covering.

All tees, plugs, caps, bends, tapping sleeves, and hydrants shall be suitably restrained to resist thrust forces by providing reaction backing as shown on the standard details, or by using approved mechanically restrained joints.

22.10. Tapping for Service Connections.

A. Wet Taps – For nominal tap sizes less than two-inch, ductile iron pipe in all classes may be directly tapped with standard corporation stops which shall have had two layers of 3-mil TFE tape or thread TFE paste applied to the inlet threads. For nominal tap sizes two-inch or larger, service saddles or mechanical joint tapping sleeves shall be used. On all other pipe materials, service saddles and mechanical joint tapping sleeves shall be used for all size taps. Direct and service saddle taps shall be located at either the ten or two o'clock position on the pipe circumference.

B. Dry Taps – Dry taps shall be made as described above. Mechanical joint tees and valves conforming to Section 4 may be used in lieu of tapping sleeves and valves.

22.11. Railroad and Highway Crossings. Unless otherwise approved by the Director of Public works, pipelines crossing railroads or highways shall be installed by boring, jacking, or tunneling. The pipeline shall be installed within a casing of sufficient size to allow the unrestrained passage of the pipe bells and pipe skids through the casing. Within the casing the pipe shall be supported as shown in Bored Road Crossing Standard Details (W-7) so that the pipe shall not rest on the pipe bells or couplings. Care shall be taken to maintain the integrity of the pipe joints during the installation of the pipe in the casing and in

no cases shall pipe with non-locked joints can be pulled by the pipe through the casing. The casing and skids shall be as shown on the standard details. Carrier pipelines, smaller than three inch nominal size, shall consist of a single length of continuous tubing without any joints. Carrier pipelines three inch and larger nominal size shall be ductile iron pipe. On three inch and larger carrier pipelines having a joint or coupling within the casing, each protruding pipeline and end shall be rodded to the end of the casing. Railroad crossings shall be installed according to the requirements and permit provisions imposed by the railroad company.

22.12. Aerial Crossings. Aerial crossings, where allowed, shall be adequately supported using hanging and supporting systems suitable for use with the structure supporting the pipelines. Pipelines attached to highway or railway structures shall be installed according to the requirements of the Virginia Department of Transportation and the railroad company respectively. Aerial crossings shall be protected against freezing, shall be accessible for repair, and shall be located above the 100-year flood level. Aerial pipelines shall be ductile iron pipe with factory fabricated integral locking joints. All pipe jointing systems, restraints, and expansion fittings are to be approved by the Director of Public Works.

22.13. Restoration. All areas within the construction limits or utilized during construction shall, upon completion of the work within a section, be completely restored to a condition equal or better than that which existed prior to construction. Restoration shall include, but not be limited to, pavement, concrete, grassed plots, fences, signs, ornamental shrubbery or trees, drainage structures, other public or private improvements. VDOT roadway pavement restoration shall be in accordance with the VDOT's permit provisions. Restoration shall be finished in a neat and uniform condition and within a schedule acceptable to the Director of Public Works.

22.14. Pressure and Leakage Testing. After the pipe and appurtenances have been installed, all newly laid pipe or any valved sections shall be subjected to a hydrostatic pressure and leakage test and shall comply with the standards below, AWWA standards or the manufacturers' recommended installation procedures.

Tests shall be performed between each two adjacent main line valves except at tees and crosses at which locations the test section shall include the tee or cross and the valve or valves beyond the tee or cross. The test shall be performed with fittings and service connections in place and with auxiliary hydrant line valves open. At no time shall any valve be operated in either direction at a differential pressure exceeding the valves' rated working pressure.

The test section shall be filled slowly with potable water and all air expelled through a hydrant or other appurtenance. Water for testing shall be supplied by the Director of Public Works at the nearest suitable location. The Contractor shall be responsible for any loading, hauling, and discharging of the water.

The test section shall then be left undisturbed for 24 hours after which time the test pressure shall be applied.

The test pressure shall be at least 1.5 times the rated working pressure of the pipe at the test point and at least 1.25 times the rated working pressure of the pipe at the highest elevation within the test section, but

the test pressure shall not exceed twice the rated pressure of closed hydrants and shall not exceed the rated pressure of closed resilient seat gate or butterfly valves when such hydrants and valves are on the pressure boundary.

The test shall be maintained for at least two hours and the observed pressure shall not vary more than 5 PSI from the test pressure.

The leakage shall be defined as that volume of water that must be added to maintain the test pressure for the test duration. The leakage shall not exceed that determined by the following formula:

$$L = \frac{S \times D \times \text{Square Root } P}{133200}$$

Where

L = the allowable leakage in gallons per hour

S = the length of pipe tested in feet

D = the nominal pipe diameter in inches

P = the average test pressure in psi during the leakage test

When testing against closed metal-seated valves, an additional leakage per closed metal-seated valve shall be 0.0078 gallons per hour per inch of nominal valve size.

If any test of pipe laid discloses leakage greater than that specified above, the contractor shall, at his expense, locate and make repairs as necessary to reduce the leakage to the specified allowance.

22.15 Disinfection. Before being placed into service, all newly installed main, fittings, appurtenances, and service connections shall be disinfected in accordance with ANSI/AWWA C651-86 except s may be required below. During the disinfection procedure, all hydrants and valves, including meter stops, shall be operated.

The main and appurtenances shall be disinfected by one of the following methods:

- A. Tablet Method. **WARNING:** This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite. This method shall be used only if the pipeline and appurtenances have been kept clean and dry during construction. During installation of the pipeline and appurtenances, calcium hypochlorite tablets or granules containing 65% available chlorine by weight shall be placed in the pipeline. Granules shall be placed at the upstream end of the line, in upstream end of each branch main and at the intervals of 500 feet.

The quantity of granules at each placing shall be:

Pipe Diameter (inches)	Granules (ounces)
4	0.5
6	1.0
8	2.0
12	4.0
16 & larger	8.0

Tablets (5g), when used, shall be attached to the top of each joint of pipe. The tablets shall be attached with an adhesive such as Permatex No.1 or approved equal. Tablets shall also be attached to or crushed in each appurtenance. The number of tablets at each joint of pipe shall be:

Pipe Diameter (inches)	No. 5g Tablets per Section	
	18 ft.	20 ft.
4	1	1
6	1	1
8	2	2
10	3	3
12	4	4
16	6	7

Potable water shall be introduced into the pipeline at a velocity of less than one foot/second. The water shall remain in the line for at least 24 hours. During this 24 hour period all hydrants and valves, including meter stops, shall be operated. If the water temperature is less than 41° F (5°C), the water shall remain in the pipe for at least 48 hours.

B. Continuous Feed Method.

1. Preliminary Flushing. Prior to disinfection, all lines shall be filled to eliminate air pockets and flushed to remove any particulates. The flushing velocity shall be at least 2.5 feet/second.

2. Chlorinating the Pipe. Potable water shall be introduced into the pipe at a constant flow rate. Chlorine shall be added at a constant rate to this flow beginning of the new pipe to be disinfected in such a manner that the water in the pipe has a free chlorine concentration of at least 50mg/l.

The chlorinated water shall remain in the pipe line at least 24 hours, after which the chlorine concentration shall be at least 10 mg/l. During this 24 hour period all hydrants and valves, including meter stops, shall be operated.

C. Slug Method.

1. Pre-chlorination. During installation of the pipeline and appurtenances, calcium hypochlorite granules containing 65% available chlorine by weight shall be placed in the pipeline in accordance with section 22.15.A above.
2. Preliminary Flushing. Prior to slug disinfection, all lines shall be filled to eliminate air pockets and flushed to remove any particulates. The flushing velocity shall be at least 2.5 feet/second.
3. Chlorinating the Pipe. Potable water shall be introduced into the pipe at a constant rate. Chlorine shall be added at a constant rate to this flow at a point not more than ten feet downstream from the beginning of the new pipe to be disinfected in such a manner that the slug of highly chlorinated water in the pipe has a free chlorine concentration of at least 100 mg/l. The chlorine shall be added long enough to insure that all portions of the pipeline are exposed to the 100 mg/l chlorine solution for at least three hours. The chlorine residual in the slug shall be checked at regular intervals not to exceed 2000 feet to insure that adequate residual is maintained. Should the free residual in the slug be less than 50 mg/l, the flow shall be stopped, chlorination equipment moved to the head of the slug, and as the flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/l. As the chlorinated water flows past, all hydrants and valves, including meter stops, shall be operated.

For all methods, after the applicable retention period, the chlorinated water shall be flushed from the line at a velocity of at least 2.5 feet/second using potable water until the chlorine residual leaving the line is no higher than that generally prevailing in the system or is acceptable for residential use.

The heavily chlorinated disinfection water from all methods shall be disposed of in a manner acceptable to the Director of Public Works and in such a manner as to prevent adverse environmental impacts, including, but not limited to, erosion, damage to vegetation, damage to natural habitats, or damage to watercourses. Where, in the Director of Public Works' opinion, adverse environment impact might be done, a reducing agent shall be used to neutralize the chlorine to safe levels prior to disposing of the disinfection water.

Where connections, appurtenances, or fittings are installed on the existing lines, all fittings and the existing line for three feet in each direction from the work shall be swabbed or sprayed with a 1% hypochlorite solution.

22.16. Bacteriological Testing. After the pipeline has been disinfected and flushed, two bacteriological samples taken at least 24 hours apart shall be collected at intervals not to exceed 2000 feet throughout the pipeline. The samples shall be collected and tested by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipeline is placed into service. If coliform

contamination is present, then the disinfection procedure shall be repeated until no coliform contamination is indicated.

Section 30. GENERAL REQUIREMENTS

30.01. General Statement. Standard construction details, specifications and materials standards approved by the Director of Public Works shall be followed unless specific deviation there from is authorized, in writing by the Director of Public Works. In no case shall deviations be allowed from the Virginia Sewerage Regulations without prior written approval of the Virginia Department of Health.

30.02. Type of Sewer. All sewer systems shall be designed and constructed to achieve total containment. Combined storm and sanitary sewers are prohibited.

30.03. Minimum Sizes. The minimum nominal size for public sanitary sewers shall be eight-inch for gravity lines.

30.04. Velocity, Slope and Alignment. Gravity sewers shall be designed for a minimum full-flow velocity of two feet per second. In those gravity sewers in which velocities in excess of 15 feet per second are expected, the pipe shall conform to ASTM or AWWA specifications which provide protection against internal erosion. Velocity in force mains shall be no less than two feet per second but no greater than eight feet per second.

Where a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered to provide a continuous gradient through the manhole. Drop pipes shall be installed in manholes in which the inverts of incoming sewers are 24 inches or higher above the outlet invert.

Sewers with slopes of 20% or greater shall be securely anchored with concrete anchors or other approved methods. Anchorage shall be provided on maximum 36-foot centers for slopes 20% to 35%; maximum 24-foot centers for slopes 35%-50%; and 16-foot centers for slopes exceeding 50%.

Gravity sewers shall be installed with straight horizontal alignment between manholes.

All gravity sewers shall be designed and constructed with continuous and uniform slope or grade between manholes. The following are the minimum slopes that shall be provided; however greater slopes are desirable: (nominal size in inches and slope in per 100 feet)

Size	Slope	Size	Slope	Size	Slope
8	0.40	10	0.28	12	0.22
14	0.17	15	0.15	16	0.14
18	0.12	21	0.10	24	0.08

30.05. Minimum Cover. All sewers and force mains shall have 3 feet of minimum cover from the top of the pipe to the finished grade.

30.06. Manhole and Cleanout Locations. Manholes shall be installed at every change in pipe size, or alignment and at the ends of sewers 8-inch and greater nominal size. The maximum distance between manholes shall be 400 feet for sewers up to 15-inch nominal size and 500 feet for sewers greater than 15-inch nominal size. A cleanout shall be installed at the end of every sewer service lateral.

30.07. Location of Sewers. Sewers shall be located within public rights-of ways or within permanent easements not less than 20 feet in width for collectors and not less than 20 feet in width for inceptors. During construction or reconstruction of the sewer, the easement shall increase to a width of not less than 40 feet centered about the sewer.

30.08. Separation Between Sewers and Potable Water Facilities. Separation between water lines and sanitary sewers shall be as described in Section 20.08 of these Construction Specifications and Standards. The minimum I or II well shall be 50 feet. In addition to the minimum separation between wells of lesser class and any sewer line or lateral of 50 feet, no manhole shall be located within 100 feet of such wells and any sewer within 100 feet of such wells shall be constructed of an AWWA approved water pipe which shall be pressure tested in place.

30.09. Location of Sewers in Relation to Streams and Lakes. Sewers shall be designed to remain fully operational during 25 year recurrence interval floods. Within the 25 year flood plan manholes shall have watertight frames and covers. Ventilation of sewers shall be provided for continuous watertight sections 1000 feet in length or greater. Vents shall be at least 4-inches in diameter, shall be screened. Vent openings shall have openings above the 100 year recurrence interval flood level. Sewers and their appurtenances located along streams or lakes shall be protected against the 100 year recurrence interval flood.

30.10. Force Mains and Sewage Pumping Stations. Sewage force mains and sewage pumping stations must be designed in accordance with the Commonwealth of Virginia Sewerage Regulations. A Certificate to Construct issued by the State Water Control Board must be obtained prior to construction.

30.11. Virginia Sewerage Regulations. These Construction Specifications and Standards are in compliance with the Commonwealth of Virginia Sewerage Regulations. In no case shall the Director of Public Works grant any waiver, deviation or exception that may be contrary to the Sewerage Regulations without prior written approval of the Virginia Department of Health.

Section 31. SEWERAGE FACILITIES MATERIALS

31.01. General Requirements. Unless otherwise approved in writing by the Director of Public Works, or as specifically indicated on plans approved by the Director of Public Works, all pipe, fittings and accessories used within sewerage systems shall be defined in this section.

31.02. Gravity Sewer Pipe.

A. Ductile Iron Pipe. Ductile iron pipe 4-inch and larger shall be centrifugally cast and manufactured in accordance with ANSI/AWWA C151/A21.51. Cast iron pipe and fittings shall be cement-mortar lined in accordance with ANSI/AWWA C104/A21.4. Both the interior and exterior of the pipe and fittings shall have standard coating of bituminous material. Ductile iron pipe shall be at least class 52.

Joints for ductile iron pipe and fittings shall be one of the following:

1. Push-on Joints with Rubber Gaskets. Push-on joints and jointing materials shall comply with ANSI/AWWA C111/A21.11.
2. Mechanical Joints. Mechanical joints and jointing materials shall comply with ANSI/AWWA C111/A21.11.
3. Locked Type Mechanical Joints. The locked type of mechanical joint shall only be used when integral joint restraint is required. No locking system involving set-screws or field welding shall be used when the locked type of joint is the sole means of joint restraint.
4. Flanged Joints. Flanged joints shall be used in meter and valve vaults and where required by the Director of Public Works. Flanges and jointing materials shall comply with ANSI/AWWA C115/A21.15.
5. Gasket Lubricant. Gasket lubricant shall be a tasteless, non-toxic, non-bacterial supporting grease. Gasket lubricant shall not be supplied by the pipe manufacturer.
6. Gaskets. Gaskets shall be supplied by the pipe manufacturer. Transition gaskets shall be labeled with a "T" or the word, "TRANSITION".

B. Polyvinyl-Chloride Pipe. Polyvinyl-Chloride (PVC) pipe shall be one of the following:

1. DR35 PVC. DR35 gravity sewer pipe shall be manufactured in accordance with ASTM D3034. Joints shall consist of an integral wall section with a solid cross section rubber gasket conforming to ASTM D1869. Minimum pipe stiffness at 5 percent deflection shall be 46 PSI as per ASTM D2412.
2. ASTM 1785 PVC. Schedule rated PVC pipe shall be manufactured in accordance with ASTM 1784 and ASTM 1785. The minimum schedule rating shall be scheduled 40. Schedule rated pipe shall be jointed with twin-gasketed couplings.

C. Reinforced Concrete Pipe. Reinforced concrete pipe shall be manufactured in accordance with ASTM C76. The pipe shall be manufactured with Type II Portland cement concrete which

shall have a 28 day compressive strength of 6000 PSI. Each joint shall be longitudinally reinforced with at least six 3/8-inch smooth bars per cage. The pipe shall have a bell and spigot joints with sewage compatible O-ring gaskets which shall be furnished by the pipe manufacturer. The joints shall conform to ASTM C443.

31.03. Force Mains. Piping 4-inch and larger for force mains shall be ductile iron pipes with dual tracer wire, 10 gauge copper connection tracers not to exceed 400 feet.

31.04. Manholes and Cleanouts.

A. Concrete. All concrete work shall be in accordance with the applicable sections of these Construction Specifications and Standards.

B. Concrete. Solid concrete shall only be used to form inverts or to provide vertical spacing or adjustment between the highest pre-cast section or spacer and the manhole frame.

1. Concrete masonry units or segmental concrete manhole block shall conform to ASTM C139.

C. Waterproofing. Waterproofing material shall be Bitumastick 50 or approved equal.

D. Metal Items.

1. Frames, covers, and lids shall be cast to the size, thickness, and shape as shown on the standard details or approved plans. Such items shall be cast of the best quality grey iron in accordance with ASTM A48. The castings shall be sound and machined on all bearing and mating surfaces. Casting shall be sand blasted or cleaned of scale or sand and shall be coated with black asphaltum paint.

2. Manhole steps shall be polypropylene coated cast iron or steel.

E. Pre-cast Concrete Manholes. Pre-cast concrete manhole base sections, risers, eccentric taper units and grade rings shall be constructed of reinforced concrete in accordance with ASTM C478.

The base section shall be the extended type and shall be cast monolithic with the first riser section. Pipe openings shall be as shown on the approved plans and shall be provided with flexible resilient watertight connector sleeves conforming to ASTM C923.

The connector sleeves shall be cast in as a permanent, integral part of the monolithic base casting and shall be fitted with stainless steel pipe locking bands. In the base sections with pre-built inverts, the invert channels shall be smooth, semicircular and conform to the inside of the adjoining sewer pipe. Transitions in channel size and direction shall be gradual. The bench shall be smooth and shall slope to the invert channel at one inch per foot.

The sections shall be a minimum of 5 inches thick and shall be joined with O-ring gaskets conforming to ASTM C443. Polypropylene coated steel steps shall be cast integrally with the riser and cone sections. Lifting holes shall be provided on each section. One coat of bitumastic, 10 mils dry thickness shall be applied to the exterior surface of all manholes.

G. Chimney Seals. The chimney, cone or corbel section of each manhole shall be sealed to the frame using an internal flexible rubber seal as manufactured by Cretex or approved equal.

SECTION 32. SEWER LINE CONSTRUCTION

32.01. General Requirements. The sewer lines shall be laid and maintained to the required lines and grades with all appurtenances set at the required locations as shown on the approved plans for the project or as directed by the Director of Public Works.

Whenever during the progress of the work obstructions or conditions not shown on the plans are encountered which interfere to such an extent that an alteration in the plans is required, the Director of Public Works shall be advised and approval given before such alterations are made.

All pipe shall be laid with a minimum cover of 36 inches measured from the finish grade to the top of the pipe.

All pipe and appurtenances shall be installed according to the manufacturer's recommendations.

32.02. Work within Highway Rights of Way. All work performed within or requiring utilization of any City of Fredericksburg rights of way shall comply with the following:

- A. A Special Excavation Permit must be obtained from the Department of Public Works. The work must comply with the latest edition of VDOT's Bridge and Road Specifications and the general provisions of the VDOT's Land Use Permit Manual unless the Director of Public Works approves otherwise in writing.
- B. No trees or tree roots larger than 3 inches in diameter shall be cut without written authorization of the director of Public Works.
- C. All measures necessary or as may be required by the Director of Public Works shall be taken to safely accommodate pedestrian and vehicular traffic. The unnecessary obstruction of streets and/or sidewalks shall not be allowed. At least one traffic lane shall be kept open at all times and streets and sidewalks shall be kept clear and clean during all phases of construction unless authorized by the Director of Public Works.

32.03. Protection of Existing Underground Utilities. All work shall be performed in compliance with:

A. Water Supply Interconnections. There shall be no physical connection between the 's water system and any private water supply system or any sewer system.

B. All work shall be performed in compliance with the "Underground Utility Damage Prevention Act", Title 56, Chapter 10.3, Sections 56-265.14 through 56-265.29 of the Code of Virginia, as amended.

32.04. Disruption of Water Service During Construction. Water service disruption during sewer construction shall comply with:

A. Prior to any planned disruption of existing water service, the Director of Public Works shall be notified at least two full working days prior to the disruption. The Director of Public Works may require rescheduling of disruption.

B. Should an unplanned but intentional disruption be unavoidable, the Director of Public Works shall be notified as soon as possible. The Director of Public Works may reschedule the disruption.

C. Should an accidental or unintentional disruption occur, the Director of Public Works shall be notified immediately. The Director of Public Works may issue specific instructions which the contractor shall implement as required.

32.05. Occupational Safety and Health. All work shall be performed in accordance with the "Occupational Safety and Health Standards" and the "Construction Safety and Health Regulations" of the U.S. Department of Labor's Occupational Health and Safety Administration.

32.06. Clearing and Grubbing. Where clearing and grubbing is required, the Contractor shall clear the required work area of all trees, shrubs, brush, rubbish, and other materials. Only those areas in which the work is to be performed and those areas which must be utilized to gain access to the work shall be cleared. The Contractor shall make every effort to minimize the area to be cleared and grubbed and explosives shall not be used during the clearing. The debris from the clearing and grubbing operations shall be removed from the site or disposed of in an approved manner.

Where ornamental trees or shrubs, domestic fruit trees, or other cultivated or tended trees, bushes or shrubs are encountered during the work, such vegetation shall be uprooted so as not to harm their viability and shall be stored or replanted as directed by the Director of Public Works.

All clearing and grubbing shall be performed in a manner to minimize the effects of sedimentation and erosion. The work shall be done in accordance with all applicable sedimentation and erosion control ordinances.

32.07. Excavation. The trench shall be excavated to the alignment, depth, and grade as shown on the plans or as required by the Director of Public Works. The maximum length that a trench can be open including backfilled trenches which are not suitable for traffic shall be 200 feet. Trench widths shall be sufficient to allow for proper jointing of the pipe, for proper installation of backfill and bedding, and for installation of manholes or other appurtenances.

Where conditions dictate, the trench shall be stabilized by sheeting, shoring, or bracing or the width of trench shall be increased in order to insure the safety of workmen, existing structures, and the surrounding area.

Ledge rocks, boulders, and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and appurtenances for pipes up to 24-inch nominal size. The specified minimum clearance is the minimum clear distance which will be permitted between any part of the pipe or appurtenance and any projection or joint of any such rock, boulder or stone.

The bottom of the trench shall be at the required depth so as to provide a continuous and uniform bearing and support for the pipe. Bell holes shall be provided at each joint. Trenching below specified grade shall be backfilled with approved materials and shall be thoroughly compacted.

Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workmen, obstruct nor endanger traffic, obstruct sidewalks, driveways or other structures.

Discharge from any trench dewatering pump shall be conducted to natural drainage channels or storm sewers in such a manner not to create a nuisance or endanger traffic or workmen.

Should the trench pass over or through any previous or existing trench, the new trench bottom shall be sufficiently compacted to provide support equal to that of the native soil.

When the sub-grade is found to include unsuitable materials such as ashes, cinders, refuse, organic material, or other unsuitable material, the unsuitable material shall be removed as directed by the Director of Public Works and replaced with approved suitable backfill. Should the sub-grade be found to be unstable and cannot be removed or replaced, then a suitable foundation for the pipe and appurtenances shall be provided as directed by the Director of Public Works.

Where pavement has to be excavated, the pavement shall first be cut with mechanical pavement cutting equipment along a straight line with a vertical face.

32.08. Backfill. Unless bedding type dictates otherwise, backfill material shall consist of selected material from the excavation, and shall be free of large clods, cinders, ashes, refuse, vegetable or organic material, boulders, frozen or excessively wet soil, stones, rocks, or broken concrete rubble.

The backfill from the trench bottom to at least one foot over the top of the pipe shall be free of earth clods or stones greater than 1 inch in diameter and shall be hand placed and thoroughly compacted by mechanical means and shall be free of rocks or stones larger than 2 inches in their greatest dimension. The remainder of the backfill shall be placed in lifts not to exceed two feet and thoroughly tamped.

Where the excavation has been made through pavement, curbs, driveways, and sidewalks the backfill shall of approved select backfill material and shall be compacted in six-inch layers to a minimum of 95% theoretical density at optimum moisture content.

The area around manholes shall be backfilled in a like manner.

32.09. Pipe Installation. Unless otherwise shown on the plans or otherwise required by the Director of Public Works sewers shall be laid using the standard gravel bedding shown in the standard details.

Pipe, fittings, and other accessories and appurtenances shall be loaded and unloaded by lifting with hoists or by skidding so as to avoid shock or damage. Under no circumstances shall these materials be dropped or skidded or rolled against any pipe already on the ground or already installed. Pipe and fittings shall be handled so that the coatings and linings shall not be damaged. No damaged pipe, fittings, or other accessories and appurtenances shall be installed. The pipe may be strung prior to installations of conditions allow and with approval of the Director of Public Works. The sewer pipe shall be installed with bells upstream and such that the completed pipe shall have a smooth invert.

Precaution shall be taken to keep the interior of the pipe free of dirt, cement, or other foreign material. As each length of pipe is placed in the trench each joint shall be assembled according to the manufacturer's recommendations, all jointing surfaces including gaskets shall be wiped dry and clean before the pipe or fitting is installed. When hydraulic equipment is used to push home the pipe a block of wood shall be placed between the pipe being pushed and the pushing device to prevent damage to the pipe. When pipe materials other than ductile iron are used, the use of lifting or hydraulic equipment to push home the pipe is prohibited. Once the joint is made the pipe shall be secured in place with the approved backfill material.

At times, when the work is not in progress, the open ends of pipes and fittings shall be closed to prevent the entry of earth, water, cement or other foreign matter.

Cutting of the pipe shall be done without damage to the pipe or linings, and shall be done only by experienced workmen. All cuts shall leave a smooth end and shall be made at right angles to the axis of the pipe. All cutting debris shall be removed from the pipe.

Force main shall be installed in accordance with the applicable parts of Section 22 above. Force mains shall have air release valves placed at all high points.

32.10. Manhole Installation. Manholes shall be installed according to the locations, depths, and heights as shown on the approved plans. The base sections shall be installed on a 12-inch bed of crushed stone.

Each section shall be carefully set in place above the previously installed section. All lifting holes shall be patched flush with mortar upon completion of setting of the manholes.

Where allowed, brick or masonry unit components shall be constructed in accordance with the dimensions shown in the standard details. Bricks and masonry units shall be laid in a full mortar bed with joints ½ inches thick and shall be laid only at temperatures greater than 40 degrees Fahrenheit, and shall be protected from freezing for at least 48 hours. Invert channels, benches, and pipe holes shall be constructed as described in Section 31.03.F above. The interior and exterior shall be pargeted with ½-inch thick mortar.

Pipe connections to existing manholes and new manholes set over existing sewers shall be made so as to conform as nearly as possible to the essential applicable requirements for new manholes.

Manholes on the discharge ends of force mains shall have an interior coating of bituminous paint or other acid resistant liner.

Force mains shall enter manholes through saxophone bends as shown in Standard Details (S-6).

32.11. Service Connections or Laterals. Laterals shall be installed as indicated on the approved plans. Service connections shall be made to the main sewer by means of tees or wyes of the same material as the main, or by using approved strapped sewer service saddles. When sewer saddles are used, the hole in the main sewer shall be cut using hole saws and the hole shall not be made by chipping the wall section out with a hammer.

The minimum grade on a lateral shall be 1/4-inch per foot for 4-inch pipes and 1/8-inch per foot for 6-inch pipes and each service connection shall terminate with a cleanout to be located at the easement boundary or property line. Each service connection shall be capped or plugged as directed by the Director of Public Works.

32.12. Highway and Railroad Crossings. Unless otherwise approved by the Director of Public Works sewers crossing highways shall be installed by jacking, boring, or tunneling in accordance with requirements of the Virginia Department of Transportation.

Railroad crossings shall be installed according to the requirements and permit provisions imposed by the Railroad Company.

All boring, jacking and tunneling shall be completed prior to the construction of adjacent sections. Approved casing materials shall be used where required.

On any oversize borings the cavity between the casing and the bore shall be pneumatically grouted as shall any unfurnished borings.

Within the casting, the sewer shall be installed so as to preserve the integrity of the joints.

32.13. Buried Stream Crossings. Buried stream crossings shall be installed using restraint mechanical joint ductile iron pipe with a nominal size equal to that of the adjoining sewer pipe, or the next larger nominal size if equal sizes are not available. The crossing shall be tested in place and shall be exhibit

zero leakage. The ductile iron pipe shall extend at least 10 feet beyond each bank and shall be installed with concrete anchors as required by the Director of Public Works. The tops of all sewers entering or crossing streams shall be at least 3 feet below the bottom of the stream bed. Should 3 feet of cover not be obtainable, the sewer shall be encased in concrete.

32.14. Aerial Crossings. Aerial crossings of any kind shall consist of a carrier sewer installed within a bituminous coated continuously welded steel casing pipe which is suitably supported.

32.15. Restoration. Restoration of disturbed areas shall be in accordance with:

A. All areas within the construction limits or utilized during construction shall, upon completion of the work within a section, be completely restored to a condition equal or better than that which existed prior to construction. Restoration shall include, but not be limited to, pavement, concrete, grassed plots, fences, signs, ornamental shrubbery or trees, drainage structures, other public or private improvements. VDOT roadway pavement restoration shall be in accordance with the VDOT's permit provisions. Restoration shall be finished in a neat and uniform condition and within a schedule acceptable to the Director of Public Works.

32.16. Acceptance Testing of Gravity Sewers. Hydrostatic infiltration, hydrostatic ex-filtration, air, or deflection testing will be performed as directed by and in the presence of the Director of Public Works. Should any section of pipe fail any required test, that section shall be repaired or replaced as directed by the Director of Public Works.

A. Hydrostatic Infiltration Test. After backfilling, the trench shall be thoroughly saturated with water to a depth of 4 feet above the crown of the pipe. The infiltration shall be measured three times at least one hour apart at the nearest downstream manhole. The average of the three measurements shall not exceed 100 gallons per inch of diameter per day per mile for any section between adjoining manholes.

B. Hydrostatic Ex-filtration Test. The inlet to the lower manhole in the test section shall be plugged, and the upper manhole shall be filled with water to the top of the manhole or four feet above the crown of the outlet pipe whichever is the lesser. Leakage from the sewer including manholes shall not exceed 100 gallons per inch diameter per day per mile for any section between adjoining manholes.

C. Air Testing. Where required by the Director of Public Works, the Contractor shall provide all equipment, materials and labor to perform an air test. The air test shall be performed in accordance with ASTM C828. The air testing equipment and air hose configuration shall be subject to approval by the Director of Public Works.

Prior to air testing the pipe section, pneumatic plugs with sealing lengths equal to or greater than the pipe diameter shall be tested by setting the plugs on each end of a joint of pipe. The plugs

shall then be air pressurized to 25 PSIG, then the pipe to 5 PSIG. The plugs shall withstand this test procedure without movement or bracing.

Each pipe section between manholes shall be tested by installing a tested plug on each end of the section being tested and pressuring the plugs to 25 PSIG. The pipe section shall then be pressurized with low pressure air until the air pressure inside the pipe is 4 PSIG greater than the hydrostatic pressure of any water standing over the pipe. After the pressure has been stabilized to at least 3/5 PSIG greater than the hydrostatic pressure, the air supply to the control panel shall be disconnected and the time over which a one PSIG pressure loss occurs shall not be less than given below.

Test Length (feet)	Nominal Size (inches)					
	4	6	8	10	12	14
	Time in Minutes: Seconds					
25	0:04	0:10	0:18	0:28	0:40	0:54
50	0:09	0:20	0:35	0:55	1:19	1:48
75	0:13	0:30	0:53	1:23	1:59	2:42
100	0:18	0:40	1:10	1:50	2:38	3:36
125	0:22	0:50	1:28	2:18	3:18	4:30
150	0:26	0:59	1:46	2:45	3:58	5:23
175	0:31	1:09	2:03	3:13	4:37	6:17
200	0:35	1:19	2:21	3:40	5:17	6:37
225	0:40	1:29	2:38	4:08	5:40	6:37
250	0:44	1:39	2:56	4:35	5:40	6:37
275	0:48	1:49	3:14	4:43	5:40	6:37
300	0:53	1:59	3:31	4:43	5:40	6:37
325	0:57	2:09	3:47	4:43	5:40	6:40
350	1:02	2:19	3:47	4:43	5:40	7:11
375	1:06	2:29	3:47	4:43	5:40	7:42
400	1:10	2:38	3:47	4:43	6:02	8:13
	15	16	18	20	21	24
Test						

Length (feet)	Time in Minute: Seconds					
25	1:02	1:10	1:29	1:50	2:01	2:38
50	2:04	2:21	2:58	3:40	4:03	5:17
75	3:06	3:31	4:27	5:30	6:04	7:55
100	4:07	4:42	5:56	7:20	8:05	10:37
125	5:09	5:52	7:26	9:10	9:55	11:20
150	6:11	7:02	8:30	9:27	9:55	11:20
175	7:05	7:33	8:30	9:27	9:55	11:20
200	7:05	7:33	8:30	9:27	9:55	12:04
225	7:05	7:33	8:30	9:27	10:24	13:35
250	7:05	7:33	8:30	10:29	11:33	15:05
275	7:05	7:33	9:20	11:31	12:42	16:36
300	7:05	8:03	10:11	12:34	13:52	18:06
325	7:40	8:43	11:02	13:37	15:01	19:37
350	8:15	9:23	11:53	14:40	16:10	21:07
375	8:50	10:03	12:44	15:43	17:19	22:38
400	9:26	10:44	13:35	16:46	18:29	24:08
425	10:01	11:24	14:26	17:49	19:38	25:39
450	10:36	12:04	15:16	18:51	20:47	27:09
475	11:12	12:44	16:07	19:54	21:57	28:40
500	11:47	13:25	16:58	20:57	23:06	30:10

D. Deflection Testing. Sewers constructed of DR35 PVC pipe shall be subjected to a deflection test using a pull-through device. The test shall be performed after completion of all work along and over the pipeline, including other acceptance testing, backfilling, grading, concreting, and restoration; and after any superimposed live or dead loads have been applied. The deflection of the installed pipe under all external loads shall not exceed 7.5% of the pipe's average inside diameter +/- manufacturers' tolerances.

The pull-through device shall be approved by the Director of Public Works and shall be of a design conforming to Uni-Bell Plastic Pipe Association publication UNI-B-5-82.

The test shall be conducted by either pulling or flushing, with water, the test device through each section of pipe. If the device fails to pass freely through a pipe section, the pipe section with excess deflection shall be replaced and retested as required by the Director of Public Works.

The Director of Public Works may perform a warranty period deflection test just prior to one year from the date of original testing. Should the pipe deflection exceed 8%, the Contractor shall

be required to replace the pipe section with excess deflection. The replacement pipe shall be installed in accordance with these Construction Specifications and Standards.

E. Leakage Testing of Manholes in Relation to Hydrostatic Testing of Sewer Lines. Manholes may be tested for leakage at the same time that gravity sewer lines are being hydrostatically tested for leakage. For manholes greater than 4 feet in depth whose entire depth was not included in the hydrostatic testing of the sewer line, the manholes shall be tested by ex-filtration. Inflatable stoppers shall be used to plug all lines into and out of the manhole being tested. The manhole shall be filled with water to the top of the rim. A maximum 12-hour soak period shall be allowed. Leakage shall not exceed 0.5 gallons per hour.

F. Leakage Testing of Manholes in Relation to Air Testing of Sewer Lines. If air testing of sewer lines is employed, the manholes shall normally be tested by ex-filtration. Inflatable stoppers shall be used to plug all lines into and out of the manhole being tested. The stoppers shall be positioned in the lines far enough from the manhole to insure testing of those portions of the lines not air tested. The manhole shall then be filled with water to the top of the rim. A maximum 12-hour soak shall be allowed. Leakage shall not exceed 0.5 gallons per hour.

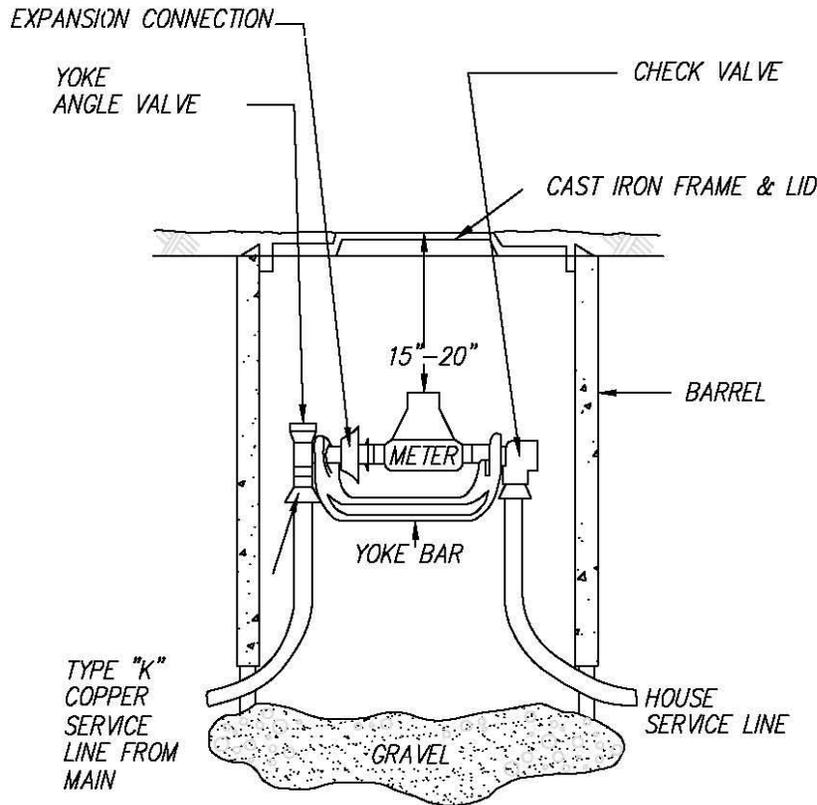
G. Vacuum Testing For Concrete Sewer manholes. All manholes shall be vacuum tested in accordance with the manufacture's recommendation.

32.17. Acceptance Testing of Force Mains. Force mains shall be subjected to a pressure test as described in Section 22.14 above.

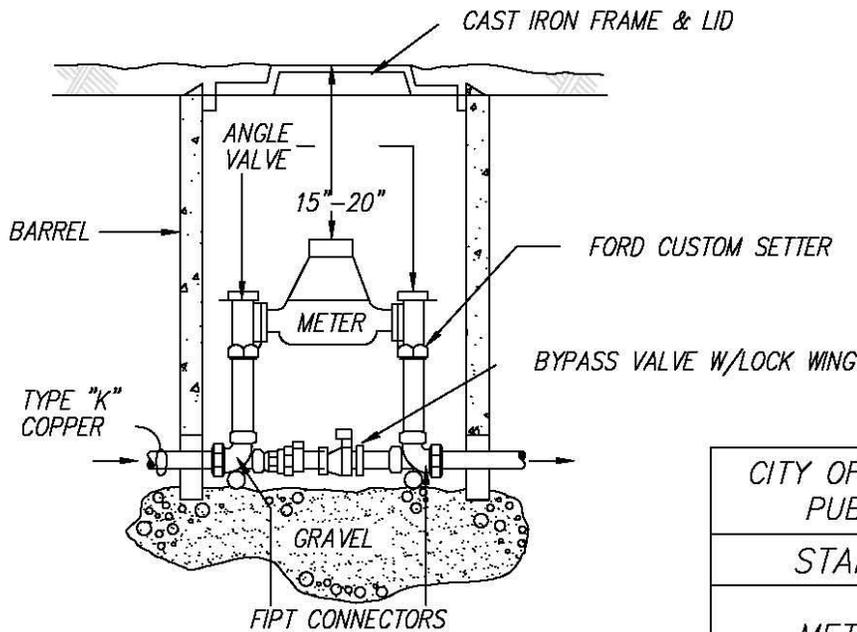
The test pressure shall be the greater of the rated working pressure of the pipe or 1.5 times the design operating pressure.

TYPE	STANDARD		YOKE		CUSTOM	SETTER	W/BYPASS
METER SIZE (IN.)	$\frac{5}{8} \times \frac{3}{4}$		$\frac{3}{4}$		1	$1\frac{1}{2}$	2
*METER (OR APPROVED EQUAL)	BADGER		BADGER		BADGER	BADGER	BADGER
BARREL DIAMETER (IN.)	18		18		24	30	36
METER YOKEBAR/SETTER	FORD Y502		FORD Y503		FORD Y504	VVF 66-12	VVF 77-12

* TO BE PROVIDED BY CITY AFTER PAYMENT OF ALL FEES



SETTING UP TO 1"



SETTING UP TO 1 1/2" & 2"

CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

METER SETTINGS FOR
UP TO 2" METERS

AUGUST 2007

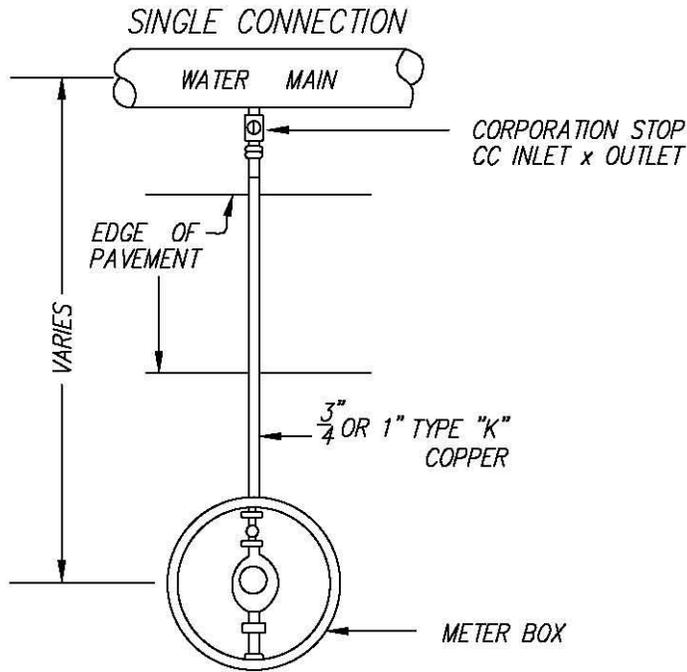
W1

IN EXISTING SUBDIVISION

NOTE
 IN AREAS WITH CURB & GUTTERS AND SIDEWALKS, METERS SHALL BE SET IN THE UTILITY STRIP BETWEEN THE CURB AND THE SIDEWALK. OTHERWISE THE METER SHALL BE SET AT RIGHT-OF-WAY

IN NEW SUBDIVISION

NOTE
 WATERMETER SHALL BE SET BEHIND SIDEWALKS.



SIZE	CORPORATION STOPS	
	INLET	OUTLET
3/4"	CC	PACK JOINT CONNECTION
1"	CC	PACK JOINT CONNECTION

CITY OF FREDERICKSBURG, VA
 PUBLIC WORKS DEPT.

STANDARD DETAILS

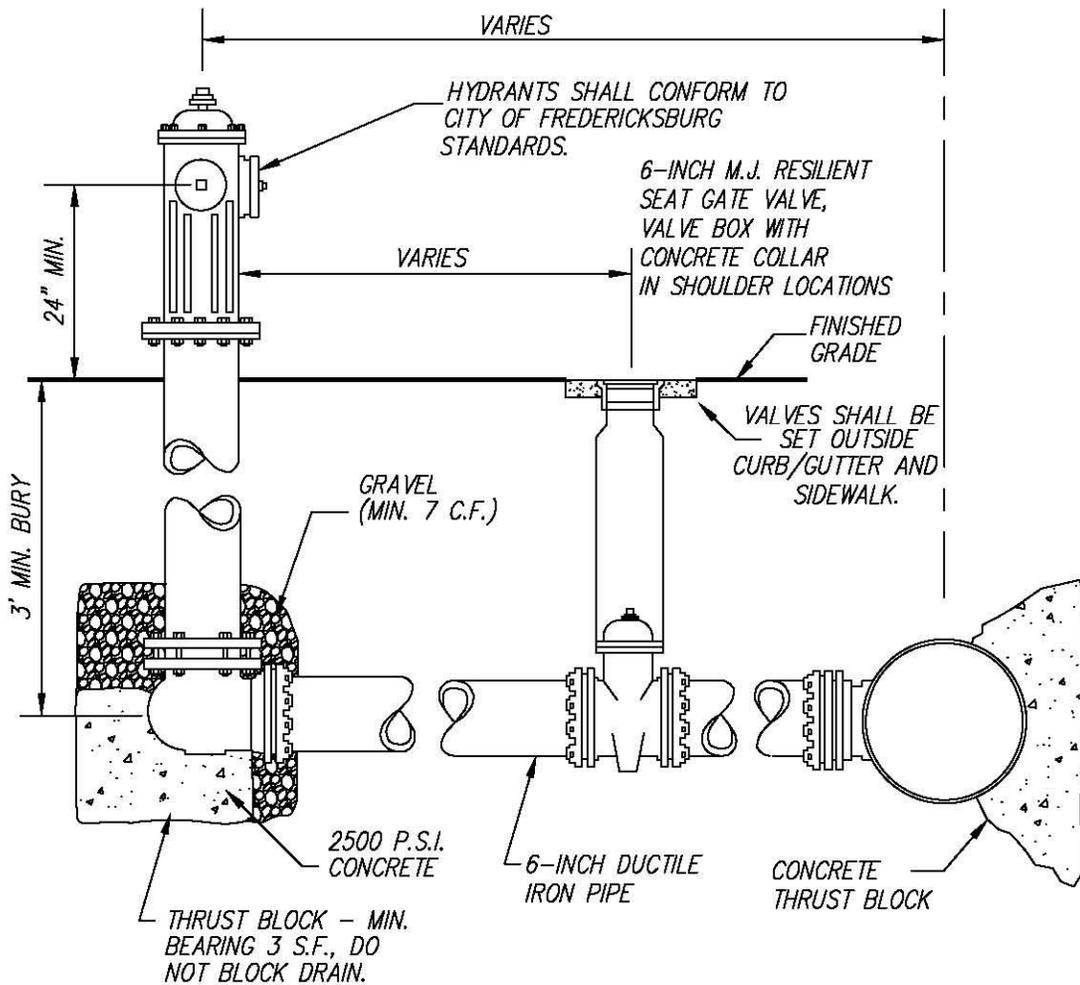
WATER SERVICE
 CONNECTIONS FOR SIZES
 UP TO 1"

AUGUST 2007

W2

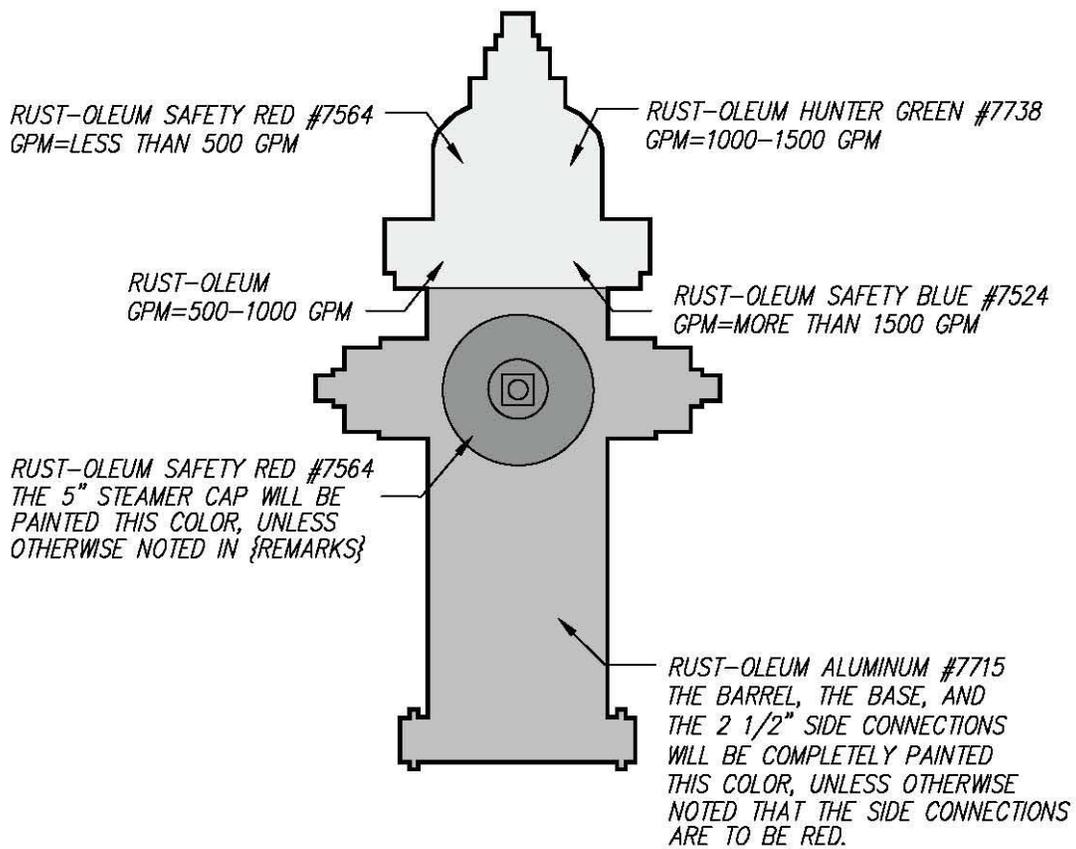
NOTES:

1. THRUST BLOCKS SHALL BE POURED AGAINST UNDISTURBED SOIL.
2. PLACE CONSTRUCTION PAPER BETWEEN FITTINGS AND CONCRETE.
3. MEGALUG RETAINER GLAND (SERIES 1100) AS MANUFACTURED BY EBAA IRON INC. OR APPROVED EQUAL SHALL BE USED.
4. FIRE HYDRANT SHALL BE RESTRAINED FROM THE HYDRANT BASE TO THE BRANCH TEE.
5. ALL VALVES LOCATED OUTSIDE THE PAVEMENT ARE TO HAVE PVC UTILITY MARKERS AS MANUFACTURED BY CARSONITE INTERNATIONAL (CUM-375) OR APPROVED EQUAL (SEE W-12).



CITY OF FREDERICKSBURG, VA PUBLIC WORKS DEPT.	
STANDARD DETAILS	
FIRE HYDRANT ASSEMBLY	
AUGUST 2007	W3

NOTE:
 DEPENDING ON GPM FOR THE HYDRANT,
 ONLY THE "BONNET" WILL BE COMPLETELY
 PAINTED THE SPECIFIC COLOR



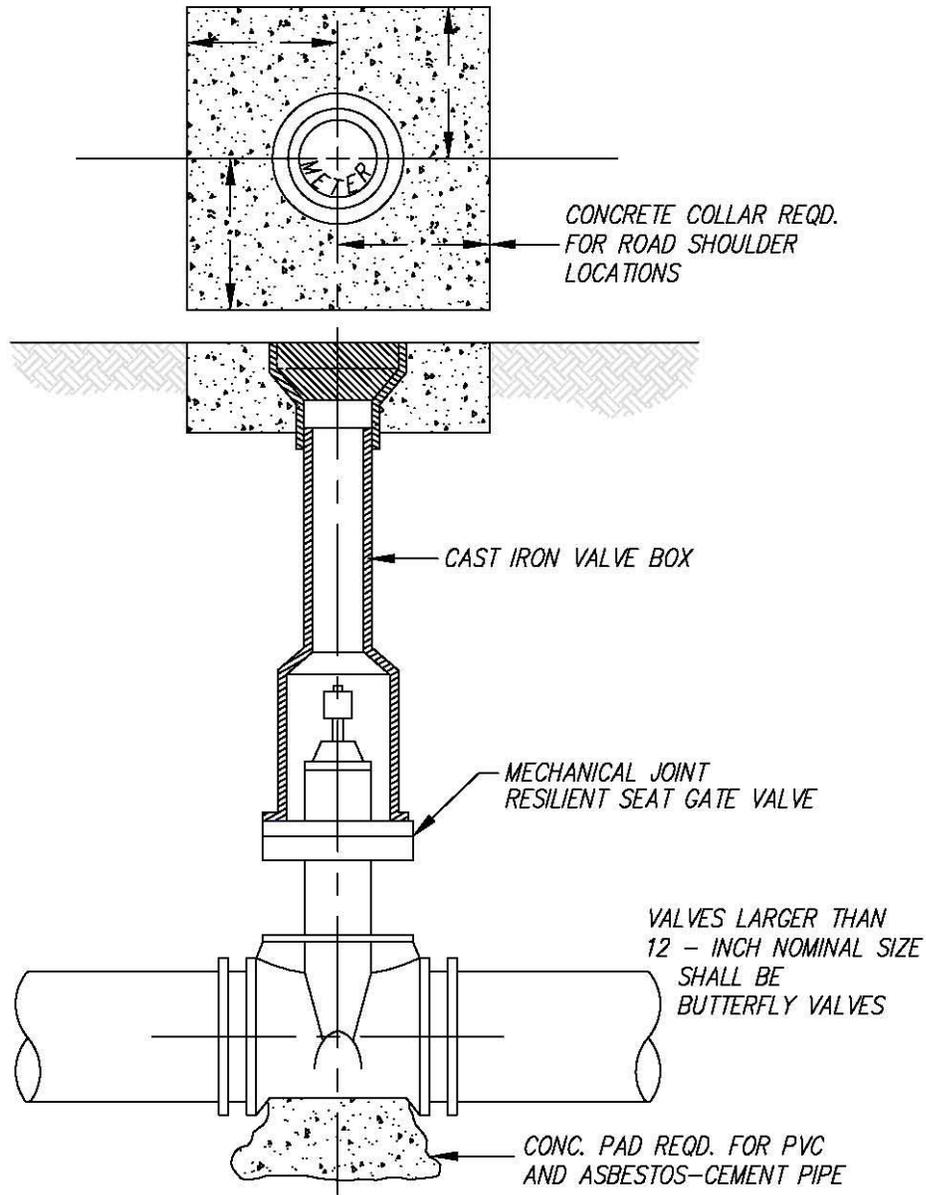
CITY OF FREDERICKSBURG, VA
 PUBLIC WORKS DEPT.

STANDARD DETAILS

FIRE HYDRANT
 PAINTING COLOR CODE

AUGUST 2007

W3A



CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

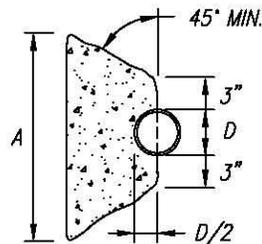
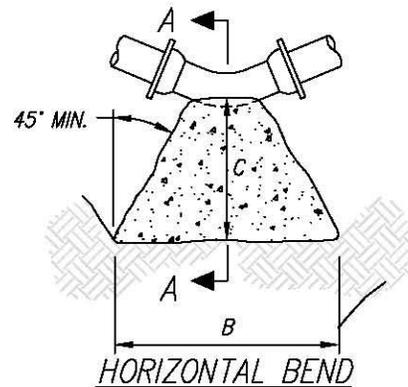
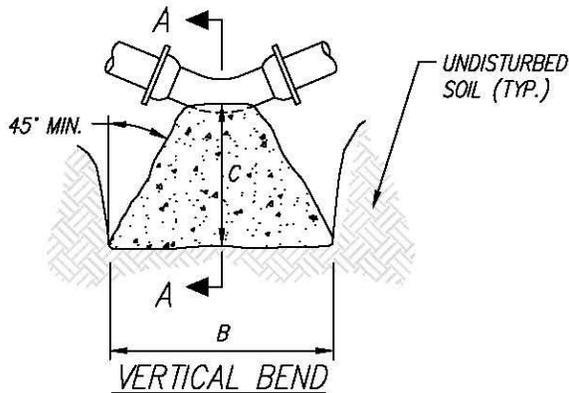
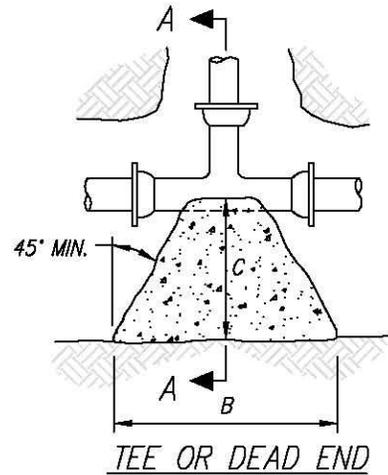
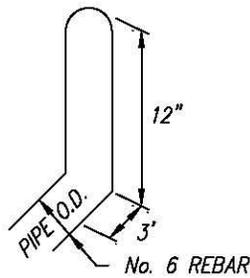
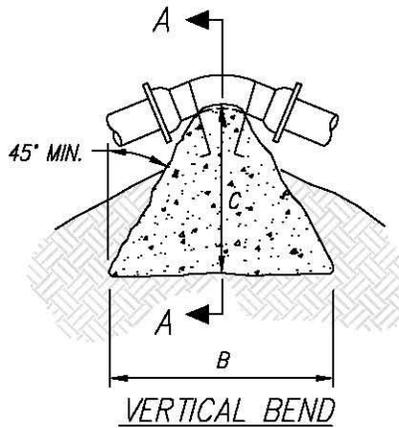
STANDARD DETAILS

VALVE BOX INSTALLATION
AND VALVE SETTING

AUGUST 2007

W4

SIZE	TEE OR DEAD END			90° BEND			45° BEND			22 1/2 & 11 1/4 BEND		
	A	B	C	A	B	C	A	B	C	A	B	C
6"	2'-0"	3'-0"	1'-6"	2'-6"	3'-0"	2'-0"	1'-6"	2'-6"	1'-6"	1'-6"	2'-6"	1'-6"
8"	3'-0"	4'-0"	3'-0"	4'-0"	4'-0"	3'-0"	3'-0"	3'-0"	3'-0"	2'-0"	3'-0"	3'-0"
10"	3'-0"	4'-5"	3'-0"	4'-0"	5'-0"	3'-0"	3'-0"	4'-0"	3'-0"	2'-6"	3'-0"	3'-0"
12"	4'-0"	6'-0"	3'-0"	6'-0"	6'-0"	3'-0"	4'-0"	5'-0"	3'-0"	3'-0"	3'-0"	3'-0"
16"	6'-0"	7'-0"	4'-0"	8'-0"	8'-0"	4'-0"	6'-0"	6'-0"	3'-0"	4'-0"	4'-0"	3'-0"
20"	8'-0"	8'-0"	5'-0"	9'-0"	10'-0"	5'-0"	6'-0"	8'-0"	4'-0"	4'-0"	6'-0"	3'-0"



SECTION A-A

NOTES:

1. WRAP FITTINGS WITH BUILDING PAPER.
2. CONCRETE SHALL NOT INTERFERE WITH FITTING JOINTS
3. THRUST BLOCKS SHALL BE 2,500 P.S.I. CONCRETE

CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

CONCRETE THRUST
BLOCK

AUGUST 2007

W5

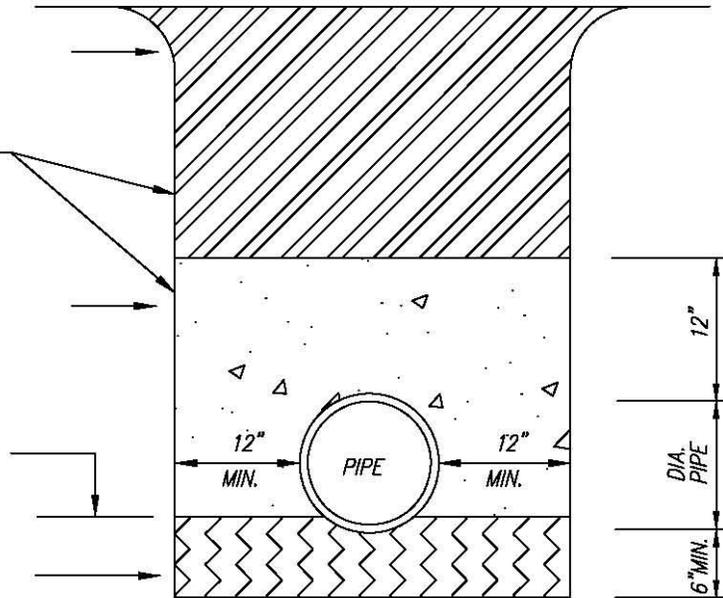
IN NON PAVED AREAS PROVIDE
BACKFILL COMPACTED TO 95%
MAXIMUM DENSITY PER ASTM D698.

IN PAVED AREAS BACK FILL WITH VDOT
NUMBER 21A STONE, FULL DEPTH PER
ASTM D698.

TRENCH BACKFILL COMPACTED TO 95%
MAXIMUM DENSITY PER ASTM D698.

EXTEND BEDDING TO 1/8 PIPE
DIAMETER, 4 INCHES MINIMUM ABOVE
BOTTOM OF PIPE. EXTEND BEDDING
TO SPRINGLINE FOR PVC PIPE.

BEDDING COMPACTED TO 95% MAXIMUM
DENSITY PER ASTM D698.



MATERIALS FOR PIPE BEDDING AND TRENCH BACKFILL SHALL BE CLASS II IN ACCORDANCE WITH ASTM D2321 AS FOLLOWS:

CLASS II COARSE SANDS AND GRAVELS WITH MAXIMUM PARTICLE SIZE OF 44MM (1.5"), INCLUDING VARIOUSLY GRADED SANDS AND GRAVELS CONTAINING SMALL PERCENTAGES OF FINES. GENERALLY GRANULAR AND NONCOHESIVE, EITHER WET OR DRY. SOIL TYPES GW, GP, SW AND SP ARE INCLUDED IN THIS CLASS AS SPECIFIED IN ASTM D2487.

BEDDING AND BACKFILL SHALL BE IMPORTED MATERIAL FROM AN APPROVED SOURCE.

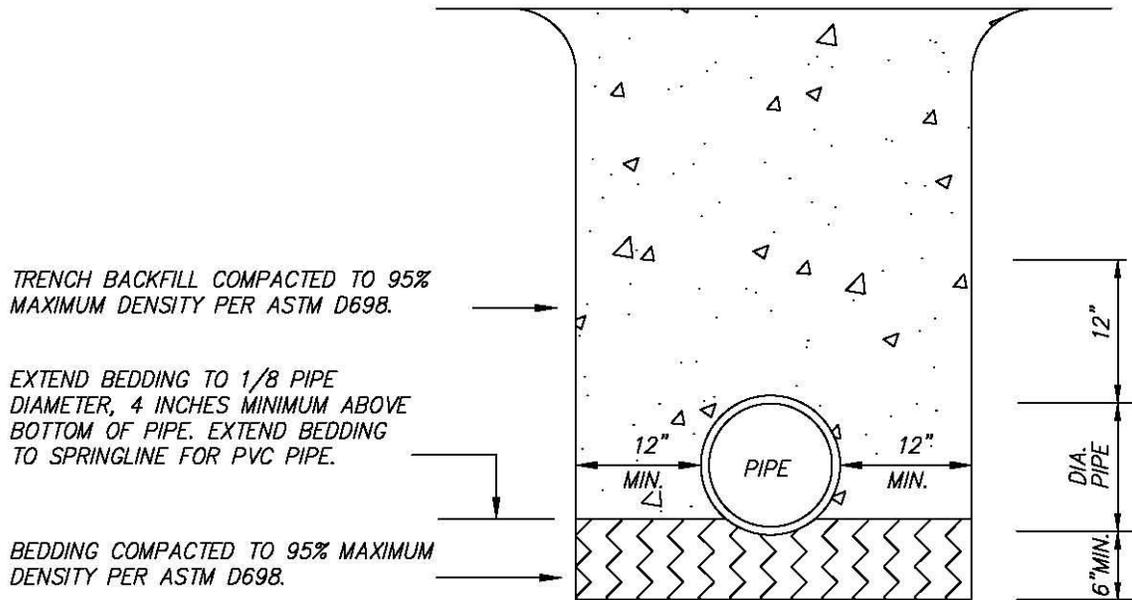
CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

TYPICAL PIPE BEDDING
(PAVED AREAS AND OTHER AREAS
WHEN IN-SITU MATERIAL UNSUITABLE)

AUGUST 2007

W6A



MATERIALS FOR PIPE BEDDING AND TRENCH BACKFILL SHALL BE CLASS II IN ACCORDANCE WITH ASTM D2321 AS FOLLOWS:

CLASS II COARSE SANDS AND GRAVELS WITH MAXIMUM PARTICLE SIZE OF 44MM (1.5"), INCLUDING VARIOUSLY GRADED SANDS AND GRAVELS CONTAINING SMALL PERCENTAGES OF FINES. GENERALLY GRANULAR AND NONCOHESIVE, EITHER WET OR DRY. SOIL TYPES GW, GP, SW AND SP ARE INCLUDED IN THIS CLASS AS SPECIFIED IN ASTM D2487.

BEDDING SHALL BE IMPORTED MATERIAL FROM AN APPROVED SOURCE.

TRENCH BACKFILL SHALL BE IN-SITU EXCAVATED MATERIAL. THE CONTRACTOR SHALL TAKE CAUTION TO PREVENT CONTAMINATION OF BACKFILL MATERIAL.

CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

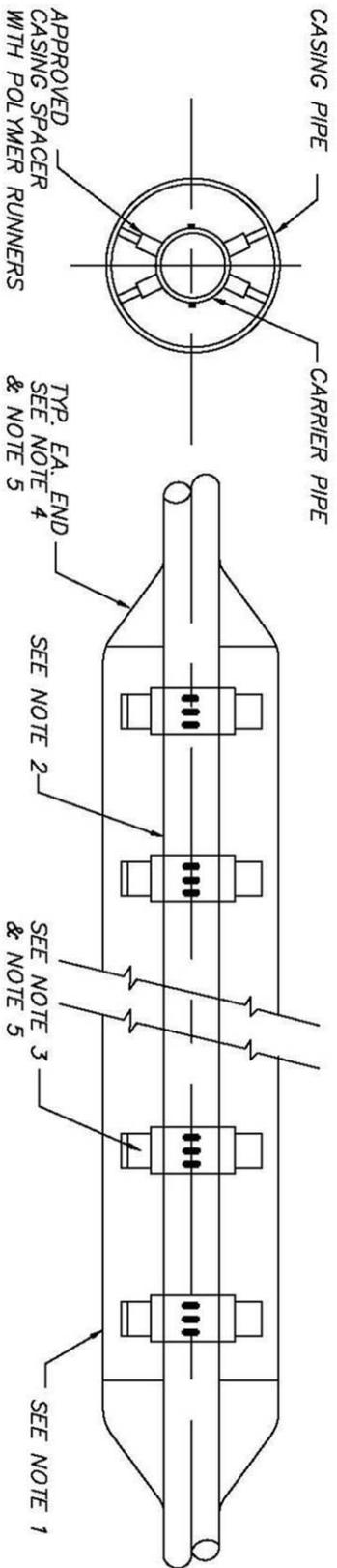
TYPICAL PIPE BEDDING
(PAVED AREAS AND OTHER AREAS
WHEN IN-SITU MATERIAL UNSUITABLE)

AUGUST 2007

W6B

IN LINE VALVE

HORIZONTAL BEND



NOTES

1. CASING PIPE SHALL BE SMOOTH WALL STEEL PIPE IN ACCORDANCE WITH SECTION 232 OF VDOT'S ROAD AND BRIDGE SPECIFICATIONS WITH A MINIMUM WALL THICKNESS OF .500".
2. D.I. WATER MAIN.
3. CASING SPACERS SHALL HAVE A TWO PIECE STAINLESS STEEL BODY WITH A PVC WITH A MINIMUM THICKNESS OF .090". RUNNERS SHALL BE GLASS REINFORCED PLASTIC OR ULTRA HIGH MOLECULAR WEIGHT POLYMER, A MIN. OF 11" LONG.
4. CASING END SEALS SHALL BE PULL ON TYPE MOLDED FROM SYNTHETIC RUBBER. SEAL SHALL BE ATTACHED TO CASING & PIPE BY BAND CLAMPS. BAND CLAMPS SHALL BE TYPE 304 STAINLESS STEEL. SEALS SHALL HAVE MOLDED SEATS FOR PROPER LOC. OF BANDS.
5. CASING SPACERS AND END SEALS SHALL BE MANUFACTURED BY PIPELINE SEAL AND INSULATOR, INC (PSI), CASCADE WATERWORKS MFG, ADVANCE PRODUCTS & SYSTEMS, INC. (APS) OR AN APPROVED EQUAL.
6. CASING SIZE SHALL BE DETERMINED BY THE ENGINEER.

CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

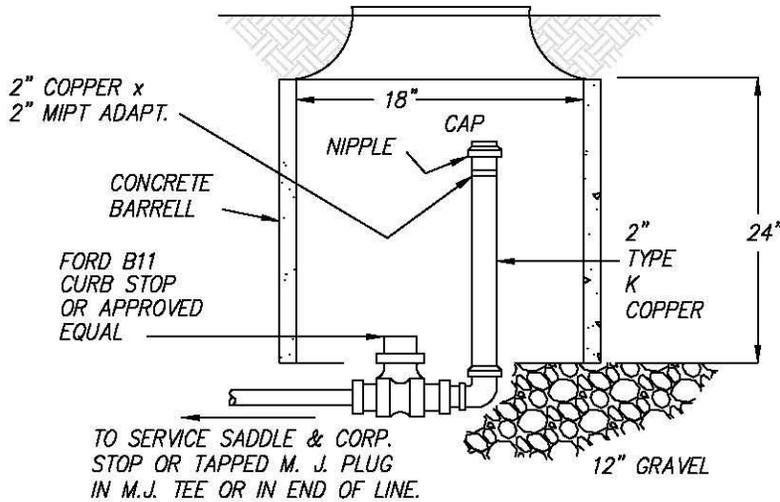
BORED ROAD CROSSING

AUGUST 2007

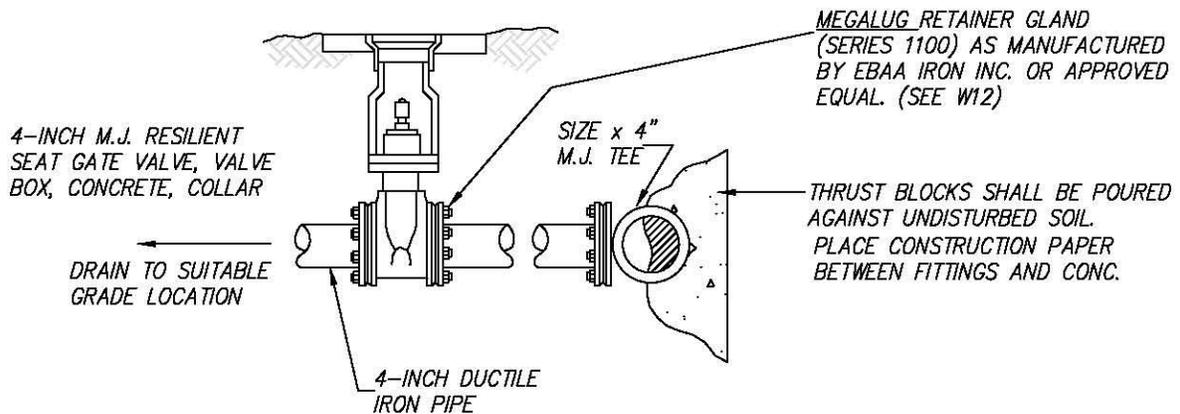
W7

NOTE:
DO NOT INSTALL IN
AREAS SUBJECT TO
FLOODING

FORD FORM & LID C52
OR APPROVED EQUAL



BLOW-OFF ASSEMBLY FOR
WATER LINES UP TO 4-INCHES
NOMINAL SIZE



BLOW-OFF ASSEMBLY FOR
WATER LINES 8 INCHES
AND LARGER

CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

BLOW-OFF AND
SAMPLE TAP ASSEMBLIES

AUGUST 2007

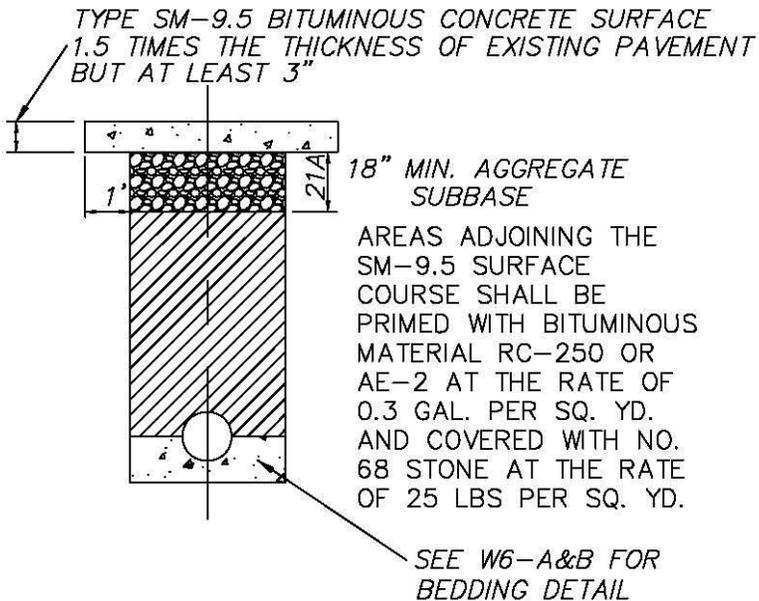
W8

1. ALL PAVEMENT CUTTING AND RESTORATION SHALL BE PERFORMED TO THE SATISFACTION OF THE CITY OF FREDERICKSBURG.

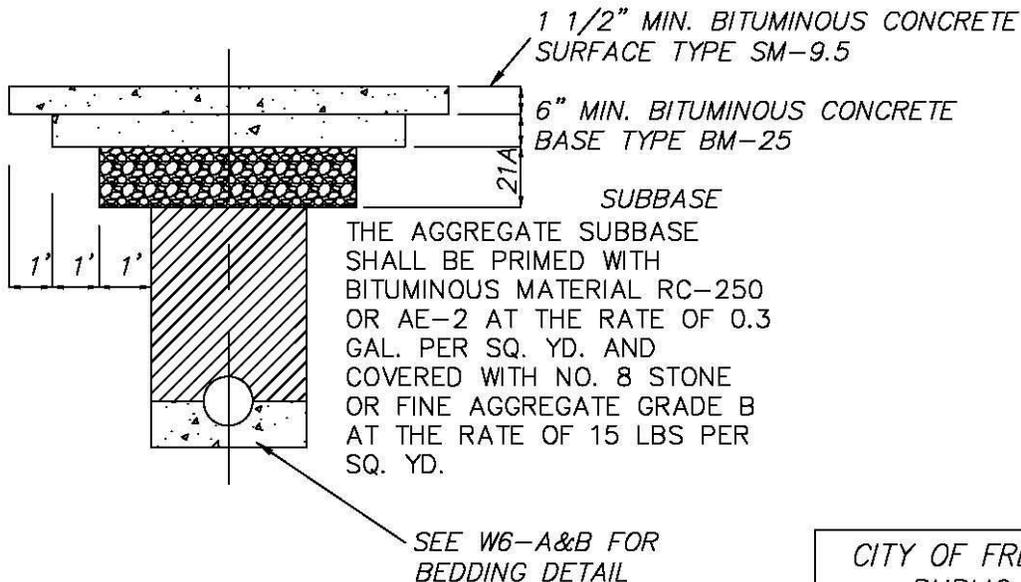
2. PAVEMENT SHALL BE CUT ONLY WHERE INDICATED ON THE PLANS OR WITH APPROVAL OF THE CITY OF FREDERICKSBURG.

3. WHEREVER ANY PORTION OF PAVED ROADWAY IS EXCAVATED, THE PAVEMENT SHALL FIRST BE CUT WITH A MECAHNICAL PAVEMENT CUTTER TO YEILD A UNIFORM STRAIGHT LINE CIT WITH VERTICAL FACES.

4. SUITABLE EXCAVATING TRENCH MATERIAL MAY BE USED AS BACK FILL SUBJECT TO APPROVAL BY THE CITY OF FREDERICKSBURG. UNSUITABLE EXCAVATED TRENCH MATERIAL SHALL BE REPLACED WITH VDOT AGGREGATE TYPE NO. 21A. ALL BACKFILL MATERIAL SHALL BE PLACED IN 6" LIFTS AND COMPACTED TO 95% DENSITY.



BITUMINOUS SURFACE
TREATED PAVEMENT
RESTORATION



BITUMINOUS
CONCRETE PAVEMENT
RESTORATION

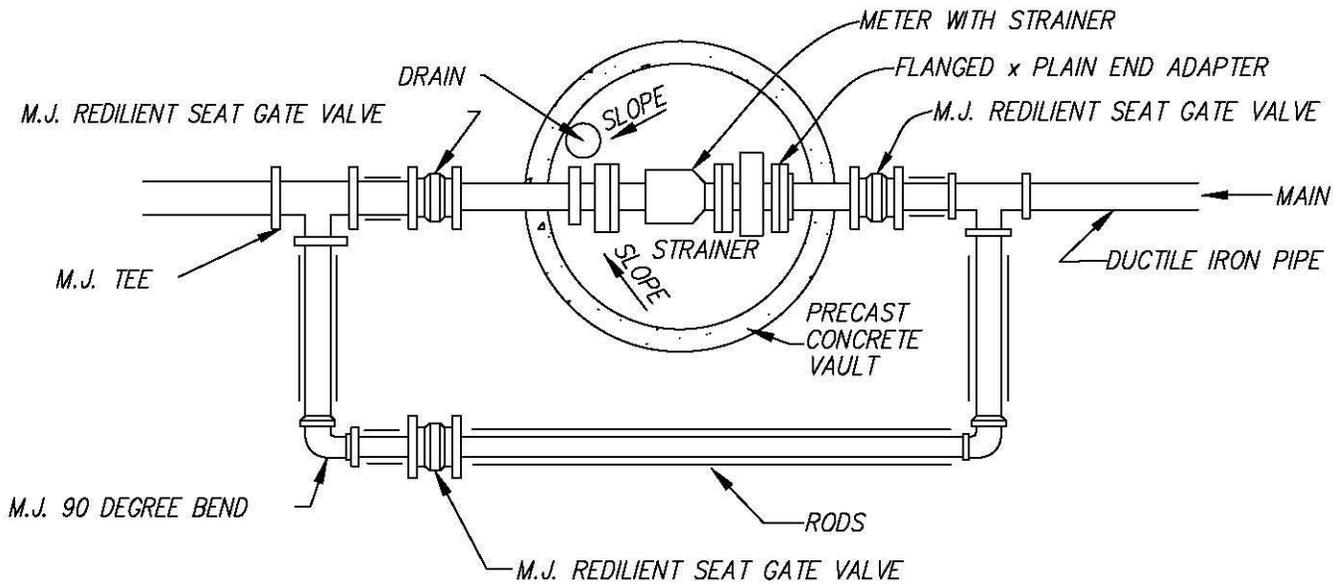
CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

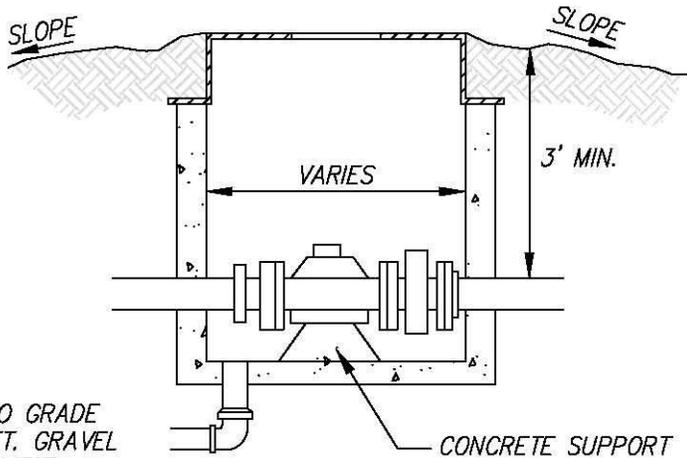
PAVEMENT RESTORATION

AUGUST 2007

W9



NEENA R-1900 MANHOLE FRAME & COVER
 WITH CENTER LID



NOTE:
 SHOP DRAWING MUST BE SUBMITTED
 TO PUBLIC WORKS FOR APPROVAL

MEGALUG RETAINER GLAND
 (SERIES 1100) AS MANUFACTURED
 BY EBAA IRON INC. OR APPROVED
 EQUAL. (SEE W11 & W11A)

CITY OF FREDERICKSBURG, VA
 PUBLIC WORKS DEPT.

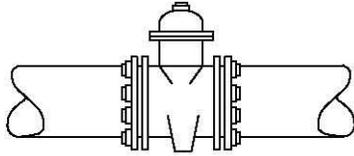
STANDARD DETAILS

METER SETTING FOR
 METERS AND SPECIAL
 DEVICES 3" AND GREATER

AUGUST 2007

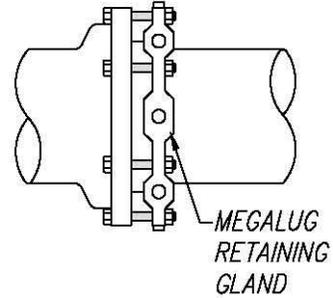
W10

IN LINE VALVE



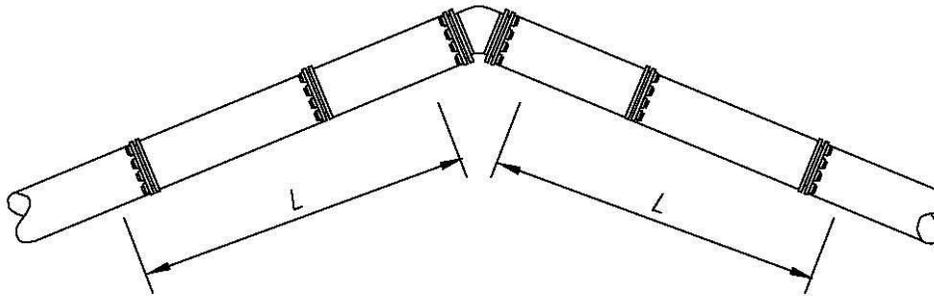
THE RESTRAINT OF VALVES REQUIRE CAREFUL CONSIDERATION IN A REDUNDANT DISTRIBUTION NETWORK. IN THIS CASE THE SHUTTING OF THE VALVE CAN RESULT IN PRESSURE FORCES ACTING IN THE DIRECTION DEPENDENT ON THE POSITION OF THE OTHER VALVE IN THE SYSTEM. IF THIS POTENTIAL EXISTS, IT MAY BE NECESSARY TO RESTRAIN BOTH SIDES OF THE VALVE.

MEGALUG RETAINING GLAND DETAIL



MEGALUG MECHANICAL JOINT RETAINING GLAND BY EBAA IRON INC. OR APPROVED EQUAL. INSTALL PER MANUFACTURERS RECOMENDATIONS.

HORIZONTAL BEND



HORIZONTAL BENDS REQUIRE RESTRAINTS OF ALL JOINTS WITHIN THE CALCULATED LENGTH (L) ON BOTH SIDES OF THE FITTING.

NOTE: (ALL JOINT RESTRAINTS)

IN SOME LOCATIONS THE REQUIRED RESTRAINED LENGTH MAY NOT BE MET. AT THESE LOCATIONS THE USE OF A THRUST BLOCK WILL BE USED ALONG WITH THE RESTRAINED LENGTH OBTAINABLE.

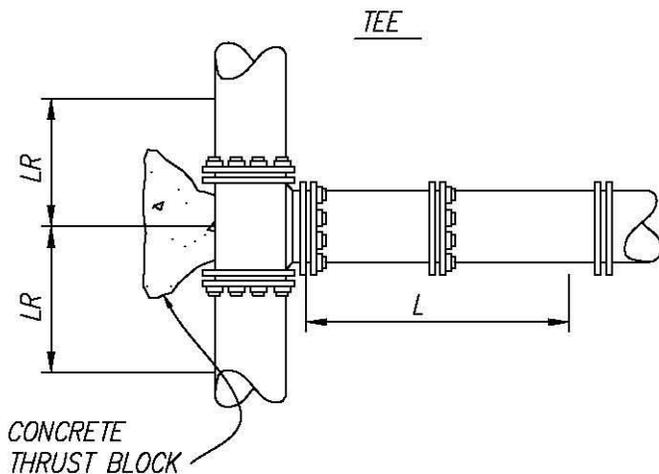
*CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.*

STANDARD DETAILS

*JOINT RESTRAINT
(IN LINE VALVE AND
HORIZONTAL BEND)*

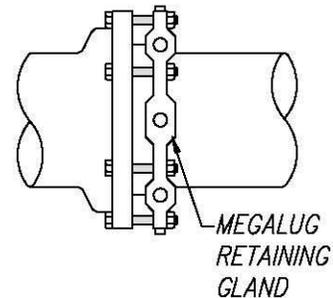
AUGUST 2007

W11

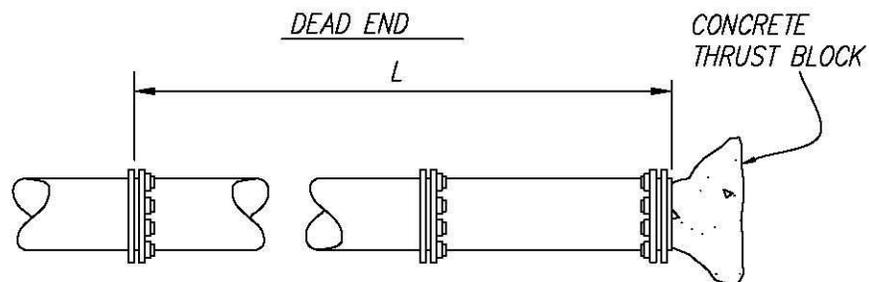


TEE FITTINGS REQUIRE THE RESTRAINT OF ALL JOINTS WITHIN A CALCULATED LENGTH ALONG THE BRANCH PIPE. THE RESTRAINT DESIGN ALSO REQUIRES THE SELECTION OF A LENGTH OF PIPE ALONG THE RUN TO BE FREE OF JOINTS.

MEGALUG RETAINING GLAND DETAIL



MEGALUG MECHANICAL JOINT RETAINING GLAND BY EBAA IRON INC. OR APPROVED EQUAL. INSTALL PER MANUFACTURERS RECOMENDATIONS.



DEAD ENDS REQUIRE RESTRAINTS OF ALL JOINTS WITHIN THE CALCULATED LENGTH (L) EXTENDED FROM THE CAP. IN SOME INSTALLATIONS THIS LENGTH CAN BECOME FAIRLY LARGE.

NOTE: (ALL JOINT RESTRAINTS)

IN SOME LOCATIONS THE REQUIRED RESTRAINED LENGTH MAY NOT BE MET. AT THESE LOCATIONS, THE USE OF A THRUST BLOCK WILL BE USED ALONG WITH THE RESTRAINED LENGTH OBTAINABLE.

CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

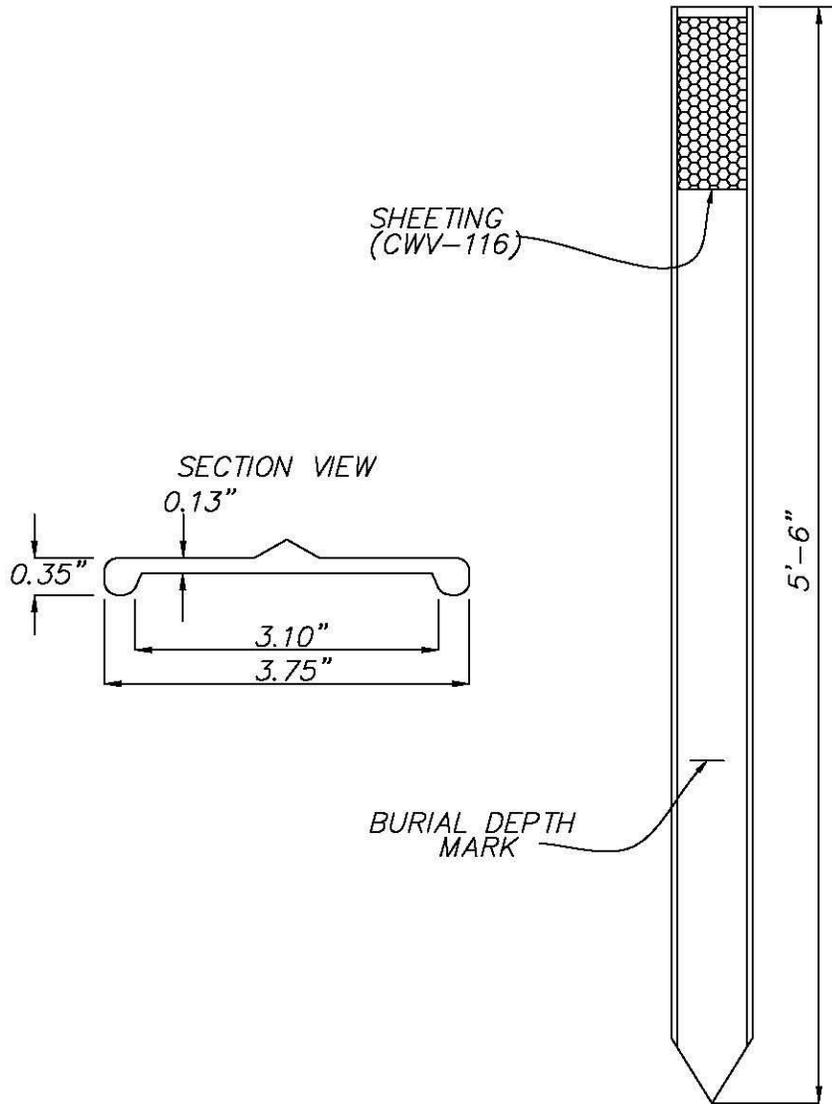
STANDARD DETAILS

JOINT RESTRAINT
(IN LINE VALVE AND
HORIZONTAL BEND)

AUGUST 2007

W11A

FRONT VIEW



CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

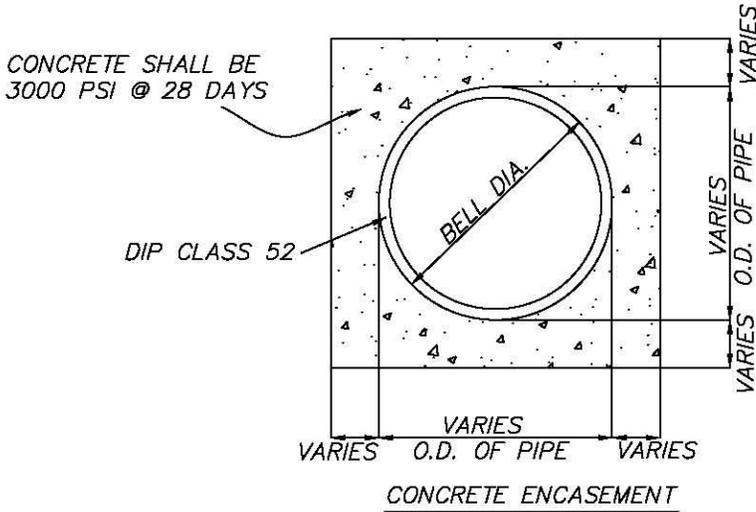
PVC UTILITY MARKER
(CARSONITE CUM-375 PRODUCT
NO. CRM 3066/BLUE)

AUGUST 2007

W12

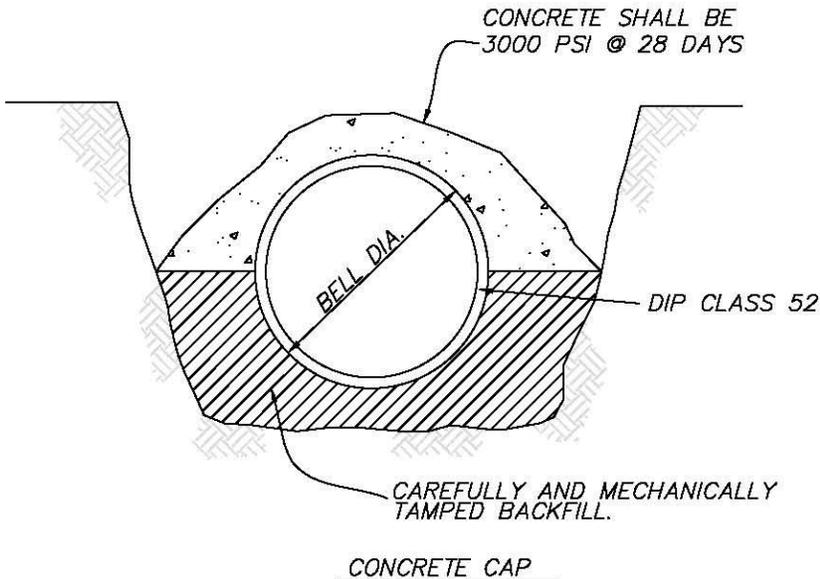
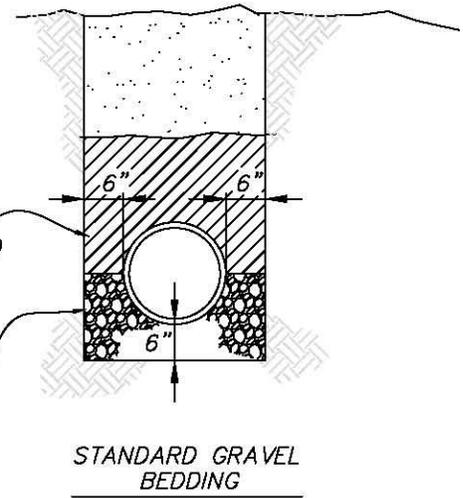
* SUITABLE EXCAVATED TRENCH MATERIAL MAY BE USED AS BACKFILL SUBJECT TO APPROVAL BY THE CITY OF FREDERICKSBURG. UNSUITABLE EXCAVATED TRENCH MATERIAL SHALL BE REPLACED WITH VDOT AGGREGATE TYPE NO 21A. ALL BACKFILL MATERIAL SHALL BE PLACED IN 6" LIFTS AND COMPACTED TO 95% DENSITY

NOTE:
SHOP DRAWING MUST BE SUBMITTED
TO PUBLIC WORKS FOR APPROVAL



APPLY MINIMUM OF CAREFULLY AND MECHANICALLY TAMPED BACKFILL (SEE DETAIL S7)

COMPACTED STONE
VDOT NO. 5



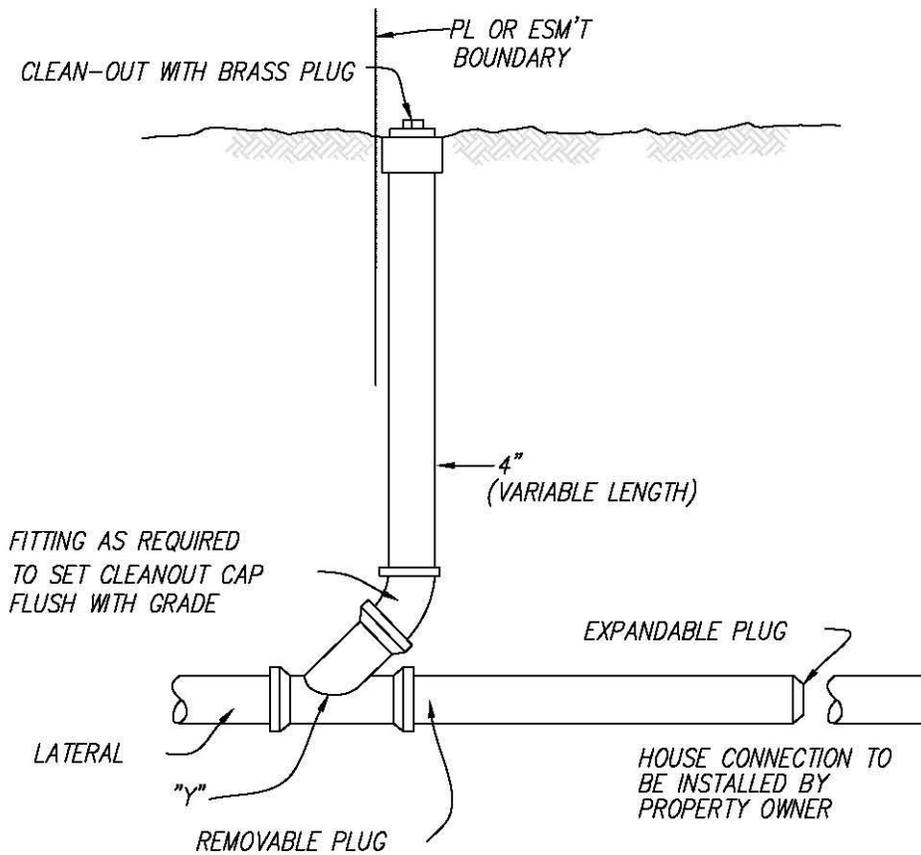
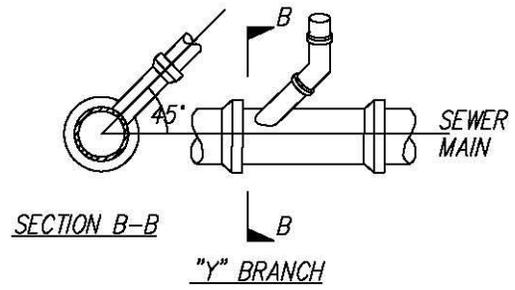
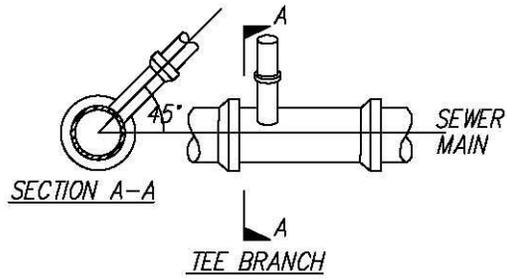
CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

SEWER PIPE BEDDING
CONCRETE ENCASEMENT
CONCRETE CAP

AUGUST 2007

S1



NOTES: NEW HOUSE CONNECTIONS SHALL BE MADE WITH 4" PIPE APPROVED STRAPPED SADDLE Y'S AND TEES MAY BE USED WHERE APPROVED BY THE DEPT OF P.W.

CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

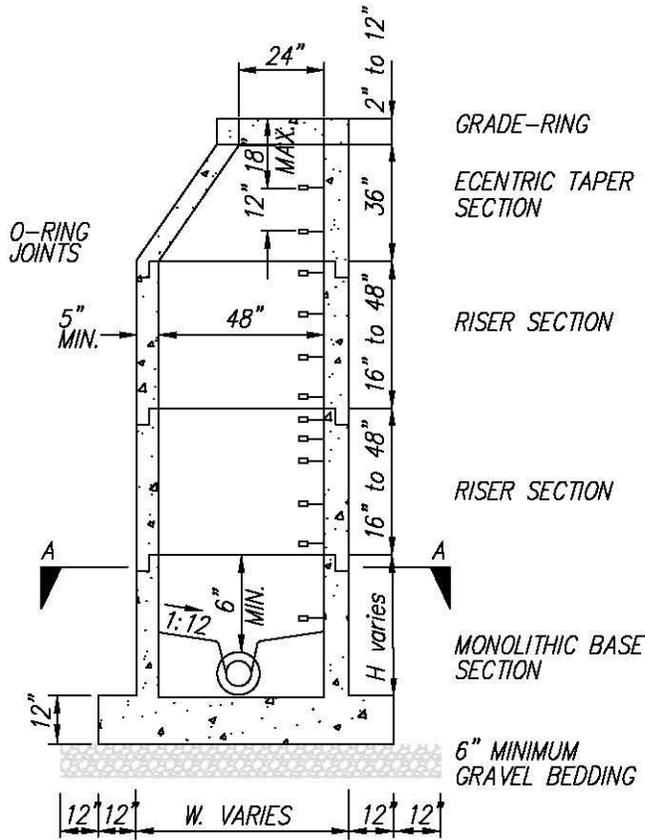
STANDARD DETAILS

SEWER SERVICE
CONNECTIONS AND
CLEAN-OUT

AUGUST 2007

S2

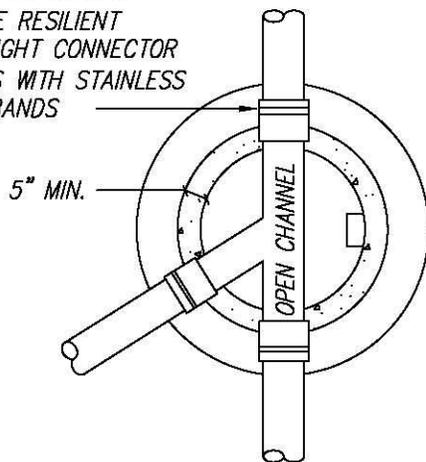
FOR FRAME AND COVER
SEE DRAWING S-7



NOTES:

1. WHERE INSIDE DROP CONNECTIONS ARE USED IN S.S. MANHOLES AND THE DROP CONNECTION IS 5' OR GREATER THE RECEIVING MANHOLE SHALL BE 5' OR GREATER IN DIAMETER.
2. WHEN THE MANHOLE HEIGHT EXCEEDS 12', THE MINIMUM DIAMETER OF THE BASE UNIT SHALL BE 5' WITH A BASE HEIGHT OF 6'.
3. INVERT CHANNELS SHALL BE SMOOTH SEMI-CIRCULAR AND SHALL PROVIDE A CONTINUOUS INVERT THROUGH THE MANHOLE.
4. NON PREFORMED INVERT CHANNELS SHALL BE FORMED WITH BRICK SURFACED WITH A3 CONCRETE.
5. TRIBUTARY CHANNELS SHALL JOIN WITH SMOOTH TRANSITION.
6. FOR STEP DESIGN SEE DETAIL ST-1 OF THE STATE ROAD AND BRIDGE SPECIFICATIONS VOLUME NO.1
7. STEPS MAY BE OMITTED WHEN SPECIFIED ON THE PLANS.
8. FRAME & COVER SHOULD BE 2' MIN. ABOVE FINISHED GRADE IN GREEN AREAS. FOR FRAME AND COVER DRAWING SEE DETAIL S5.

INTEGRALLY CAST IN
FLEXIBLE RESILIENT
WATERTIGHT CONNECTOR
SLEEVES WITH STAINLESS
STEEL BANDS



SECTION A-A

CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

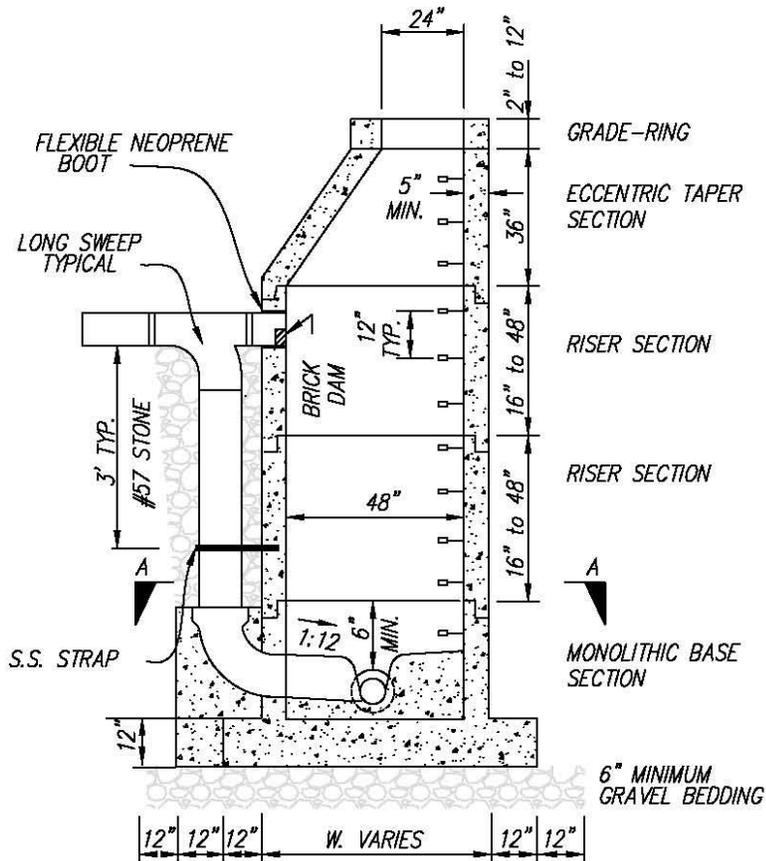
STANDARD DETAILS

STANDARD MANHOLE
TYPE "A"

AUGUST 2007

S3

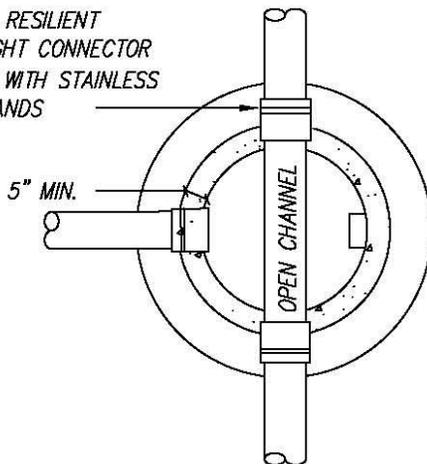
FOR FRAME AND COVER
SEE DRAWING S-7



NOTES:

1. WHERE INSIDE DROP CONNECTIONS ARE USED IN S.S. MANHOLES AND THE DROP CONNECTION IS 5' OR GREATER THE RECEIVING MANHOLE SHALL BE 5' OR GREATER IN DIAMETER.
2. WHEN THE MANHOLE HEIGHT EXCEEDS 12', THE MINIMUM DIAMETER OF THE BASE UNIT SHALL BE 5' WITH A BASE HEIGHT OF 6'.
3. INVERT CHANNELS SHALL BE SMOOTH SEMI-CIRCULAR AND SHALL PROVIDE A CONTINUOUS INVERT THROUGH THE MANHOLE.
4. NON PREFORMED INVERT CHANNELS SHALL BE FORMED WITH BRICK SURFACED WITH A3 CONCRETE.
5. TRIBUTARY CHANNELS SHALL JOIN WITH SMOOTH TRANSITION.
6. FOR STEP DESIGN SEE DETAIL ST-1 OF THE STATE ROAD AND BRIDGE SPECIFICATIONS VOLUME NO.1
7. STEPS MAY BE OMITTED WHEN SPECIFIED ON THE PLANS.
8. FRAME & COVER SHOULD BE 2' MIN. ABOVE FINISHED GRADE IN GREEN AREA.

INTEGRALLY CAST IN
FLEXIBLE RESILIENT
WATERTIGHT CONNECTOR
SLEEVES WITH STAINLESS
STEEL BANDS



SECTION A-A

CITY OF FREDERICKSBURG, VA
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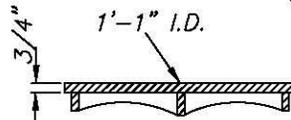
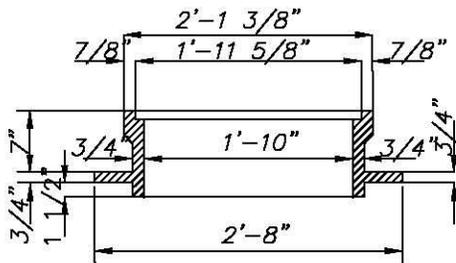
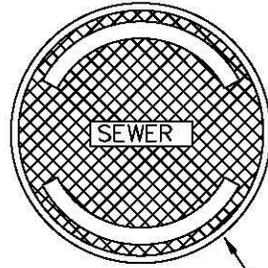
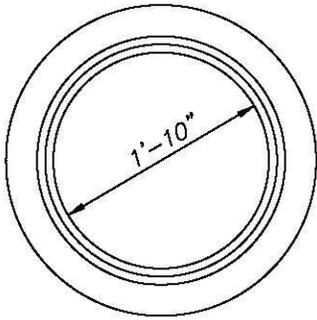
STANDARD DETAILS

STANDARD MANHOLE
TYPE "B"

AUGUST 2007

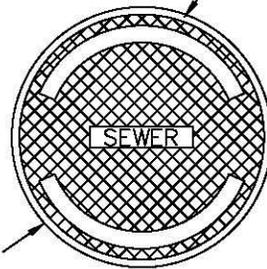
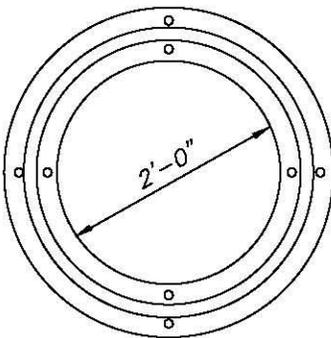
S4

NOTE: WATER TIGHT MANHOLES SHALL BE BOLTED, SHALL HAVE INTEGRAL LIFTING LOOPS, AND SHALL HAVE GASKETS BETWEEN THE COVER AND FRAME AND BETWEEN THE FRAME AND TOP MANHOLE SECTION.

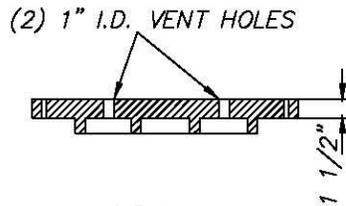
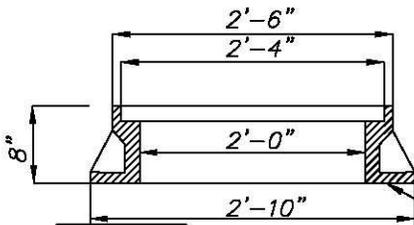


NON-BOLTED

MANHOLE FRAME SHALL BE FASTENED TO MANHOLE WITH A MINIMUM OF (4) 1/2" DIA. STAINLESS STEEL BOLTS.



SOLID COVER



HOLE FOR 1/2" DIA BOLTS. TYPICAL SEE NOTE ABOVE

BOLTED

NOTE: BOLTED FRAMES AND COVERS SHALL BE RICHARDS FOUNDRY CORP. DESIGN NUMBER B-7032 OR APPROVED EQUAL.

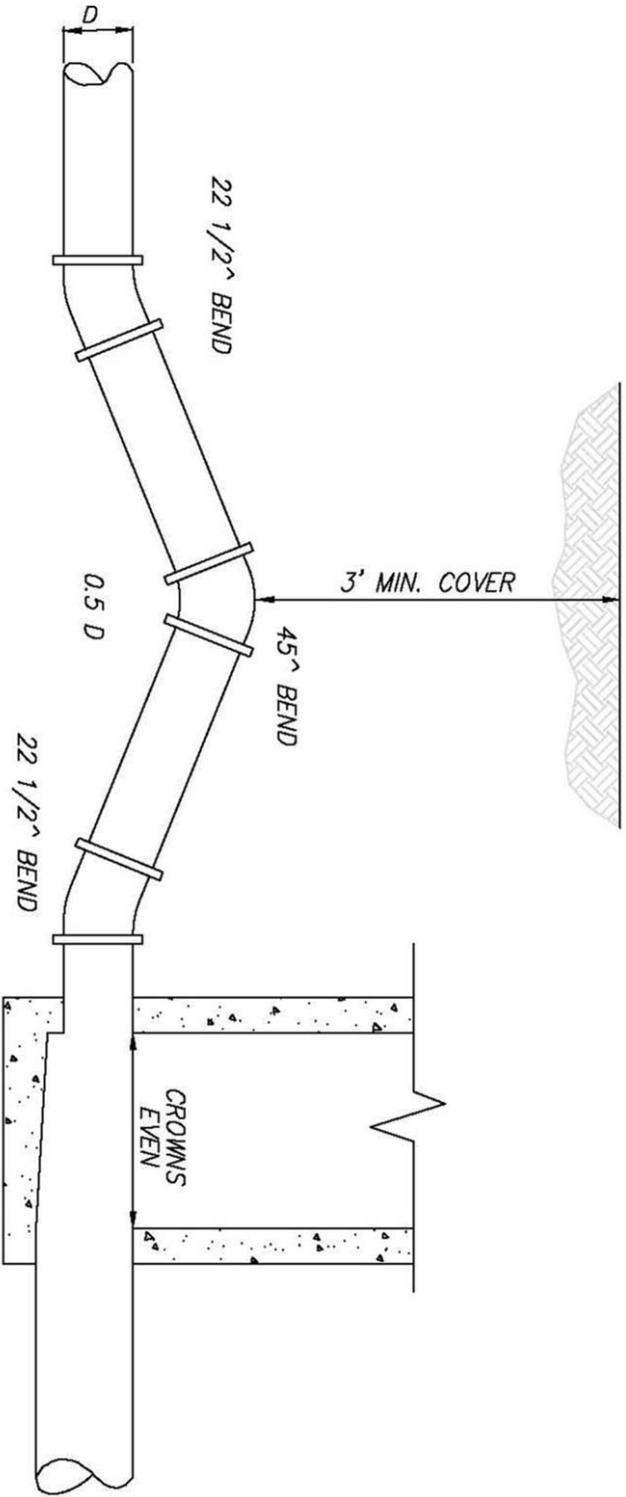
CITY OF FREDERICKSBURG, VA
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STANDARD DETAILS

MANHOLE FRAMES
AND COVERS

AUGUST 2007

S5



CITY OF FREDERICKSBURG, VA
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STANDARD DETAILS

SAXOPHONE BEND

AUGUST 2007

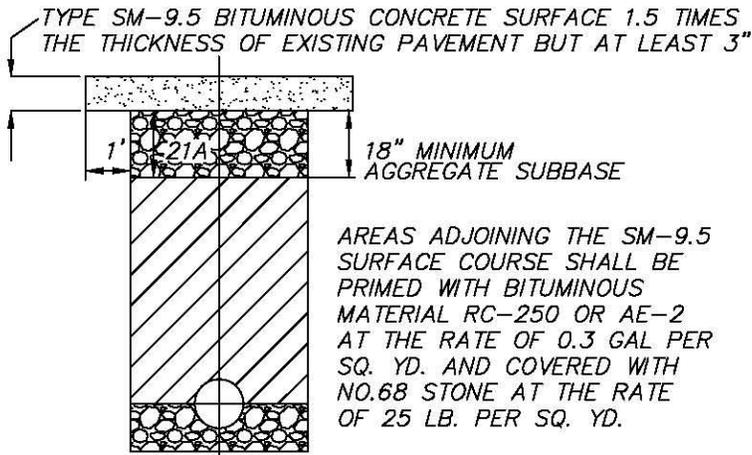
S6

1. ALL PAVEMENT CUTTING AND RESTORATION SHALL BE PERFORMED TO THE SATISFACTION OF THE CITY OF FREDERICKSBURG.

2. PAVEMENT SHALL BE CUT ONLY WHERE INDICATED ON THE PLANS OR WITH APPROVAL OF THE CITY OF FREDERICKSBURG.

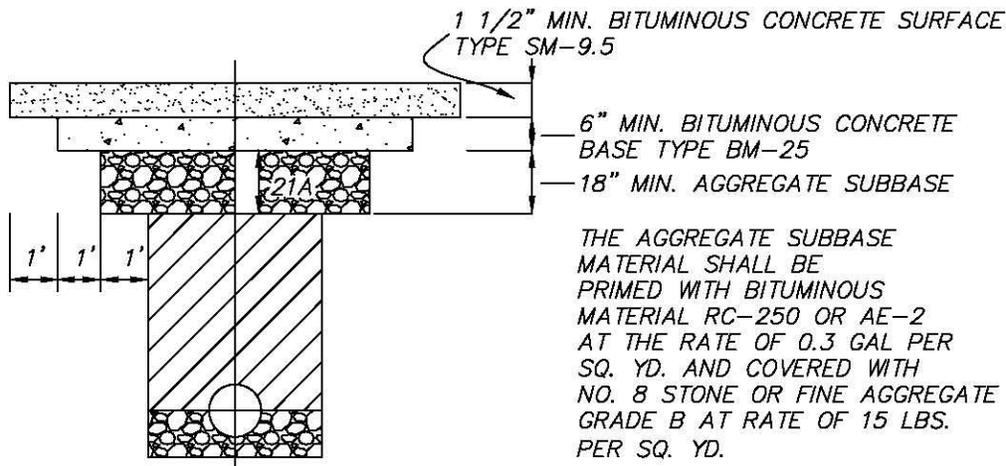
3. WHEREVER ANY PORTION OF PAVED ROADWAY IS EXCAVATED, THE PAVEMENT SHALL FIRST BE CUT WITH A MECAHNICAL PAVEMENT CUTTER TO YEILD A UNIFORM STRAIGHT LINE CIT WITH VERTICAL FACES.

4. SUITABLE EXCAVATING TRENCH MATERIAL MAY BE USED AS BACK FILL SUBJECT TO APPROVAL BY THE CITY OF FREDERICKSBURG. UNSUITABLE EXCAVATED TRENCH MATERIAL SHALL BE REPLACED WITH VDOT AGGREGATE TYPE NO. 21A. ALL BACKFILL MATERIAL SHALL BE PLACED IN 6" LIFTS AND COMPACTED TO 95% DENSITY.



SEE S1 FOR BEDDING DETAIL

BITUMINOUS SURFACE
TREATED PAVEMENT
RESTORATION



BITUMINOUS CONCRETE
PAVEMENT RESTORATION

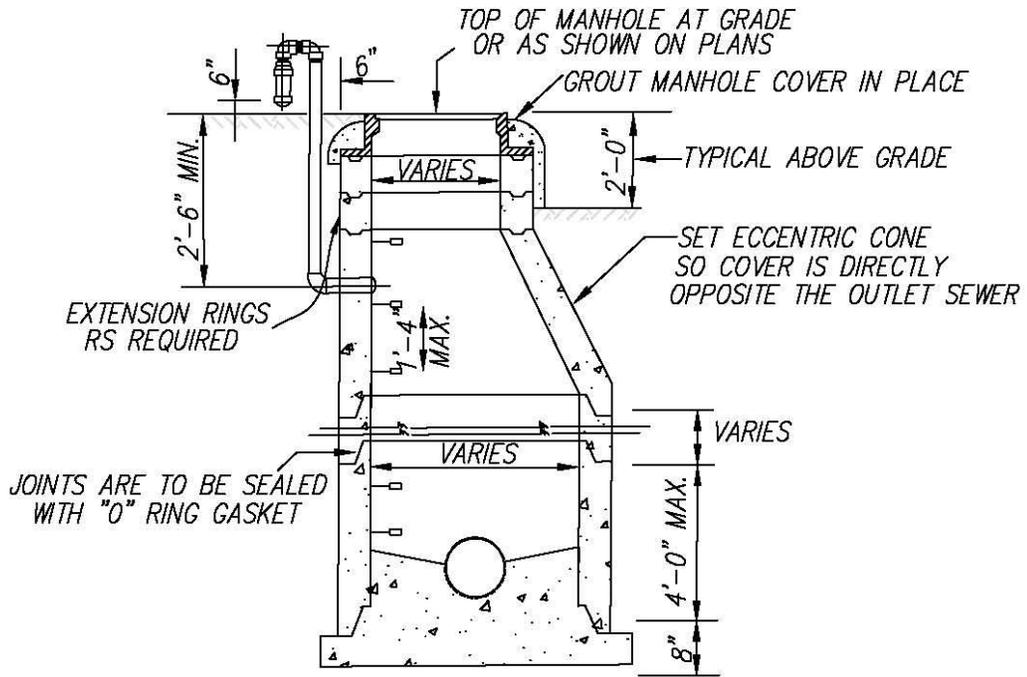
CITY OF FREDERICKSBURG, VA
PUBLIC WORKS DEPT.

STANDARD DETAILS

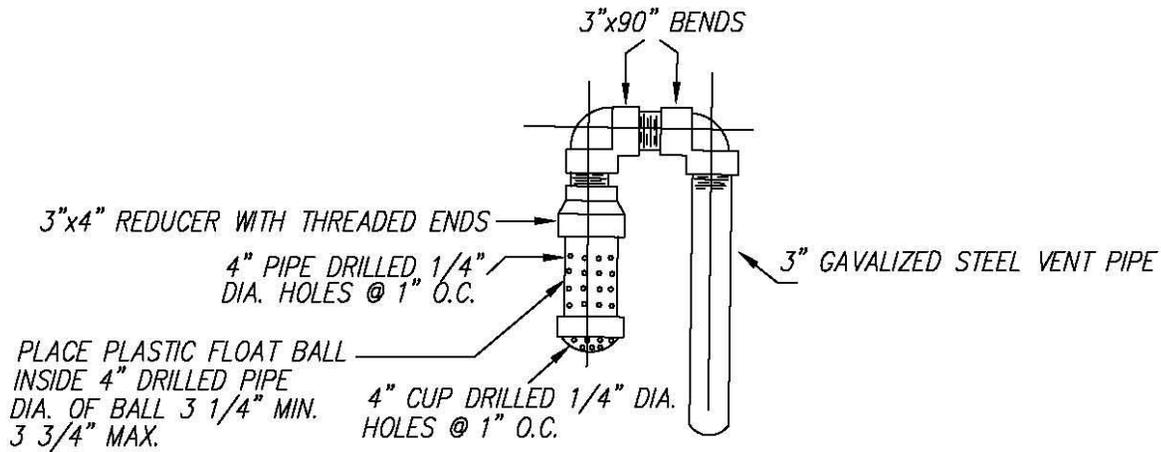
PAVEMENT RESTORATION

AUGUST 2007

S7



PRE-CAST STANDARD MANHOLE
SCALE NONE



VENT PIPE
SCALE NONE

CITY OF FREDERICKSBURG, VA PUBLIC WORKS DEPT.	
STANDARD DETAILS	
STANDARD MANHOLE TYPE "D"	
AUGUST 2007	S8