TOWN OF SMITHFIELD, VIRGINIA
DESIGN AND CONSTRUCTION STANDARDS

Waterworks, Sanitary Sewers,
Sewage Pumping Stations, Site Work and Streets

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Tables & Checklists

Reference Index

Through out this manual, references will be made to certain manuals and specification books and/or literature that will require your informational knowledge to insure your proper completion of the scope of work entitled.

Below are listed these reference materials:

1. Virginia Department of Transportation; Road and Bridge Specifications, January 1994 or most current issue.
2. Virginia Department of Transportation; Road and Bridge Standards, Vol. I & II, 1996 or most current issue.
3. Virginia Department of Transportation; Drainage Manual, January 1980 or most current issue.
4. Virginia Department of Transportation; Urban Manual, 1987 or most current issue.
5. Virginia Department of Transportation; Subdivision Street Requirements, 1996 or most current issue.
6. Virginia Department of Transportation; Pavement Design Guide for Subdivision and Secondary Roads in Virginia, 1996 or most current issue.
7. The current National Fire Code
8. The current American Water Works Association Manual

Introduction

The purpose of this manual is to establish minimum requirements for public improvements to be accepted for ownership by the Town of Smithfield, Virginia. The manual contains requirements for preparation of Plans and requirements for construction. The Waterworks and Sanitary Sewer sections, Section I and II, have been approved by the State Department of Health and may be incorporated in Construction Documents by reference.

Approval of any plans for a project by the Town or its designated agent shall not relieve the Owner or its Engineer of the responsibility for errors and/or omissions contained in said plans. By its approval, the Town does not certify as to the correctness or completeness of plans.

It shall be the sole responsibility of the developer to secure all regulatory agency approvals and permits required for the prosecution of work associated with a project.

The Developer agrees to indemnify and hold harmless the Town of Smithfield and its agent(s) from and against all claims, damages, losses and expenses arising out of or resulting from the performance of work included in any project pursuant to requirements in this manual.

The Town of Smithfield must be notified a minimum of 24 hours prior to the commencement of work, of any nature, on a project which requires inspection by the Town. Failure to provide proper notification may result in rejection of the work.

After completion of construction of facilities from approved plans and/or specifications the developer or owner responsible for the construction shall prepare as-built plans, based on accurate, field-obtained information, to show actual conditions of the finished construction. The Developer shall furnish the Town a complete set of reproducible drawings and two (2) sets of prints showing as-built conditions. Receipt of as-built plans will be a prerequisite to acceptance of the project by the Town and release of bonds that may be required. The Town will not accept any portion of a project until all facets are complete including utilities, roads, ditches, etc.

Article I
Waterworks

1. **General**

a. All waterworks shall be designed by a professional engineer licensed in accordance with the requirements of the Code of Virginia. All waterworks shall be in accordance with these guidelines and requirements of the Commonwealth of Virginia "Waterworks Regulations". All Plans and Specifications shall be approved in writing by the Town prior to commencement of construction.

b. The construction of any new private water system is prohibited unless otherwise approved by Town Council. The term "private water system" refers to any water line service to two (2) or more separately platted lots which are not directly owned and maintained by the Town.

c. All water distribution facilities and operations shall comply with Part II Article 3: "Cross Connection Control and Backflow Prevention in Waterworks" of the Waterworks Regulations of the Virginia Department of Health. All water distribution facilities and operations shall also comply with the "Program for Cross Connection Control and Backflow Prevention" of the Town of Smithfield, Virginia.

d. Water meters shall not be installed until all water lines have been installed and approved by the Town.

2. **Plans**

a. All plans for water works shall bear a suitable title showing the name of the project and shall show the scale in feet, a graphic scale, north arrow, datum, the name of the engineer, his signature, an imprint of his registration seal, and the date. Plans and specifications shall include provisions for excavation and backfill, dewatering, sheeting and bracing, maintenance of traffic and protection of the public, protection of existing utilities and structures, separation of water and sewer lines, trench widths and preparation, materials, material testing, details of pipe laying and construction of pipe lines and appurtenances and other items as may be applicable to the project and all in accordance with good engineering practices. Plans shall include profiles, details and

topographic information such as existing and proposed zoning, lot numbers, street pavement, sidewalks, driveways, curb and gutter, storm drains, utilities, trees, shrubbery, property lines, street names and house numbers (where available) and appropriate elevations. Each plan shall also include a vicinity map, map and deed book references for adjacent property and existing easements, and typical sections of streets, roads and ditches.

b. Plans shall be clear and legible. They shall be drawn to a scale, which will permit all necessary information to be plainly shown. Datum shall be U. S. National Ocean Survey (formerly U.S.C & G.S.) Datum, Mean Sea Level = 0.00, and a referenced bench mark and project benchmark shall be shown.

c. A comprehensive plan of the existing and proposed water lines shall be submitted for new water distribution systems or substantial additions to existing systems. This plan shall show existing or proposed streets and all streams or water surfaces. Spot elevations, with contour lines at suitable locations, shall be included. The plan shall show the location and size of all existing and proposed water mains. A single cover sheet showing, in a general layout, all substantial project features, with a sheet index, vicinity map and legend, shall be provided. The title block shall appear in the lower right corner of each plan sheet.

d. Detailed plans consisting of plans, profiles, elevations, sections and supplementary views, and specifications shall be provided.

e. Profiles shall have a horizontal scale of not more than 40 feet to the inch and vertical scale of not more than 5 feet to the inch where practical. Plan views shall be drawn to a corresponding horizontal scale. Plans and profiles shall show:

(1) Location of streets and water mains.

(2) Line of ground surface above the pipe, size, material and type of pipe, and the water main between each two adjacent valves or hydrants.

(3) Locations of all special features such as meters, valves, fittings, hydrants, concrete encasements and elevated mains.

(4) All known existing structures and utilities both above and below ground which might interfere with the proposed construction, particularly sewer lines, gas mains, storm drains, underground conduits, etc. Whenever available, the size and type of material shall be indicated.

(5) Special detail drawings, made to a scale to clearly show the nature of the design, shall be furnished to show conflicts and/or other critical details.

f. Revised sheets shall contain a revision with identifying notation, date and mark for the revision.

g. As-Built drawings for the Water lines shall be prepared and submitted when installation of these lines has been completed. Each sheet shall be stamped “As-Built” and dated. These drawings shall indicate the location of all mains, lateral, meter and valve boxes ± 6”. A full set of “As-Built” drawings will be required.

3. **Flow and Size**

a. Water distribution systems shall be designed to provide adequate flow and pressure for both domestic supply and fire flow, based on sound hydraulic analysis. Design shall be based on a maximum flow velocity of 8 feet per second, a Hazen-Williams "C" factor no greater than 120, and a minimum system pressure of 20 psi.

b. Flow requirements shall be based on water consumption required by Table 1, Design Basis For Water Consumption, Appendix. Any deviations shall be based on sound engineering knowledge and shall be subject to the approval of the Town.

c. Fire flow requirements shall be in accordance with the latest edition of the National Fire Protection Association Handbook.

d. Pipes shall be sized based on adequate hydraulic analysis using either maximum hourly demand or required fire flow with maximum daily demand, whichever produces the more stringent requirement. Maximum hourly and maximum daily demands shall be as defined in AWWA Manual "Distribution System Requirements for Fire Protection".

e. No meter fitting or other device shall be used that limits flow below estimated fire flow requirements. Regardless of current domestic demand, a separate fire line will be required.

f. Each fire hydrant shall be provided with a minimum flow of 750 GPM at 20-psi residual pressure. On cul-de-sacs or dead-end streets which cannot be extended and whose intersections are not in excess of 500 feet from the nearest existing hydrant, 500 GPM at 20 psi residual pressure will be acceptable.

g. Pipe size shall be a minimum of 6", on looped systems and a minimum of 8", unless otherwise specified by the Town**.** 4" pipe may be used on the last 300 feet of pipe located beyond the last hydrant on cul-de-sacs or streets, which cannot be extended. Dead-ends shall be eliminated by looping when feasible.

h. Services and meters shall be sized in accordance with the AWWA Manual "Sizing Water Service Lines and Meters". Minimum service size shall be 1". Each service shall have an individual tap, except that for duplex and townhouse lots, one 1" service and tap may be used for two services.

4. **Location**

a. Water mains shall generally be located on the northern and eastern side of public rights-of-way and no further than five (5) feet from the right-of-way boundary line. All other utilities shall be a minimum of 5' horizontally/vertically from the water main or as per direction of the Town of Smithfield's Superintendent of Public Utilities. Water mains will be permitted in easements only when approved by the Town. Easements shall provide sufficient space for both installation and maintenance with a minimum width of twenty (20) feet. Water main shall not be located under sidewalk.

b. Existing and proposed sanitary sewers and storm drainage systems and all other underground utilities and structures shall be considered in the design and selection of pipe depths and alignments to avoid conflicts and facilitate maintenance.

c. Recommended minimum hydrant spacing is based on the roadway centerline:

Residential	600' intervals (400' radius)
Commercial/Industrial	400' intervals (250' radius)

Hydrants in residential areas shall be located at intersections and in the middle of long blocks whenever practicable. On cul-de-sacs or dead-end streets which cannot be extended, hydrants shall be placed approximately 400 feet from the end of the cul-de-sac or dead end.

d. Valves shall be of flange tee and valve configuration (see W-5) located at not over 1,000 foot intervals and at all changes in pipe diameter. Valves shall also be required at all sides at all pipe line intersections so as to provide shut-off for repairs of limited sections without interruptions of service to large areas and to facilitate testing.

e. Water mains shall be provided with air release valves and blow-offs at suitable locations to allow testing, chlorination and draining of the line. Where air relief's are subject to flooding the open end shall be extended to at least 1-foot above grade and be provided with a screened downward facing elbow.

f. Where dead ends occur, there shall be provided with a fire hydrant, flushing hydrant, or blowoff for flushing purposes.

g. Meter boxes shall be located at property lines. All water meter lids shall be of the “touch-read” type.

5. **Conflicts and Clearances**

a. **Parallel Installation**

(1) Normal Conditions - Water mains shall be laid at least ten (10) feet horizontally from any sanitary sewer or sewer manhole whenever possible. The distance shall be measured edge to edge.

(2) Unusual Conditions - When local conditions prevent a horizontal separation of ten (10) feet, a water main may be closer to a sanitary sewer or sewer manhole provided that:

(a) The bottom of the water main is at least 18 inches above the top of the sewer.

(b) Where this vertical separation cannot be obtained the sewer shall be of AWWA approved water pipe and shall be pressure tested to assure water tightness prior to backfilling and after backfilling.

(c) The sewer manhole is constructed watertight and tested in place.

b. **Crossings**

(1) Normal Conditions - Water mains crossing sanitary sewers shall be laid to provide separation of at least eighteen (18) inches between the bottom of the water main and the top of the sewer, wherever possible.

(2) Unusual Conditions - When local conditions prevent a vertical separation of eighteen (18) inches, the following shall be used:

(a) Sewers passing over or under water mains shall be in accordance with Article 1, Section 5.a.2

(b) Water mains passing under sewers shall, in addition, be protected by providing:

(i) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main.
(ii) Adequate structural support for the sewer to prevent excessive deflection of joints and settling on and breaking of the water main.
(iii) That the length of water pipe be centered at the point of crossing so that the joints will be equi-distant and as far as possible from the sewer.

(3) Surface water crossing - Where a water main crosses above surface water, the pipe shall be adequately supported, completely insulated to protect it against damage from freezing, accessible for repair or replacement, and above the level of a 100-year flood and any floating debris it may carry.

c. **Sewer Manholes**

No water pipe shall pass through or come into contact with any part of a sewer manhole.

6. **Water Main Materials**

a. Water mains shall be ductile iron pipe conforming to the following:

Pipe - ANSI/AWWA C151/A21.51, Class 51 minimum.
Fittings - ANSI/AWWA C110/A21.10.
Joints - ANSI/AWWA C111/A21.11 (Mechanical or slip-on).
Cement Lining - ANSI/AWWA C104/A21.4.

b. Gate valves may be iron body, bronze mounted, double disc, non-rising conforming to ANSI/AWWA C500 or resilient seat, non-rising conforming to ANSI/AWWA C509. Valve boxes and covers shall be adjustable cast iron with full cast iron lid with the word "WATER" cast in the top. Gate valves shall be manufactured by AVK or Mueller. Provide valve extension rod if nut is below 30 inches below grade.

c. Hydrants shall be Mueller "Centurion" with 4-1/2" pumper nozzle and two 2-1/2" hose nozzles and shall open left.

d. Side outlet fittings for valves or future extensions shall be flanged and provided with valve and blind flange.

e. Restraint for piping shall be Romac Industries Grip Ring Pipe Restrainer or approved equal

f. Water taps shall be made with corporation stop and gooseneck. Corporation stops shall be provided with compression fittings and stainless steel inserts. Water taps for service lines 2-inch diameter and larger shall be rigid connection and gate valve and shall be brass or copper unless otherwise specified by the Town. Taps under 2- inch shall be CTS (copper tube size) plastic rated at 200 psi

g. Coppersetter shall be Ford VHH71-7W-41-43 with padlock wings on key valve, angle double check valve at meter outlet, 1" C.T.S. compression fitting at inlet, 3/4" iron pipe fitting at outlet. An 18-inch Schedule 80 PVC pigtail, threaded at both ends, shall be provided on the outlet side of the coppersetter or as otherwise approved by the Town.

h. Meter boxes shall be 18" plastic with full cast iron lid. Meter boxes shall be located at property lines. Line setters shall be 18”-24” below the finished grade of the lot. The type

of meter shall be “schlumberger” or as otherwise specified by the Town. All water meter lids shall be of the “touch-read” type as specified by the Town – A.Y. McDonald MFG. Model # 74MDLNLRG (see diagram)

A.Y. McDonald MFG. Model # 74MDLNLRG

i. Warning tape shall be bright blue plastic with detectable foil and "CAUTION-WATER LINE BELOW" printed on it. See also Article 1, Section 7.f. Tape shall include a minimum 10 gauge copper wire for enhanced detectability and shall be installed 18”- 24” above waterline. If CTS material is used, then 10 gauge copper wire shall be provided.

j. Water mains constructed in fill areas shall be MJ or restrained joint ductile iron pipe extending to nearest manhole or native ground.

7. Installation

a. All water mains shall have a minimum of thirty-six (36) inches and a maximum of forty-two (42) inches of cover from finished grade, unless otherwise approved by the Town. Water service lines shall have a minimum of eighteen (18) inches of cover (includes bottoms of ditches). See “Design Basis For New Sewage Works” (page 63) for additional cover requirements for pipes and valves.

b. Thrust protection shall be specified on Plans and shall consist of concrete thrust blocks against undisturbed earth and approved tie rods, or lock type feature joints. Retainer rings may be permitted. Hydrants shall be protected from thrust by means of tie rods and retainer glands. Thrust blocks will not be permitted behind temporary plugs.

c. Where valves are placed at the ends of lines for future extension sufficient length, but not less than one pipe length, of kicker joint shall be installed to hold the valve in place with retainer clamps on the valve. Dead-end lines shall be provided with an air release or blow-off corporation valve.

d. Pipe shall be supported over its entire length by a continuous and uniform bedding. Where unsuitable material is encountered provide select bedding as shown on Plate S-8. Stones and rock encountered during trench excavation shall be removed to a depth of at least six inches below the bottom of the pipe and select fill bedding provided.

e. Backfill over pipe shall be compacted in 6-inch layers. Select backfill material may be required if the native material is deemed by the Town to be unsuitable for backfill. Under areas to be paved 90% of maximum density as determined by ASTM D698 shall be achieved. It shall be the responsibility of the Contractor to engage a certified laboratory, approved by the Town, to make compaction tests to verify that adequate compaction has been attained.

f. Any plastic or other nonmetallic pressurized conduit installed underground shall have installed with it a warning tape of electrically conductive material. Such shall be installed directly over the pipe at a depth of twelve inches. In addition a continuous 10 gauge copper wire shall be taped directly on the top of the pipe.

g. Installation of new water mains and connection to existing water mains shall be subject to the requirements of the "Cross Connection Control and Backflow Prevention Program" of the Town of Smithfield".

h. No flushing devices, or chambers or pits containing valves, blow- offs, meters or other such accessories, shall be directly connected to any sewer.

8. **Water Main Testing**

a. A hydrostatic pressure test shall be made for all water mains which includes the coppersetter. Procedure shall conform to ANSI/AWWA C600. Test pressure shall be 150 psi for 2 hours with NO pressure drop.

b. Tapping sleeve valve, when installed, will be required to be pressure tested for 10 minutes at 150 psi with no pressure drop.

c. All other testing including flushing ,disinfection, and coliform shall be in accordance with HRPDC Reginald Standards, these Special Provisions, and VDH Regulations

9. **Disinfection**

a. **Chlorination**

After completion of testing the main shall be flushed at a minimum velocity of 2.5 feet per second and disinfected by chlorination in accordance with AWWA Specification C601 and the Virginia Department of Health Waterworks Regulations. Any of the three (3) methods of chlorine application given in the Waterworks Regulations may be utilized as appropriate. Otherwise, the continuous feed method shall be employed as follows:

Potable water shall be introduced into the pipe main at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/l. The chlorinated water shall remain in the main at least 24 hours after which the chlorine concentration in the water shall be at least 10 mg/l. All valves and appurtenances shall be operated while the chlorine water remains in the main.

b. **Bacteriological Testing**

After the lines have been chlorinated and flushed, two water samples for bacteriological analysis shall be collected at least 24 hours and not more than 72 hours apart and analyzed by a certified laboratory. These samples will be taken in the presence of a Town representative and placed in a sealed container which shall be approved and accepted by the Town. These samples shall be collected at regular intervals, not exceeding 2,000 feet throughout the length of pipe line. The results of these samples must indicate no coliform contamination before the pipe, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedure must be repeated.

ARTICLE II
Sanitary Sewers

1. **General**

a. Sanitary sewers shall be designed by a professional engineer licensed in accordance with the requirements of the Code of Virginia. Sanitary sewers and building sewers shall be in accordance with these guidelines, the Uniform Statewide Building Code, ordinances of the Town of Smithfield, and requirements of the Commonwealth of Virginia "Sewerage Regulations". All Plans and Specifications shall be approved in writing by the Town prior to commencement of construction.

b. The construction of any new private sewer is prohibited. The term "private sewer" refers to any sewer serving two (2) or more separately platted lots which is not directly owned and maintained by the Town.

c. Combined sewers are prohibited.

2. **Plans**

a. All plans for sewerage works shall bear a suitable title showing the name of the project and shall show the scale in feet, a graphic scale, north arrow, datum and the name of the engineer, his signature, an imprint of his registration seal, and the date. The Plans and Specifications shall include provisions for excavation and backfill, dewatering, sheeting and bracing, maintenance of traffic, protection of the public, protection of existing utilities and structures, separation of water and sewer lines, trench widths and preparation, materials, material testing, details of pipe laying and construction of pipe lines and appurtenances and other items as may be applicable to the project, all in accordance with good engineering practice. Plans shall include profiles, details and topographic information such as existing and proposed zoning, lot numbers, street pavement, sidewalks, driveways, curb and gutter, storm drains, utilities, trees, shrubbery, property lines, house numbers (where available) and appropriate elevations. Each set of plans shall also include a vicinity map, map and deed book references for adjacent property and existing easements, and typical sections of streets, roads and ditches. Methods of abandonment of existing sewers and laterals shall be shown.

b. The plans shall be clear and legible. They shall be drawn to a scale which will permit all necessary information to be plainly shown. Plans generally should not be larger than 24 inches x 36 inches. Datum shall be U. S. National Ocean Survey (formerly U.S.C. & G.S.) Datum, Mean Sea Level = 0.00, and a referenced benchmark and project benchmark shall be shown.

c. A comprehensive plan of the existing and proposed sewers shall be submitted for new sewer systems or substantial additions to existing systems. This plan shall show existing or proposed streets and all streams or water surfaces. Spot elevations with contour lines at suitable locations shall be included. The plan shall show the location, size and direction of flow of all existing and proposed sanitary sewers and pumping stations. A single cover sheet showing, in a general layout, all substantial project features, with a sheet index, vicinity map and legend shall be submitted. The title block shall appear in the lower right corner.

d. Detailed documents consisting of plans, profiles, elevations, sections and supplementary views, and specifications shall be provided.

e. Profiles shall generally have a horizontal scale of not more than 40 feet to the inch and a vertical scale of not more than 5 feet to the inch. Plan views shall be drawn to a corresponding horizontal scale. Plans and profiles shall show:

(1) Location of streets and sewers.

(2) Ground surface above the pipe, size, material and type of pipe, invert and surface elevation at each manhole, and grade of sewer between each two adjacent manholes. Manholes shall be numbered. Lateral and cleanout locations, and cleanout inverts shall be shown where necessary. Where there is any question of the sewer being sufficiently deep to serve any structure, the ground and finish floor elevations shall be plotted on the profile.

(3) Locations of all special features such as concrete encasements, sewers above ground, etc.

(4) All known existing structures and utilities both above and below ground which might interfere with the proposed construction, particularly water mains, gas mains, storm drains, underground conduits, etc. Wherever available the size and type of material shall be indicated.

(5) Special detail drawings, made to a scale to clearly show the nature of the design, shall be furnished to show conflicts and/or other critical details.

f. Revised sheets shall contain a revision with identifying notation, date and mark for the revision.

g. As-Built drawings for the Sewer lines shall be prepared and submitted when installation of these lines has been completed. Each sheet shall be stamped “As-Built” and dated. These drawings shall indicate the location of all mains, lateral, meter and valve boxes ± 6”.

3. **Flow and Size**

a. Sewers for residential areas shall be designed on the basis of 100 gallons per day per person with a minimum of four (4) persons per dwelling unit.

b. Gravity sewers for commercial buildings and other uses shall be designed in accordance with Table 2, "Design Basis For New Sewage Works", Appendix.

c. A minimum peak factor of 2.5 shall be applied to all flows for the purpose of determining peak flows. In small areas, and where justified, a larger factor shall be utilized.

d. Sewers shall be designed for the ultimate tributary population.

e. No gravity sewer, including laterals to cleanout, shall be less than 6" diameter.

f. Gravity sewer diameter shall remain constant between manholes.

4. **Location**

a. Sewers generally shall be in center of street in public rights-of-way.

b. Sewers will be permitted in easements only when there is no feasible alternative, and if approval is granted by the Town. Easements shall provide adequate working space for installation and maintenance with a minimum of ten (10) feet width for force main and fifteen (15) feet for gravity sewer six (6) feet or less in depth and twenty (20) feet width for gravity sewer from six (6) feet to twelve (12) feet in depth. No sewer over twelve (12) feet in depth shall be placed in an easement.

c. Existing and proposed sanitary sewers, storm drainage systems and other underground utilities and structures shall be considered in the design and selection of pipe depths and alignments in order to avoid conflicts and facilitate maintenance.

d. No sewer line shall pass within 50 feet of a drinking water supply well, source, or structure unless special construction and pipe materials are used to obtain adequate protection. The proposed design shall identify and adequately address the protection of all drinking water supply wells, sources and structures within 100 feet of the proposed project.

e. Sewers shall be designed to prevent damage from superimposed loads. Loads due to the width and depth of trench shall be considered. Minimum cover shall be 24" for ductile iron pipe and 36" for other pipe materials.

f. All sewers over ten (10) feet in depth shall be ductile iron pipe.

g. Sewers crossing streams, or above ground, shall be ductile iron with watertight joints.

h. Air vents shall be self-bleeding and located at all high points in force mains.

i. All other utilities shall be a minimum of 5' horizontally/vertically from the water main or as per direction of the Town of Smithfield's Superintendent of Public Utilities.

5. **Velocity and Grade**

a. Gravity sewers shall be designed for a minimum velocity, when flowing full, of 2.0 ft./sec. using a Manning's coefficient of 0.013. Maximum flow velocity shall not exceed 8.0 ft./sec. Grades shall be uniform between manholes and cleanouts. Short changes in grade shall be avoided.

b. Minimum grades shall be as follows:

Pipe Diameter Inches	Slope Percent

6	0.63
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12

Maximum grade shall be less than 20%.

c. Force mains shall be designed with a minimum velocity of 2.0 ft./sec., a maximum flow velocity of 8.0 ft./sec., and a Hazen-Williams C value of 120. Minimum size shall be 4" except that consideration will be given to smaller sizes where grinder pumps are used. Constant grades shall be used where feasible. Force main discharges require special consideration of materials, construction techniques and existing and future conditions.

d. At all connections to gravity sewer manholes the difference between entrance and exit pipe invert elevations shall be at least 0.1 foot where possible.

e. Six (6) inch sewers shall not exceed 150 feet in length and shall be used only at dead ends that are not extendable.

6. **Conflicts and Clearances**

a. **Parallel Installation**

(1) Normal Conditions - Sanitary sewers or sewer manholes shall be at least ten (10) feet horizontally from any water main whenever possible. The distance shall be measured edge to edge.

(2) Unusual Conditions - When local conditions prevent a horizontal separation of ten (10) feet, a sanitary sewer may be closer to a water main provided that:

(a) The bottom of the water main is at least 18 inches above the top of the sewer.

(b) Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints and construction that are equivalent to water mains, and shall be pressure tested to assure water tightness prior to backfilling.

(c) Where the bottom of the water main cannot be laid higher than the top of the sewer, eighteen (18) inches separation and materials equivalent to water main standards shall be required.

b. **Crossings**

(1) Normal Conditions - Sanitary sewer crossing water mains shall be laid to provide a separation of at least eighteen (18) inches between the bottom of the water main and the top of the sewer, whenever possible.

(2) Unusual Conditions - When local conditions prevent a vertical separation of eighteen (18) inches, then following shall be used:

(a) Sewers passing over or under water mains shall be in accordance with Article 2, Section 6.a, subsection 2.b.

(b) Water mains passing under sewers shall, in addition, be protected by providing:

(i) A vertical separation of at least eighteen (18) inches between the bottom of the sewer and the top of the water main.

(ii) Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking of the water mains.That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

c. All sewer line crossings of highways or other major structures shall be steel encased with adequate venting, protection, etc., as may be required.

d. No water pipe shall pass through or come into contact with any part of a sewer or sewer manhole.

e. Ductile iron pipe shall be used when crossing storm sewer and other underground conduits when the vertical separation is 18 inches or less. Full lengths of pipe shall be used with a minimum eight feet (8') feet of pipe on either side of the crossing.

f. Sewers entering or crossing streams or estuaries shall be constructed of watertight pipe. The pipe and joints shall be tested in place and shall exhibit zero infiltration. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no other practical alternative exists. Such sewers on piers shall be constructed in accordance with the requirements for sewers entering or crossing under streams. Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade due to anticipated hydraulic and physical loads, erosion, and impact. The tops of all buried sewers entering or crossing streams shall be at a minimum of 3-feet depth below the natural bottom of the stream bed to protect the sewer line. Less cover will be considered if the proposed sewer crossing is encased in concrete and will not interfere with future improvements to the stream channel. In paved channels, the top of the sewer lines should be placed below channel pavement. Sewers shall remain fully operational during the 25-year flood/wave action. Sewers and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, including the 100-year flood/wave action. Sewers located along streams shall be located outside of the stream bed wherever possible.

7. **Manholes and Laterals**

a. Manholes shall be located at the end of each line, at changes in pipe size, alignment or grade and at sewer junctions. Where future extension is possible, stubs must be provided.

b. For sewer pipe on straight runs, maximum spacing between manholes shall not exceed the following:

Diameter of Pipe (Inches)	Spacing (Feet)

8 to 12	350
14 to 18	400

c. Manholes subject to flooding shall be easily accessible and have watertight manhole covers.

d. Drop manholes should be avoided where feasible. Where the invert elevation of the incoming sewer exceeds the invert elevation of the outgoing sewer by two (2) feet or more at the manhole, a drop manhole connection shall be required.

e. On upstream ends of sewers on final runs of 150 feet or less, and 8-inch diameter or less, cleanouts may be used in lieu of manholes except that on sewers where future extension is possible, manholes with stubs must be provided.

f. No cleanout shall have an invert elevation greater than 4.5 feet below the ground elevation.

g. Drop connections to manholes, must be shown where required.

h. Sewer laterals shall have a minimum of fifteen (15) inch vertical clearance between curbs, gutters, sidewalks, driveways and ramps and shall not be in excess of 75 feet in length. Minimum cover at ditches shall be 18 inches.

i. The maximum number of laterals entering an inline manhole shall be two (2). Where a manhole is located at a cul-de-sac or dead-end, the maximum number of laterals entering shall be three (3).

8. **Sewer Materials and Installation**

a. Sewers shall be P.V.C. or ductile iron except that sewer over ten (10) feet deep shall be ductile iron. This will be based on the invert grade of the pipe.

b. P.V.C. pipe shall conform to the following:

Pipe - ASTM Specification D-3034 with minimum SDR of 35.
Joints - ASTM Specification D-3212.

c. Ductile iron pipe shall conform to the following:

Pipe - ANSI/AWWA C151/A21.51, Class 51 minimum.
Joints - ANSI/AWWA C111/A21.11.

d. Pipe used for force mains shall be ductile iron conforming to the following:

Pipe - ANSI/AWWA C151/A21.51, Class 51 minimum.
Fittings - ANSI/AWWA C110/A21.10, or ANSI/AWWA C153/A21.52, bituminous lined and coated.
Joints - ANSI/AWWA C111/A21.11, push-on or mechanical.

e. Manholes shall be precast with leveling rings, cast iron manhole frame and cover, and flexible pipe connection similar to "KOR-N-SEAL". Interior surface shall be painted with two coats of "Bituminous Super Service Black", as manufactured by Koppers Company, Inc., or approved equal thereto. Manhole steps shall be PVC or Rubber encapsulated steel. When a water tight seal is not required, then dust covers shall be installed.

g. Special bedding for P.V.C. pipe is required consisting of compacted crushed stone (ASTM No. 67, 3/4" to 1/4") from 4" below pipe up to the springline. See detail that is on plans.

h. Backfill over pipe shall be compacted in 6-inch layers. Select backfill material may be required if the native material is deemed by the Town to be unsuitable for backfill. Under areas to be paved 90% of maximum density as determined by ASTM D698 shall be achieved. It shall be the responsibility of the Contractor to engage a certified laboratory, approved by the Town, to make compaction tests to verify that adequate compaction has been attained.

i. The Town may require the Contractor, at the Contractor's expense, to make "Deflection Tests" of installed P.V.C. Gravity Sewer Pipe. The Deflection Tests shall be performed after the backfill has been compacted to 95% compaction as determined by soil compaction tests in accordance with ASTM D 698. The maximum allowable deflection shall not exceed 5% of the average inside pipe diameter, as determined by using a pull through mandrel or an approved deflection measuring device. All pipe exceeding 5% deflection shall be removed and replaced with new pipe and retested. The pull through device “pig” shall be of a design promulgated by the Uni-Bell Plastic Pipe Association and have a minimum of 9 arms.

j. Thrust protection for force main shall be provided as for water main (see Detail W-3). Restrained joints may also be used by providing such joints a minimum of 30 pipe diameters from the bend for 90 degree bends and 20 pipe diameters for 45 degree or less bends.

k. Warning tape shall be bright green plastic with detectable foil and "CAUTION-SEWER LINE BELOW" printed on it. See also Article 2, Section 8.k. Tape shall include a minimum 10 gauge copper wire for enhanced detectability.

l. Any plastic or other nonmetallic pressurized conduit installed underground shall have installed with it a warning tape of electrically conductive material. Such shall be installed directly over the pipe at a depth of twelve inches. In addition a continuous 10 gauge copper wire shall be taped directly on the top of the pipe.

9. **Excavation, Bedding and Backfilling**

Trenches shall be excavated true to line and grade. Trench sides shall be kept vertical between trench bottom and 12 inches above the pipe. Excavations must be protected from caving by suitable sheathing, shoring, and twelve inch (12”) bracing. The bottom shall be carefully finished to provide a trough such that the bottom ninety (90) degree quadrant of the pipe is in direct contact throughout its entire length with undisturbed earth. Bell holes shall be provided to insure that the pipe will rest on the trench bottom for its entire length. Trench width, as measured along a horizontal plane at the top of the pipe shall be not more than twenty-four inches (24") wider than the outside diameter of the barrel of the pipe. Wherever wet or unstable soil is encountered which the Town Inspector deems is incapable of satisfactorily supporting the pipe, such material must be removed to the depth required and the trench backfilled to the established grade with a selected bedding fill of gravel or crushed stone. All select bedding fill shall be Class II Embedment Material, coarse sands and gravels, with maximum particle size of 40 mm (1-1/2 inches). Backfill shall be placed in six inch (6”) layers and carefully compacted to a depth of twelve inch (12") over the pipe. The remainder of the backfill shall be compacted by hand or mechanical means. If backfill material is determined by the Town Inspector to be unsuitable, it shall be replaced with an acceptable sand/clay select backfill. Compaction shall be to the following listed percents of maximum density at optimum moisture content as determined by tests in accordance with A.A.S.H.T.O. Des. T99:

	Cohesive	Cohesionless

Location	Materials	Materials
General Site	85%	90%
Walks	90%	95%
Roads	90%	95%

10. **Infiltration Testing**

An acceptance test shall be specified for all gravity sewer lines. The test may be either a hydrostatic test or an air test.

a. Hydrostatic Testing - Where hydrostatic testing is specified (infiltration or exfiltration), the leakage outward or inward shall not exceed 100 gallons per inch of nominal pipe diameter per mile per day (2400 gpd/mi. maximum) for any section of the system including manholes. Where the exfiltration test is employed, the line shall be subjected to a minimum of 4 feet of head, or head to the top of the manhole, whichever is the lesser, above the crown of the pipe at the upstream manhole of the section being tested. The infiltration test shall be allowed only when it can be shown that the hydrostatic head outside the pipe is a minimum of 4 feet above the crown of the pipe for the entire length of the pipe being tested.

b. Air Testing - Where air testing is specified, test methods and acceptability criteria shall be in accordance with ASTM specification F1417-92. Air testing shall generally be acceptable for all types of pipe and materials. If air testing is employed, the manholes shall be tested by exfiltration. Lines to be tested will be designated by the Town's representative, these lines will be tested at 4 psi at 20 minute increments.

c. All sewer mains, gravity or force, PVC and /or ductile iron, will be required to have a pull through device, "pig", pulled through all lines to determine if any obstructions and/or pipe deflections have occurred.

11. **Force Main Pressure Testing**

All force mains shall be subjected to a hydrostatic pressure test of 75 pounds per square inch. The duration of each pressure test shall be at least two (2) hours. Each valved section of pipe

shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe. Before applying the specified test pressure, all air shall be expelled from the pipe. Any cracked or defective pipes, fittings, or valves discovered shall be removed and replaced with sound material and the test shall be repeated until satisfactory. Leakage shall be defined as the quantity of water that must be supplied into the test section of pipe to maintain the specified test pressure within 5 p.s.i. Allowable leakage in the section of pipe under test, in gallons per hour per 1000 feet, shall be as shown in the chart below. If the pipe is less than 1000 feet in length, then the maximum allowable leakage shall be proportional to the length of the pipe, using the chart below.

Pipe Diameter (Inches)	18 ft. Nominal Lengths	20 ft. Nominal Lengths
4	0.37	0.33
6	0.55	0.50
8	0.74	0.67
10	0.92	0.83
12	1.10	1.00

ARTICLE III
Sewage Pumping Stations

1. **General**

a. Sewage pump stations shall be designed by a professional engineer licensed in accordance with the requirements of the Code of Virginia. Sewage pump stations shall

be in accordance with these guidelines, ordinances of the Town of Smithfield, and requirements of the Commonwealth of Virginia "Sewerage Regulations". All Plans and Specifications shall be approved in writing by the Town prior to commencement of construction.

2. **Plans**

a. All plans for sewage pumping stations shall bear a suitable title showing the name of the project, scale in feet, north arrow, datum, vicinity map, the name of the Engineer, his signature and seal and the date. The plans and specifications shall include provisions for excavation, foundation, and backfill, dewatering, sheeting and bracing, protection of the public, materials, material testing, details of construction of pump station and appurtenances and other items as may be applicable to the project, all in accordance with good engineering practice. Plans shall include elevations showing site appearance of the station, sections, details, electrical details and a site plan showing existing topographic information such as pavement, storm drains, utilities, trees, shrubbery, property lines, and appropriate elevations as well as new construction including layout dimensions and final elevations. Each set of plans shall also include a vicinity map and a typical section of the access road and any drainage ditches.

b. The plans shall be clear and legible. They shall be drawn to a scale which will permit all necessary information to be clearly shown. Plans generally should not be larger than 24 inches x 36 inches. Datum shall be U. S. National Ocean Survey (formerly U.S.C. & G.S.) Datum, Mean Seal Level = 0.00, and a referenced benchmark and project benchmark shall be shown.

c. Dimensions and relative elevation of structures, finished floor elevations, the location and size of piping, surface water levels, 100-year flood level, and ground elevations shall be shown.

d. Plans submitted for approval shall be accompanied by technical specifications, hydraulic calculations, pump curves, and pump cycle calculations.

3. **Capacity and Type**

a. Pumps shall be sized to handle the peak flow anticipated from the service area with one (1) pump. A second pump shall be furnished as standby.

b. Pump stations with capacity greater than 100 gpm shall be of the wet well/dry well type. The Town may elect to permit submersible grinder pump type stations for capacities up to 100 gpm. Grinder pumps, if approved, shall be as manufactured by Hydro-o-matic Pumps, Inc. All pump stations and lift stations shall have 3 phase motors.

c. Dry well pumps shall be capable of passing 3" diameter solids unless preceded by a sewage shredder.

4. **Construction**

a. Construction shall be of reinforced concrete with all wall penetrations sleeved. Superstructure walls shall be masonry or approved precast concrete panels with hipped frame roof. All hatches and aluminum fabrications shall be 6061-T6.

b. Wet well shall contain aluminum bar screen with maximum 3/4" openings, aluminum stairs, emergency suction, intermediate floor, and be provided with adequate lighting and ventilation. All bolts and fasteners in wet well and the lift stations shall be stainless steel. See Article II, Section 8.e for required interior wet well coating.

c. Dry well shall contain pumps, header piping and valves, sump pump, air relief piping, stairway, adequate lighting and ventilation.

d. Motor Room shall contain motors, control panel, remote alarm terminal, adequate lighting and ventilation

e. Pump suction velocity shall be 2-6 fps and discharge velocity shall be 2-8 fps.

f. Electrical service shall be underground. An exterior plug-in connector shall be provided for connection of a 3 phase portable electric generator if permanent generator is not provided. Control panel shall include phase monitors, running time meters, convenience outlet, and lightning suppression.

g. Exterior of wells below grade shall be coated with a waterproof foundation coating.

h. Level controls shall be purged bubbler for wet well/dry well type stations and sealed mercury float for submersible type pump stations.

i. Remote alarm terminal specifications will be furnished by the Town, but paid for and installed by the Contractor. Contractor shall provide duplex outlet for service to alarm transmitter. Connections to alarm transmitter shall be by 18 gage stranded telemetry wire. If exterior control box is provided for pump controls, it shall be NEMA 4 and have sufficient space for the alarm transmitter. Separate dry well high level float shall be wired directly to the alarm transmitter.

j. Emergency connection shall be furnished on the discharge force main with 6” quick disconnects compatible with the Town system.

k. Portable pumps and hoses may be required to be furnished and turned over to the Town if needed to supplement the Town's continuous operability program.

l. Wet well/dry well station shall have 8' high chain link fence and double gate.

m. All stations shall have hard surface entrance drive.

n. Submersible stations shall have check valves removable with the pump, removable winch, separate high water alarm, remote alarm terminal (see Article 3, Section 4.j and 4.k) and sealed stainless steel electrical junction box with a stainless steel riser mounted on the top deck for ease of pump removal. Separate check valves and isolation valves shall be located outside the wet well in a vault with aluminum weathertight top and access hatch. There shall be a mounted outside light with a switch.

o. All stations shall be provided with water service equipped with a hose bibb and a backflow preventer approved by the State Department of Health. If termination is outside, hydrant shall be freeze proof type, Simmon #802 yard hydrant with minimum two (2) feet of soil cover.

ARTICLE IV

Site Work, Drainage and Streets

1. **General**

a. Design shall be by a professional engineer licensed in accordance with the requirements of the Code of Virginia. All plans, plats and specifications shall be approved in writing by the Town prior to commencement of construction.

b. The Contractor shall be responsible for traffic control during the course of the work and shall provide certified flagmen, signs, etc., as necessary to meet requirements of VDOT and/or the Town of Smithfield. At least one (1) lane of traffic shall be maintained on existing residential streets at all times.

c. Tree trunks and exposed roots damaged during equipment operation shall be painted immediately with a good grade of "Tree Paint". All tree limbs damaged during construction or removed for any other reason, will be sawed to tree trunk and painted with a "Tree Paint".

d. The Contractor shall construct and maintain all necessary silt devices sufficient to prevent soil from being eroded from the site into any adjacent system, ditch or watercourses. Any material that is eroded shall be promptly removed. The Contractor shall comply with the current requirements of the "Virginia Erosion and Sediment Control Handbook".

d. All excavated materials shall be stockpiled so as not to interfere with existing drainage. Stockpiles shall have as a minimum silt fence installed around its perimeter.

f. The Contractor shall be responsible for removing and replacing with matching materials any pavement, driveways, walks, curbs, etc., that must be cut or that are damaged during construction. Cuts in pavements shall be straight line saw cut. Cuts in curbs and walks shall be saw cut at an existing joint. Repair as per Article 4, Section 3.c.7.

2. **Plans**

a. Plans, profiles and specifications shall include provisions for excavation and backfill, dewatering, sheeting and bracing, maintenance of traffic and protection of the public, protection of existing utilities and structures, trench widths and preparation, materials, material testing, details of pipe laying and construction of pipe lines and appurtenances and other items as may be applicable to the project and all in accordance with good engineering practice. Plans (Scale 1"=40' or larger) shall include profiles, details and

topographic information such as existing and proposed zoning, lot numbers, street pavement, sidewalks, driveways, curb and gutter, storm drains, utilities, trees, shrubbery, property lines, street names and house numbers (where available) and appropriate elevations. Plans shall also include a vicinity map, map and deed book references for adjacent property and existing easements, and typical sections of streets, roads and ditches.

b. Elevations shall be based on U. S. National Ocean Survey (formerly U.S.C. & G.S.) Datum, Mean Sea Level = 0.00. Plans shall show referenced Bench Mark and a minimum of two (2) Bench Marks established for the project. Permanent benchmarks in subdivisions shall be established by the developer. The number and locations are to be determined by the Town's representative and developer. The benchmark elevation is to be certified by a licensed land surveyor or a professional engineer.

3. **Drainage**

a. **General** - Drainage shall be designed in general by the criteria established in the current VDOT Drainage Manual. Design and construction shall also meet the applicable requirements of the Town of Smithfield "Chesapeake Bay Preservation Area Ordinance"; and stormwater management and erosion and sediment control requirements of the Commonwealth of Virginia Soil and Water Conservation Board. Refer to the current "Virginia Erosion and Sediment Control Handbook".

b. **Design** - Drainage shall be designed by the criteria established in the VDOT Drainage Manual and in coordination with the following guidelines:

(1) Peak runoff shall be computed by the rational method with the intensity taken from the intensity-duration curve for Norfolk, Virginia.

(2) Where the drainage basin exceeds 200 acres or when a retention design is involved, hydrographic or other approved methods are to be used for design purposes.

(3) Runoff coefficients shall be based on a weighted coefficient for the composite area.

(4) Inlet capacities and pavement spread calculations shall be designed in accordance with the current VDOT Drainage Manual. These capacities shall be designed for a storm having a minimum 10-year recurrence frequency. Inlets shall be spaced to eliminate pavement spreads in excess of ten feet (10') on the typical street section calculated on a 10-year recurrence frequency.

(5) Pipe Capacities:

(a) Hydraulic grade line calculations are required which take into account structure, bend losses, etc. Pipe joints must be designed to withstand pressures proposed. System must be designed to prevent flooding during the design event.

(b) Hydraulic grade line calculations must reflect the same design event in the downstream or receiving facility.

(6) Off-site drainage improvements will be required to prevent the proposed development from having any significant detrimental effect on the downstream facilities to a natural outfall.

c. **Materials and Standards** - Materials and standards shall be in accordance with the current Virginia Department of Transportation (VDOT) "Road and Bridge Specifications" and "Road and Bridge Standards", unless otherwise stated.

(1) Temporary drainage during construction shall be provided by the Contractor to relieve areas that may cause damage to roadways, etc. and as approved by the Town.

(2) Concrete shall be Class "A3" Air Entrained (3,000 p.s.i. minimum) for general concrete and Class "A4" Air Entrained (4,000 psi minimum for precast units).

(3) All storm sewer pipes in Town right of way shall be concrete tongue and groove. Pipes not subject to traffic loading may be non-reinforced pipe. Pipes subject to traffic loading shall be reinforced concrete pipe, Class III minimum. H.D.P.E. (High Density Polyethylene Pipe Smooth Bore) may be substituted in lieu of concrete pipe in all locations in which this pipe will meet or exceed the current

VDOT Standards and Specifications, and the approval of the Town. Corrugated metal pipe will not be permitted.

(4) Precast structures are acceptable. These drainage structures shall meet all current VDOT Standards and Specifications. Drop Inlet T-DI-1 may be furnished with square "Alternate Top" where wheel loading is not a factor.

(5) Riprap shall be provided at endwalls and flared end sections or as otherwise specified by the Town.

(6) All new, and where required existing downstream, storm sewer pipes and structures shall be cleaned of debris and eroded material upon completion of construction.

(7) No open cut of a public roadway shall be allowed except with written permission from the Town, accompanied with all necessary bonds. This repair shall be equal to or greater than VDOT MP-70 (pages 66-68) or as approved by the Town.

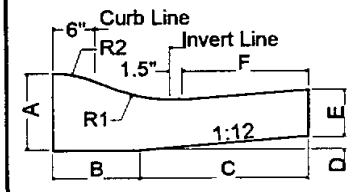
(8) Relocation of any utilities shall be at the Contractor's expense and completed with site work.

(9) Before digging the Contractor shall call "MISS UTILITY" of Tidewater at 1-800-552-7001 for location of existing utilities. Prior to construction or excavation, the Contractor shall assume the responsibility of locating any underground utilities (public or private) that may exist and cross through the area of construction. Utility companies shall be notified 48 hours in advance of any excavation in the proximity of their utilities. The Contractor shall be responsible for repairing, at his expense, any existing utilities damaged during construction. The above referenced statement shall be noted on all construction plans. At their expense, the contractor shall be responsible for repairing any existing utilities or infrastructure within the right of way of the Town during construction. This repair shall meet the approval of the Town.

(10) In lieu of CG-6 curb, roll-top curb is to be utilized where applicable by Virginia Department of Transportation's (VDOT) current standards and specifications or as directed by the Town's representative.

ROLL TOP

{6" at top of curb ≈ 155mm }
{1.5" at invert line ≈ 40mm}



Dimensions

A	11.5 in	*{290mm}*
B	1 ft 0 in	*{310mm}*
C	2 ft 0 in	*{610mm}*
D	2 in	*{50mm}*
E	7 in	*{180mm}*
F	1 ft 6 in	*{460mm}*
R1	1 ft 6 in	*{460mm}*
R2	1 ft 3 in	*{380mm}*

4. **Streets**

a. **Pavement Design Criteria -** Pavement design shall be performed by a Professional Engineer/Land Surveyor licensed to perform this type of work. Soil sampling shall be performed as per the current VDOT Pavement Design Guide. Test should be taken a minimum of 10' below the finish grade of the proposed street. The Engineer shall submit to the Town for review test logs, pavement design and bore location map. The following information shall be submitted to the Town Manager with the pavement design:

(1) **Soil Analysis** - Ten-foot (10') deep boring logs of sufficient quantity to determine the soil profile, related to elevations. The borings shall reflect ground water elevations, description of materials and blow counts on the samplers. Borings shall indicate normal water table elevation, and projected seasonable high water table elevation. Maximum spacing of test shall be 500 foot (250' radius of coverage per test) and as per the current VDOT Pavement Design Guide. No less than 2 tests are to be provided. All soil tests are to be performed a certified Testing Laboratory licensed to perform this type of work. Soil Analysis of subgrade material shall include:

(a) Gradation (Sieve and Hydrometer Analysis)
(b) Atterberg Limits.
(c) Moisture density relationships and curves.
(d) Maximum dry weight.
(e) Optimum moisture content.
(f) Specific gravity.
(g) Swell.
(h) California Bearing Ratio in accordance with Virginia Test Method (VTM-8), with soaked and unsoaked test results required. Tests shall be taken at the proposed street subgrade elevation.

(2) **Traffic Volumes** - On proposed new streets the following minimum 24-hour trip generation information shall be used or the current "I.T.E. Trip Generation Manual", whichever is greater:

Development	Trip Generation Per Dwelling Unit	%Heavy Trucks
Single Family Residential	10	5
Townhouse Residential	6	5
Apartment Residential	6	5
Schools		
Elementary and Intermediate	0.8/Student	5
High School	1.4/Students	5
Industrial	52/AC	12
Shopping Centers	600/AC	5

Where proposed streets intersect the boundary of the subdivision providing access to adjoining undeveloped property, the design traffic shall be based on the number of acres and the total number of units expected to contribute traffic to the street.

(3) **Pavement Design** - The pavement shall be designed per Section 316 of the current "VDOT Road and Bridge Specification Manual".

(a) Flexible Pavement. Flexible pavement design shall be in accordance with Section 315 of the current "VDOT Road and Bridge Specification Manual" and the current "VDOT Pavement Design Guide for Subdivision and Secondary Roads In Virginia".

Off site being private property:
- Minimum subgrade CBR of 15.
- 6-inch minimum compacted subgrade.
- Minimum flexible pavement section:
  - Asphalt Surface Course: 2".
  - Aggregate Base: 6".
  - Compacted Subgrade: 6".

(b) Full Depth Asphalt. Full depth asphalt pavement design criteria shall conform to the provisions of the Asphalt Institute Manual and/or any applicable sections of the current "VDOT Road and Bridge Specifications Manual". Minimum section shall be:
- 1-1/2-inch surface.
- 10-1/2-inch base.
- 6-inch compacted subgrade.

(c) Soil Cement Base. The use of a design which utilizes soil cement shall meet Section 307 of the current "VDOT Road and Bridge Specifications Manual".

(d) Lime Stabilized Base. The use of a design which utilizes lime stabilized base shall meet Section 306 of the current "VDOT Road and Bridge Specifications Manual".

(e) Aggregrate Base. The use of a design which utilizes aggregrate base shall meet Section 309 of the current “VDOT Road and Bridge Specifications Manual”.

b. **Materials and Standards** - Materials and standards shall be in accordance with the most recently adopted Virginia Department of Transportation (VDOT) "Road and Bridge Specifications" and "Road and Bridge Standards", unless otherwise stated.

(1) Asphalt shall be in accordance with the Section entitled "Asphalt Concrete" Table II-14, "Mixture Design Criteria". Surface mixture type shall include AC-30 viscosity grade.

(2) Aggregate shall be in accordance with Section entitled "Subbase and Aggregate Base Material", Type I or II, Sizes 21-A or 21-B.

(3) When materials which are unsuitable for foundations, subgrades or other roadway purpose occur within the limits of street construction, the Contractor shall be required to excavate such material below the grade shown on Plans, and the areas so excavated shall be backfilled with approved suitable materials. The extent of undercutting and backfilling is to be determined by the Town and at the developers/contractors expense.

(4) All roadway improvements shall be equal to or greater than the current “VDOT Road and Bridge Standards”

(5) For concrete color control, concrete mixture for all exposed concrete surfaces of walks, curbs, gutters and pour-in-place structures shall be from the same supplier and cement manufacturer.

c. Subdivision Covenants – Subdivision covenants should contain the following attachments:

(1) Paved private entrance specifications (pages 63-65).
(2) Federal mailbox regulations (pages 69-70).
(3) Along with this statement:
“Columns, posts, walls, signs, brick mailboxes or similar ornamental structures that do not enhance a roadways’ capacity or traffic safety, shall not be permitted

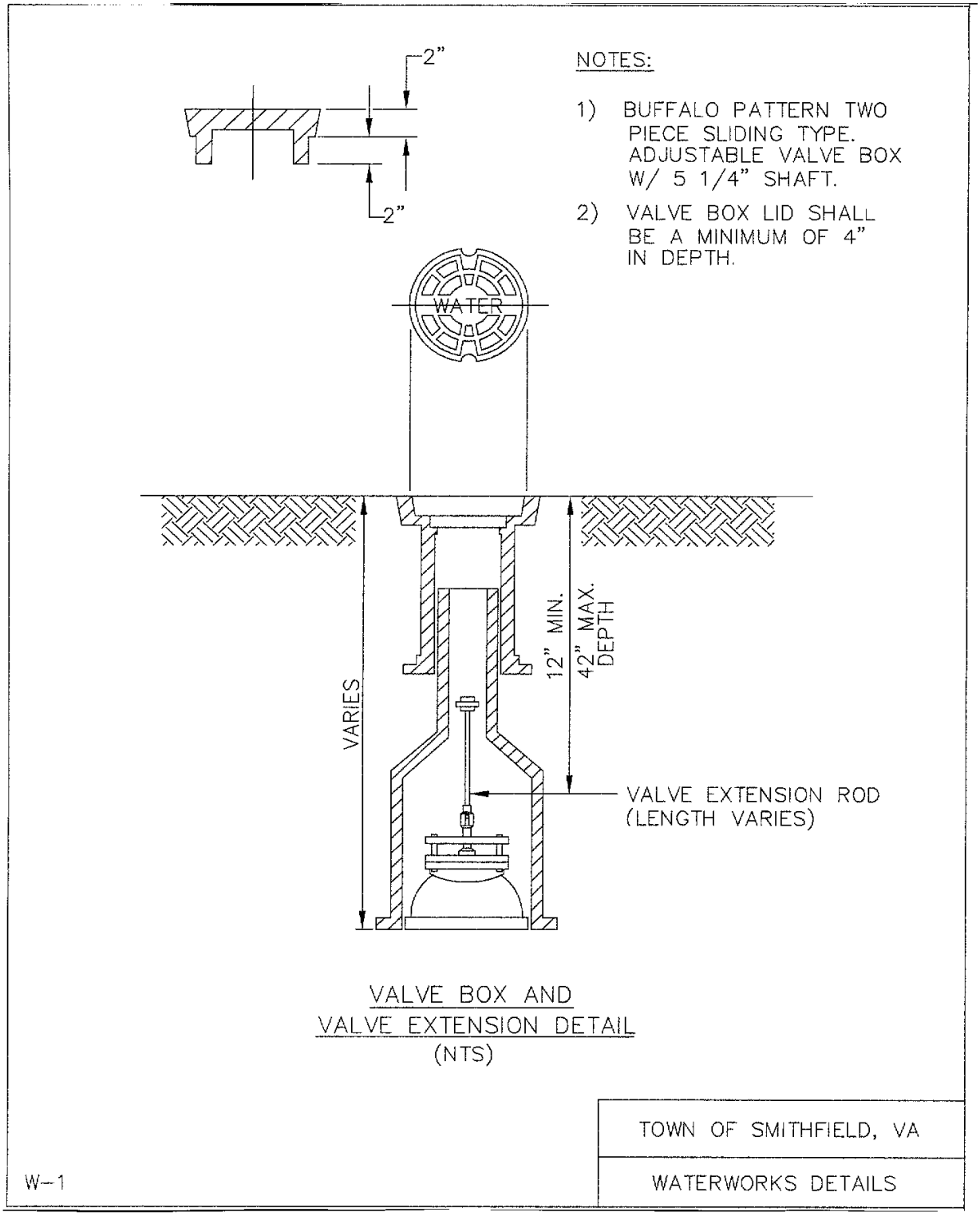
within the right-of-way of a subdivision street. Only those structures specifically authorized by permission of the Town of Smithfield may be located within the streets' right-of-way. If at any time in the future any part or parts of attachments (1), (2) or statement (3) are modified or revised to current standards or specifications, then the current attachment or statement will be applicable at that time."

A copy of the covenant is required for the Town's file. All homeowners and builders are required to be knowledgeable of these regulations, which will be effective the date indicated on the site plan which has been signed and approved by the Town.

Article V

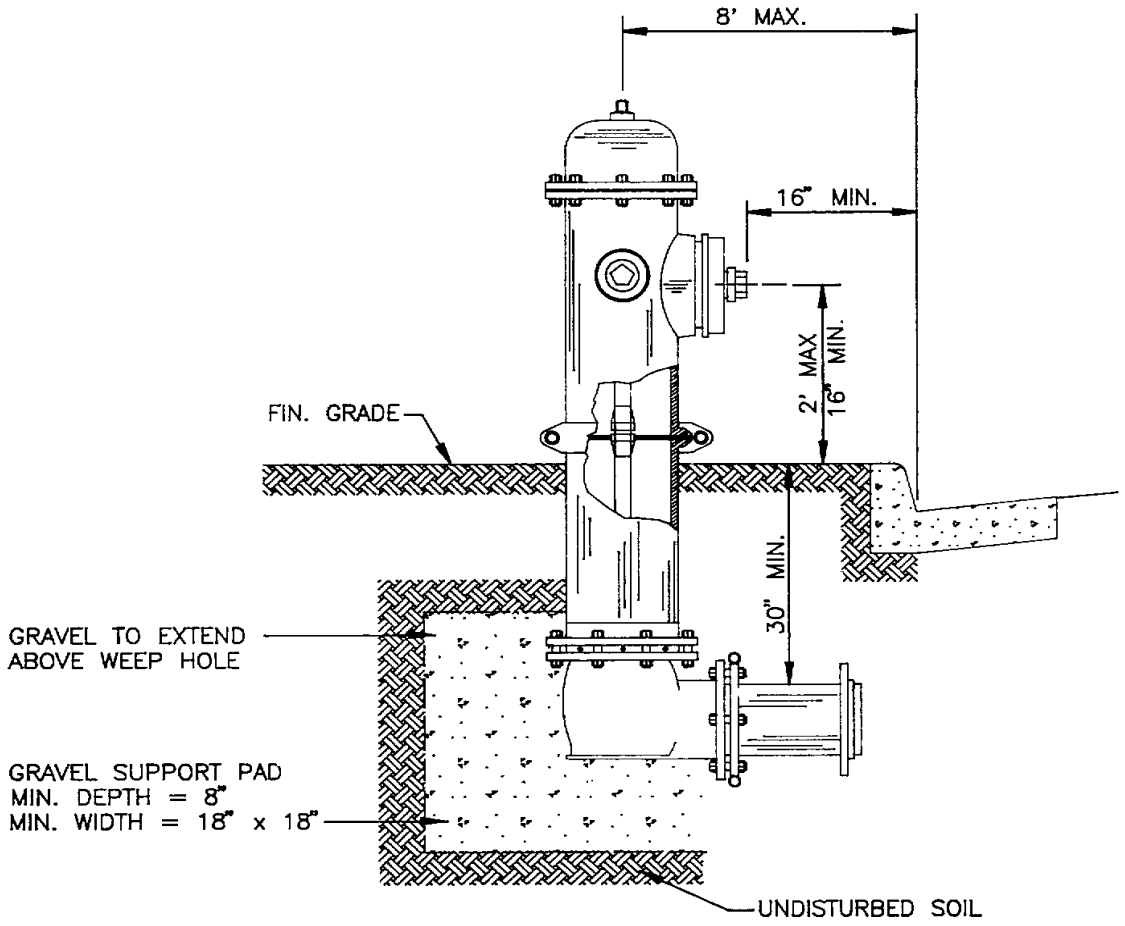
Standard Details

The following listed standard details apply to improvements in the Town of Smithfield. Other standard details such as VDOT "Road and Bridge Standards", etc., are referenced in the text.


2"
2"
NOTES:
1) BUFFALO PATTERN TWO PIECE SLIDING TYPE. ADJUSTABLE VALVE BOX W/ 5 1/4" SHAFT.
2) VALVE BOX LID SHALL BE A MINIMUM OF 4" IN DEPTH.
WATER
VARIES
12" MIN.
42" MAX. DEPTH
VALVE EXTENSION ROD (LENGTH VARIES)
VALVE BOX AND VALVE EXTENSION DETAIL
(NTS)
TOWN OF SMITHFIELD, VA
WATERWORKS DETAILS
W-1

NOTE:

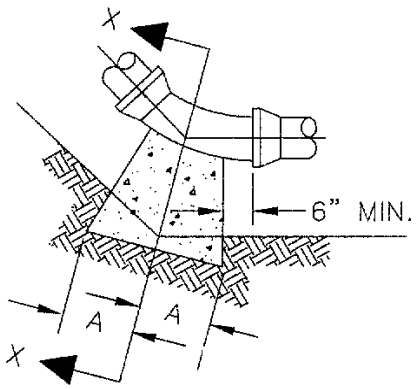
1. HYDRANT SHALL BE MUELLER "CENTURION" OR KENNEDY "K-81A" WITH 4 1/2" PUMPER AND TWO 2 1/2" HOSE NOZZLES.
2. HYDRANT SHALL BE VERTICALLY PLUMB. PUMPER CONNECTION SHALL FACE 90° to STREET CENTERLINE UNLESS OTHERWISE SPECIFIED.
3. WHERE NO CURB IS EXISTING OR PROPOSED VERIFY SET BACK WITH INSPECTOR.



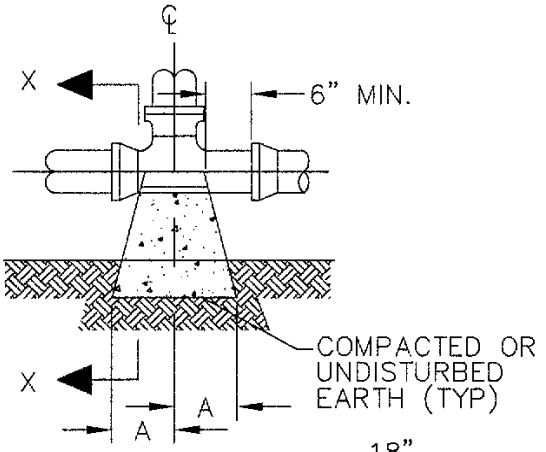
STANDARD FIRE HYDRANT SETTING

NOT TO SCALE

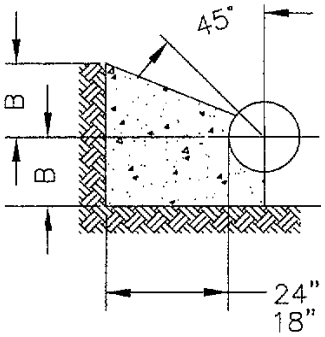
W-2

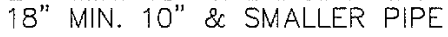


PLAN BENDS

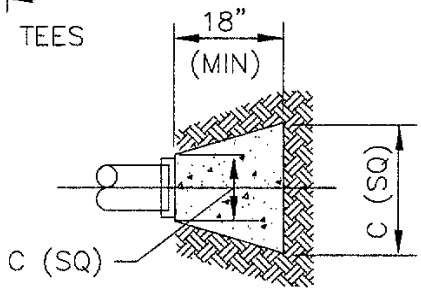


PLAN TEES





SECTION X–X
BENDS & TEES



PLAN & ELEVATION
PLUGS

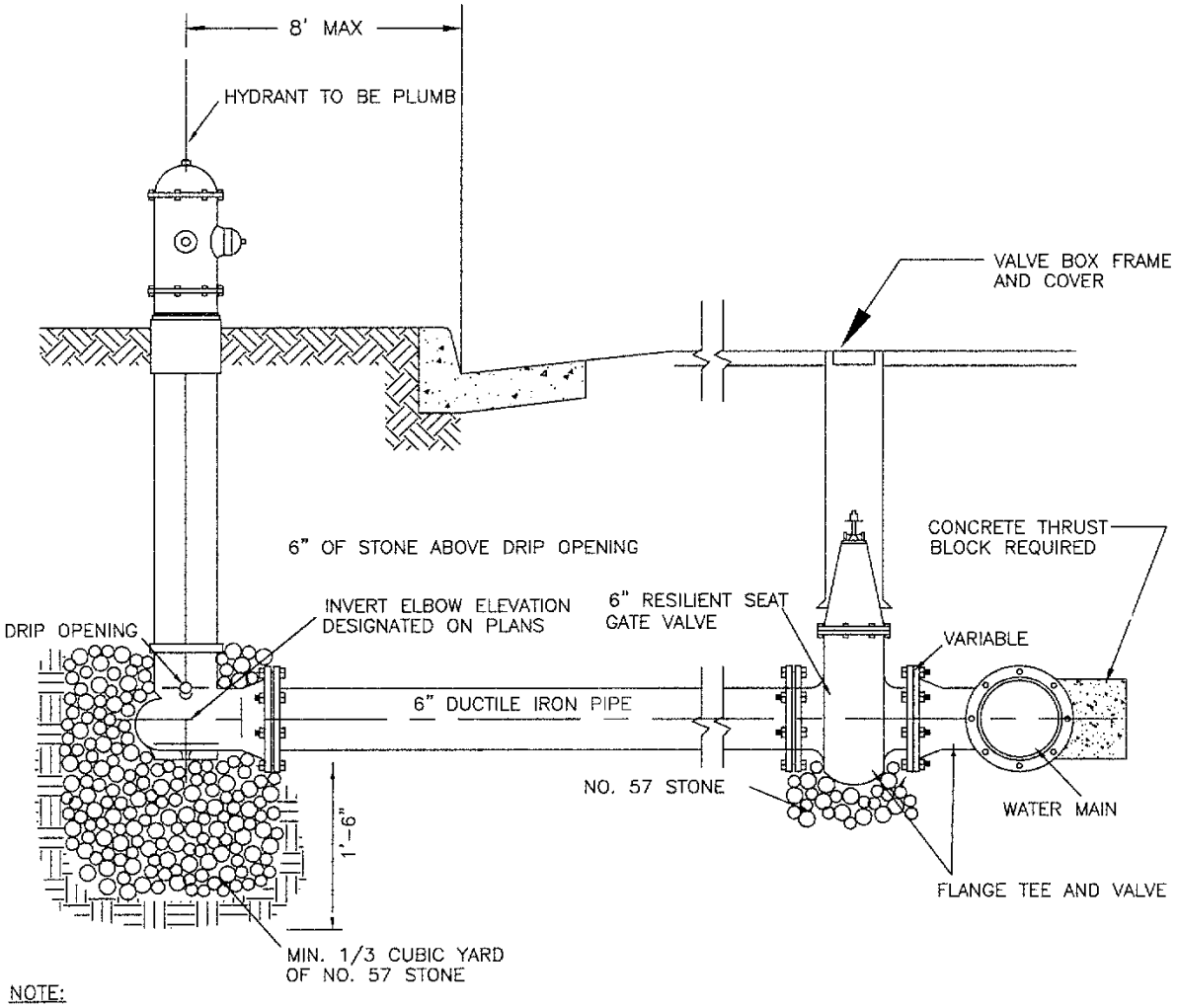
SIZE	1/4 BENDS		1/8 BENDS		1/16 BENDS		TEES		PLUGS	
	A	B	A	B	A	B	A	B	C	D
6"	10"	10"	9"	10"	6"	8"	10"	12"	10"	21"
8"	22"	13"	12"	13"	8"	10"	13"	16"	12"	29"
10"	26"	17"	14"	17"	10"	13"	16"	20"	14"	36"
12"	29"	21"	16"	21"	11"	16"	18"	24"	16"	41"
14"	35"	24"	19"	24"	12"	20"	22"	27"	18"	48"
16"	38"	27"	21"	27"	12"	24"	24"	30"	20"	54"

THRUST BLOCKS
(NTS)

TOWN OF SMITHFIELD, VA

WATERWORKS DETAILS

W–3



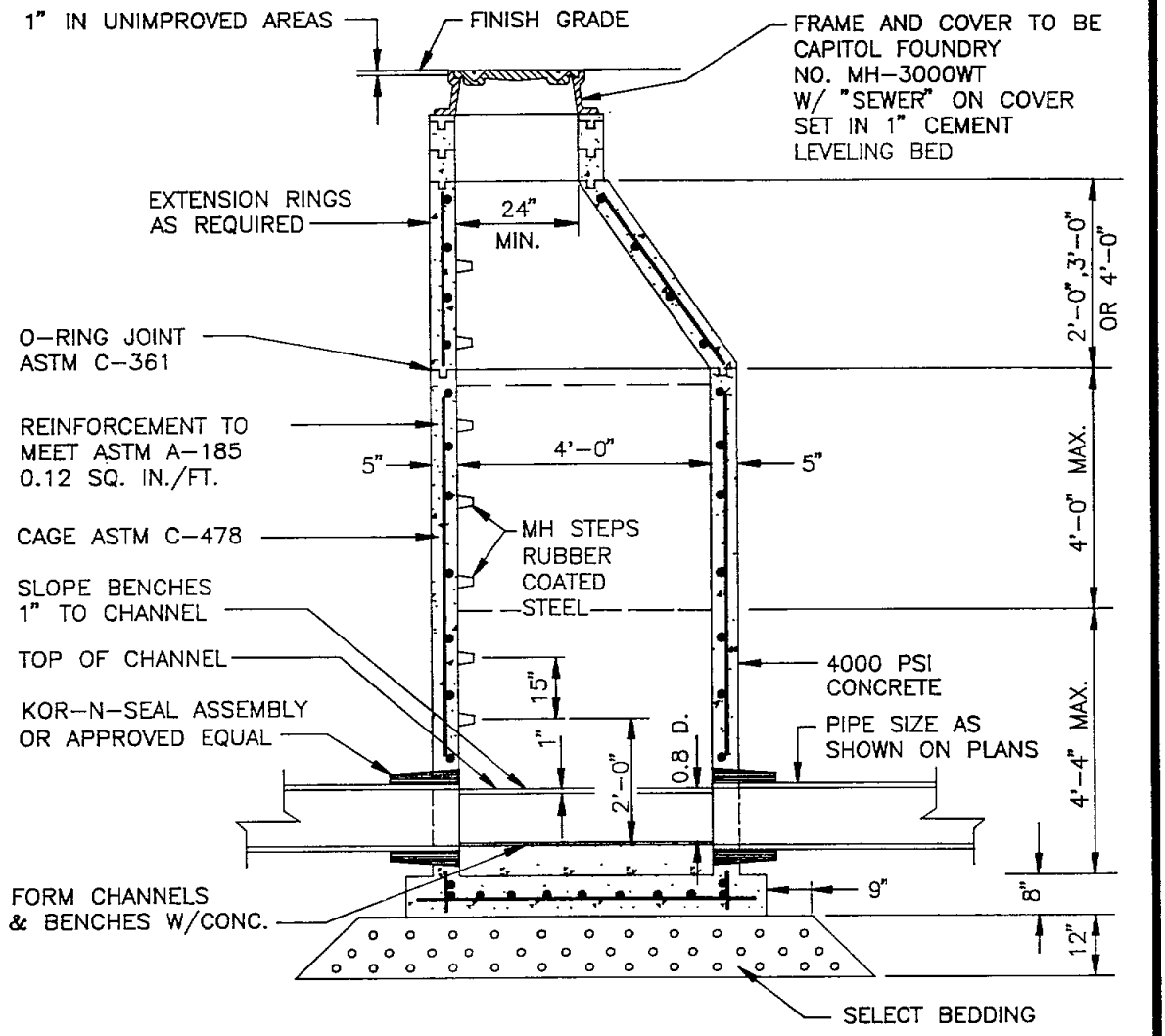
NOTE:

1) HYDRANT SHALL BE MUELLER "CENTURION" OR KENNEDY "K-81A" WITH 4 1/2" PUMPER AND TWO 2 1/2" HOSE NOZZLES.
2) HYDRANT SHALL BE VERTICALLY PLUMB. PUMPER CONNECTION SHALL FACE 90° TO STREET CENTERLINE UNLESS OTHERWISE SPECIFIED.
3) WHERE NO CURB IS EXISTING OR PROPOSED, VERIFY SET BACK WITH INSPECTOR.
4) HYDRANTS TO BE LOCATED AS APPROVED BY THE TOWN OF SMITHFIELD FIRE DEPARTMENT.

TOWN OF SMITHFIELD, VA.

WATERWORKS DETAILS

W-5



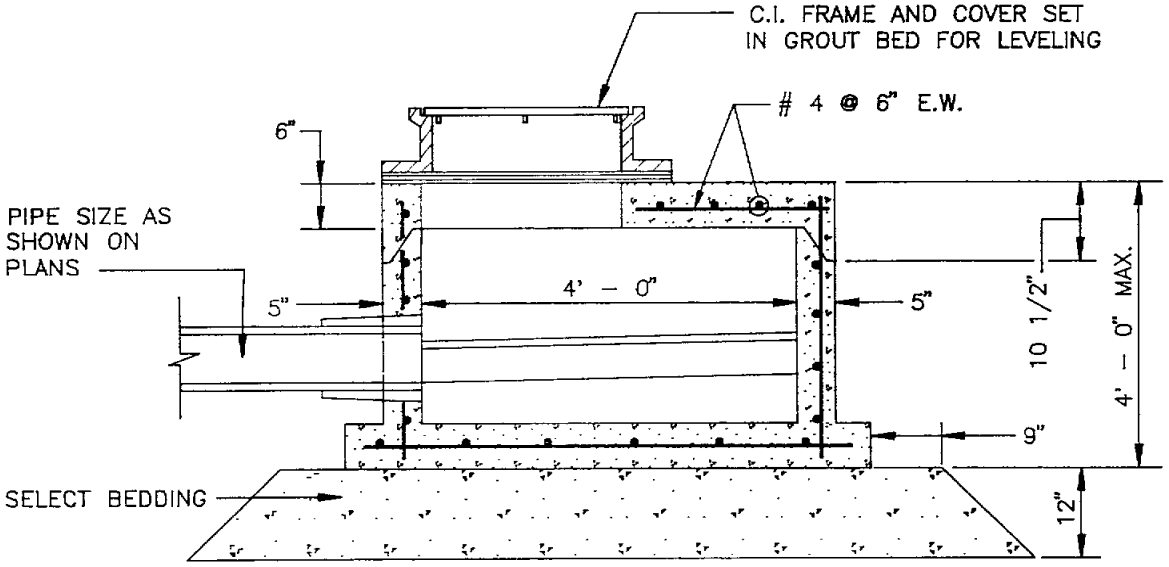
STANDARD MANHOLE

NOT TO SCALE

S-1

NOTES:

1. MANHOLE REQUIREMENTS ARE THE SAME AS STANDARD MANHOLE.
2. MANHOLE TOP SLAB REINFORCEMENT AS SHOWN.



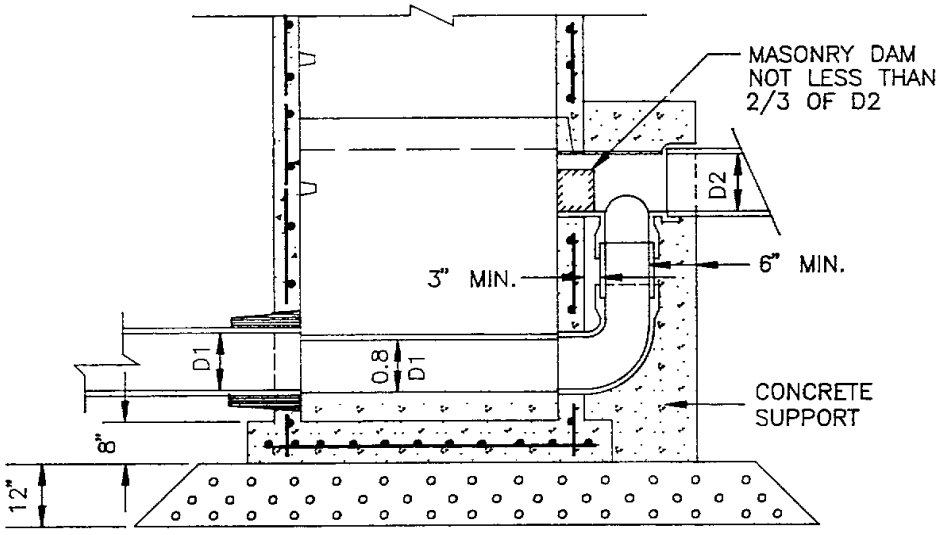
SHALLOW MANHOLE

NOT TO SCALE

S-2

NOTES:

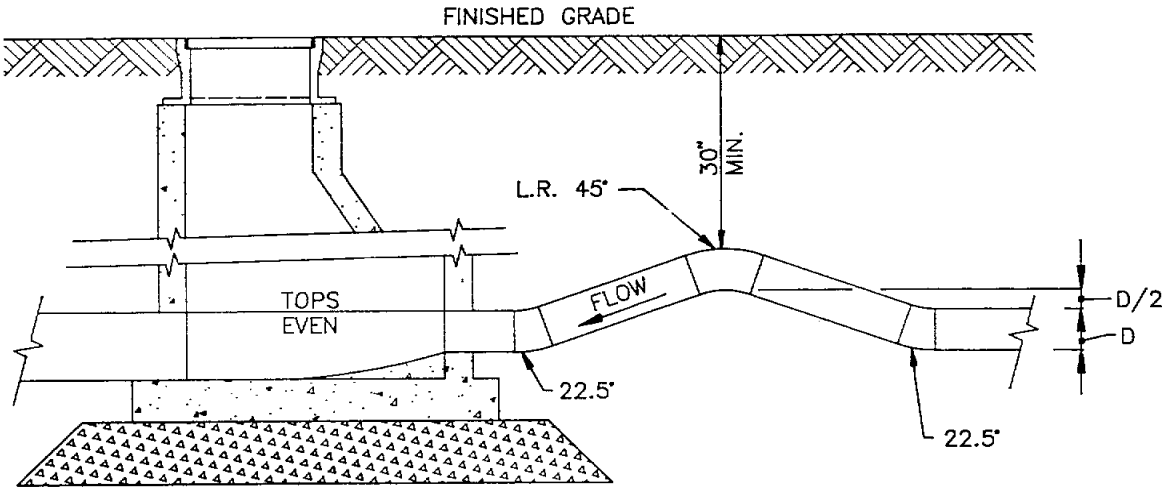
1. MANHOLE REQUIREMENTS ARE THE SAME AS STANDARD MANHOLE.
2. DROP PIPE TO BE NEXT SMALLER SIZE THAN INLET (6" MIN. DROP SIZE).



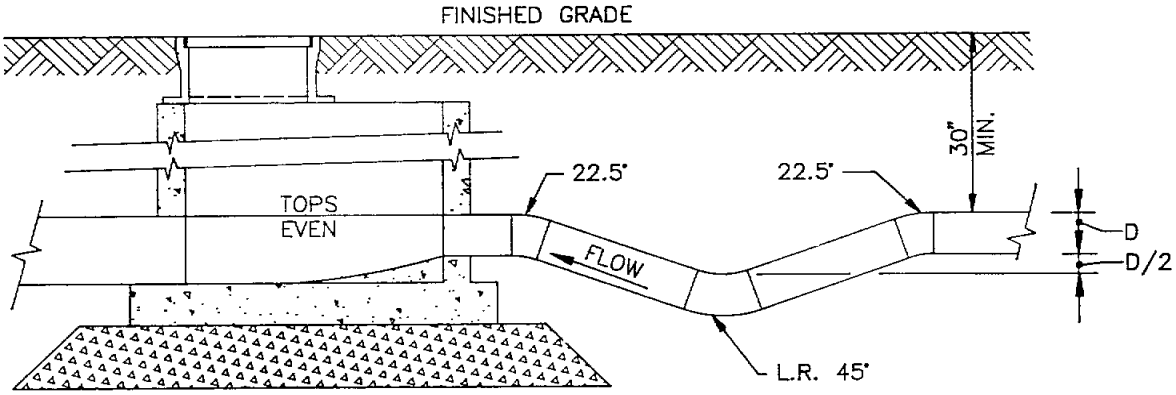
DROP CONNECTION

NOT TO SCALE

S-3



DISCHARGE INTO STANDARD MANHOLE

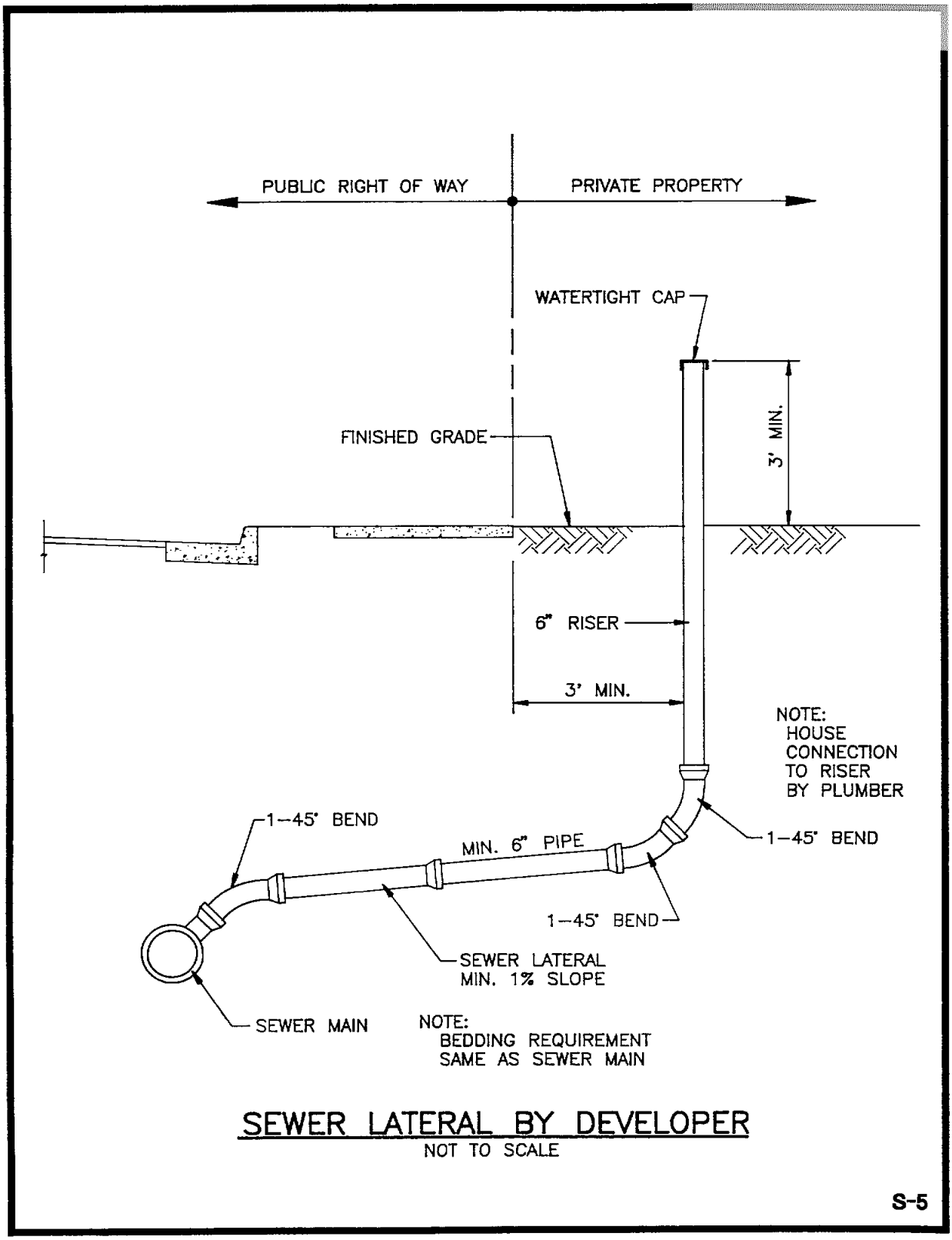


DISCHARGE INTO SHALLOW MANHOLE

STANDARD FORCE MAIN CONNECTIONS TO MANHOLES

NOT TO SCALE

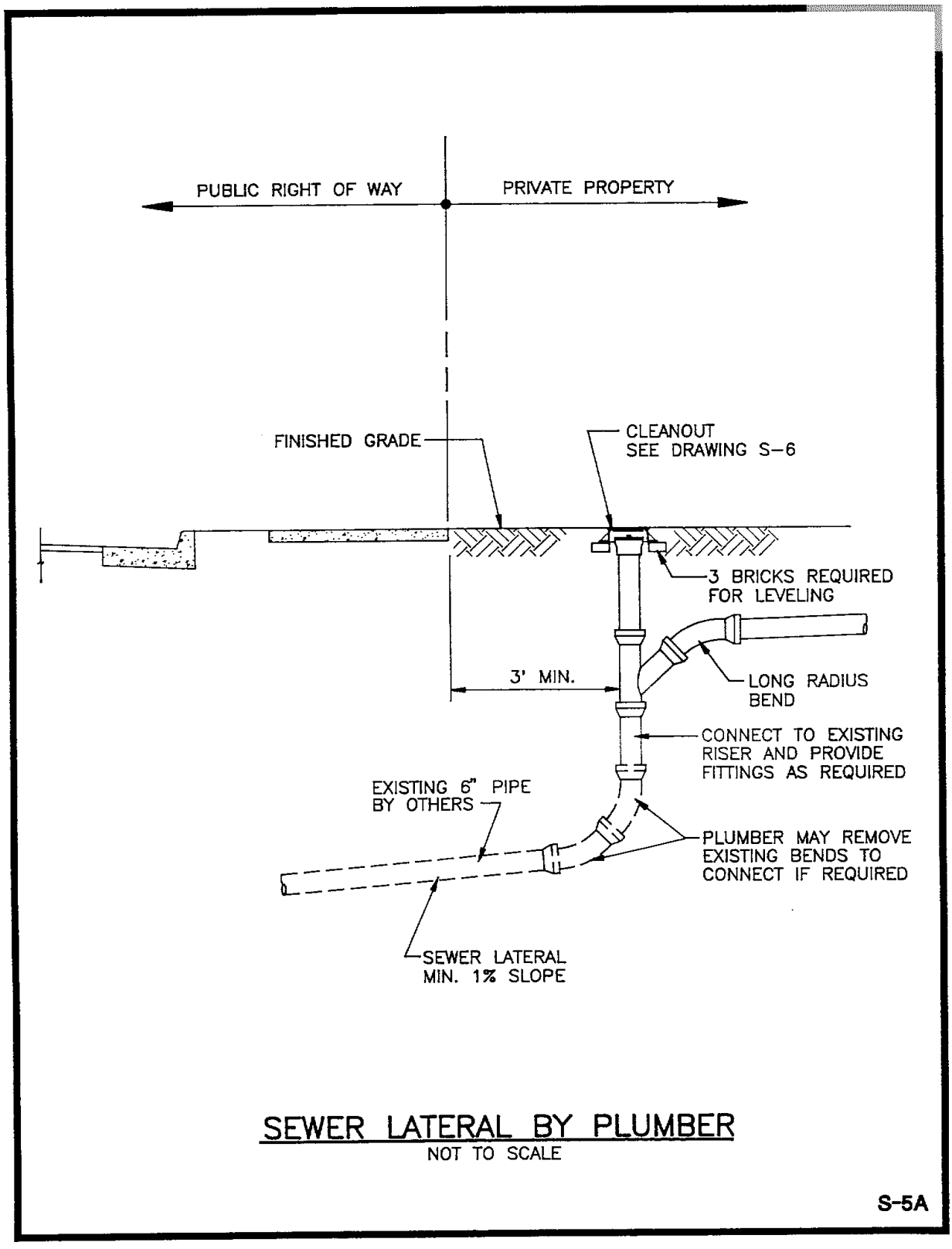
S-4



SEWER LATERAL BY DEVELOPER

NOT TO SCALE

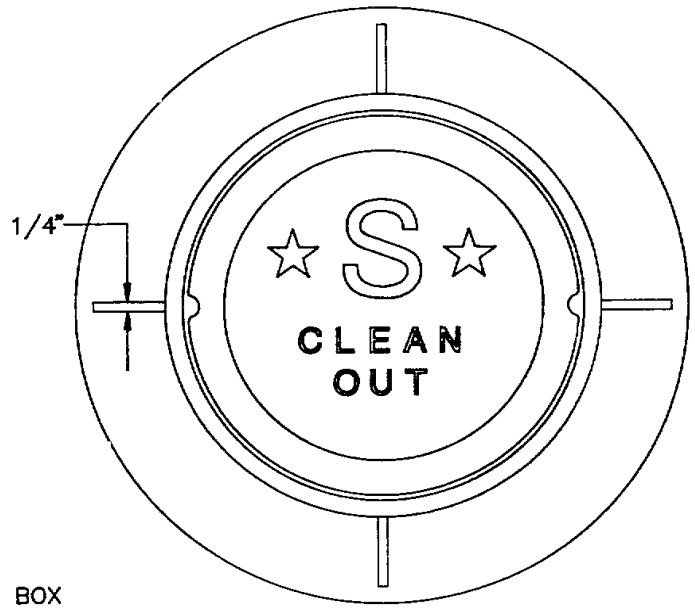
S-5

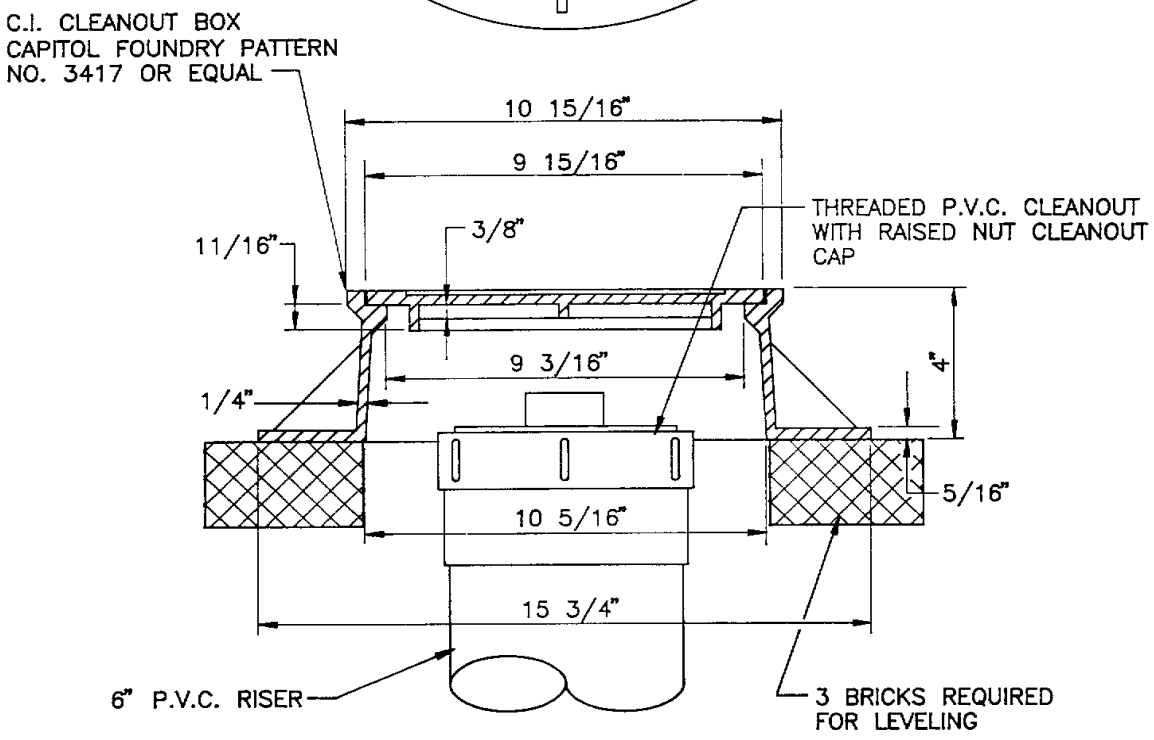


SEWER LATERAL BY PLUMBER

NOT TO SCALE

S-5A

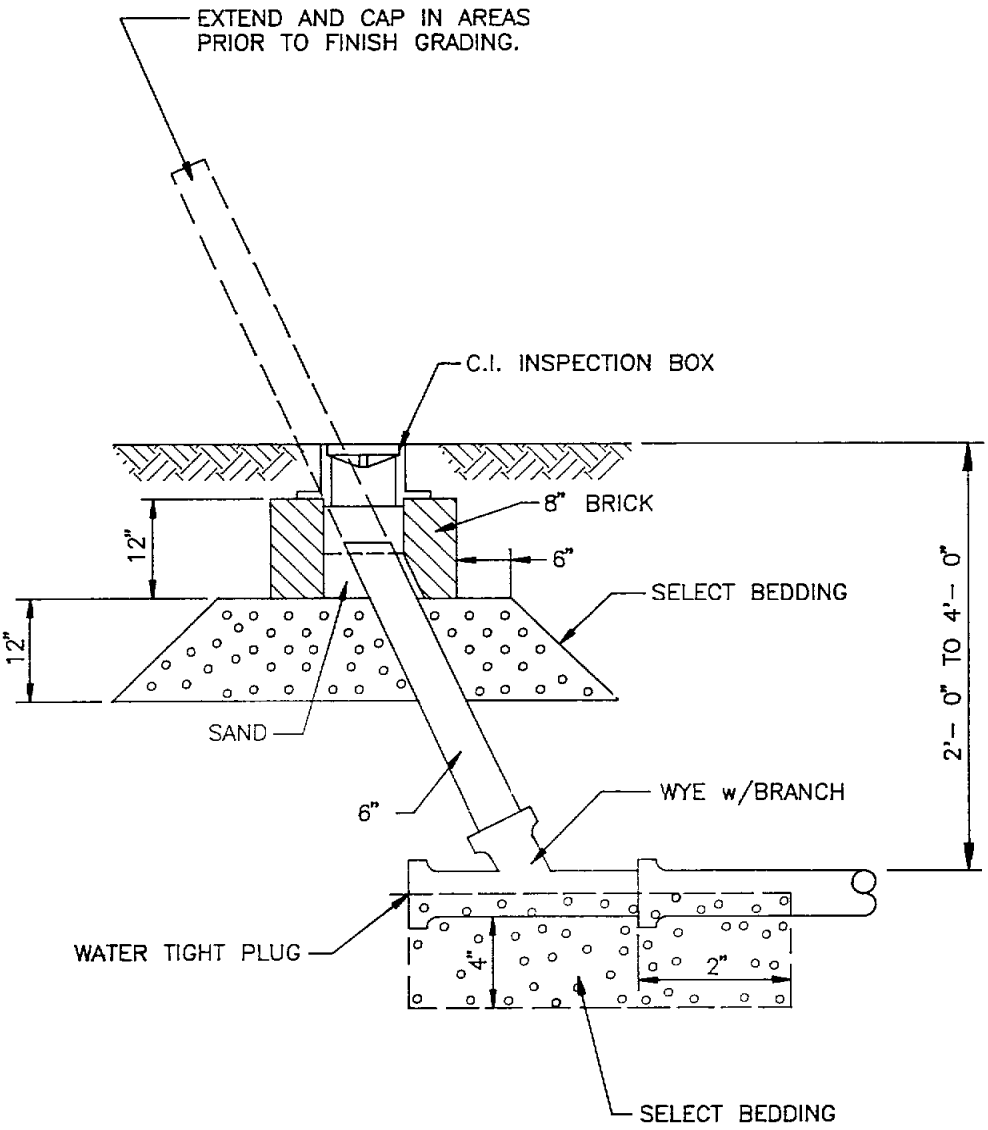




LATERAL CLEANOUT

NOT TO SCALE

S-6

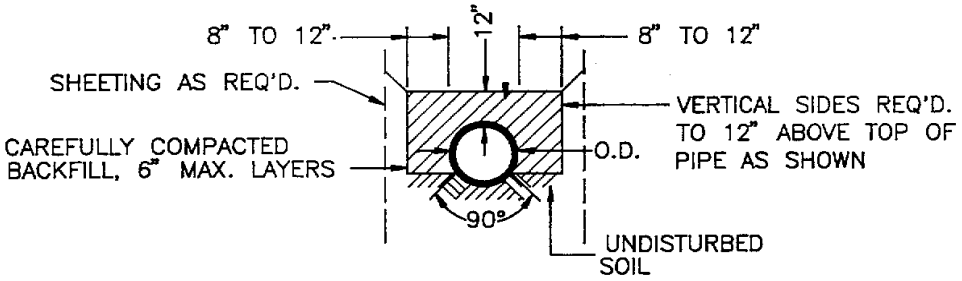


STREET CLEANOUT

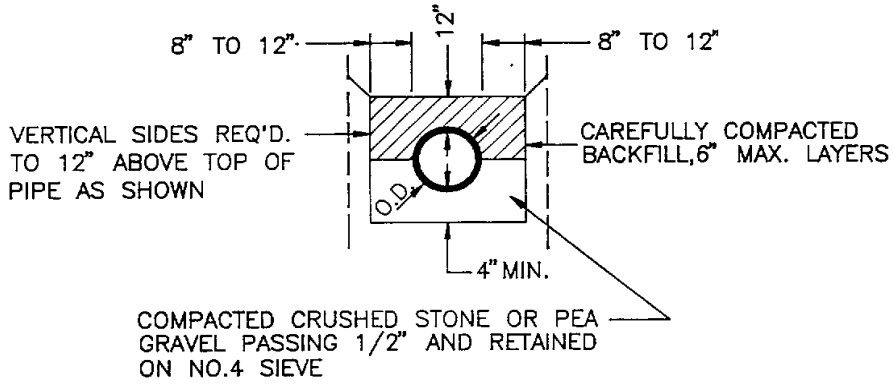
NOT TO SCALE

S-7

NOTE:
FOR PVC GRAVITY SEWER
EXTEND SELECT BEDDING
TO 6" ABOVE TOP OF PIPE



TRENCH BACKFILL



SELECT BEDDING

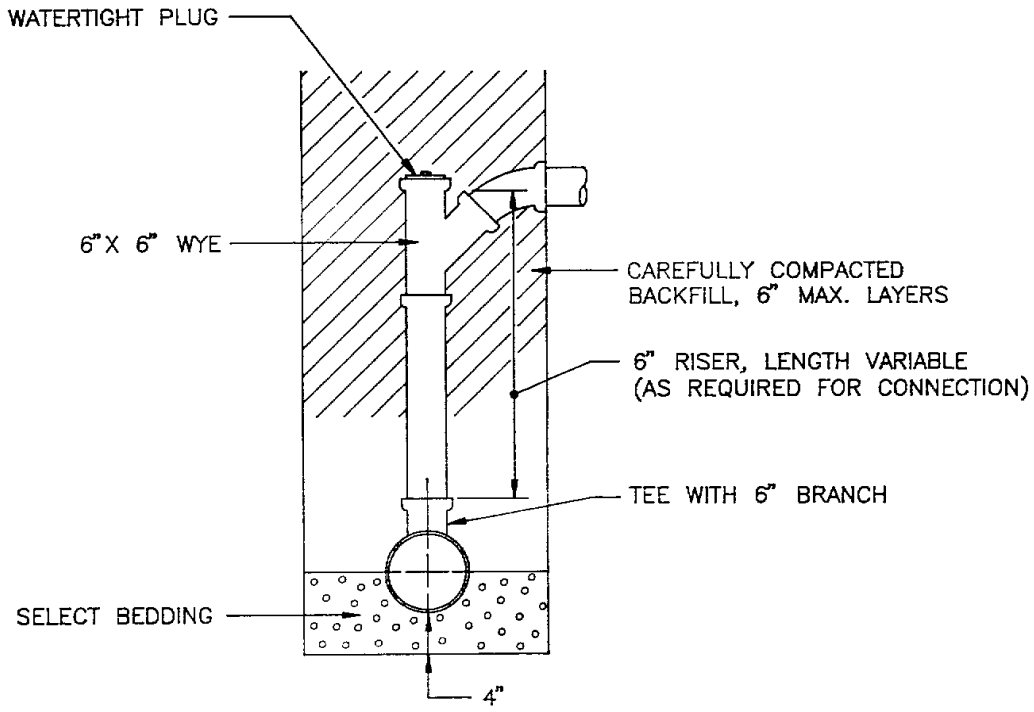
TRENCH BACKFILL AND SELECT BEDDING

NOT TO SCALE

S-8

NOTE:

THIS DETAIL TO BE USED IN LIEU OF STANDARD WYE LATERAL SERVICE IN DEPTHS 8' AND GREATER. WHERE DWELLING TO BE SERVED IS LOWER THAN THE STREET, STANDARD WYE AND LATERAL SERVICE MAY BE USED WITH TOWN APPROVAL.



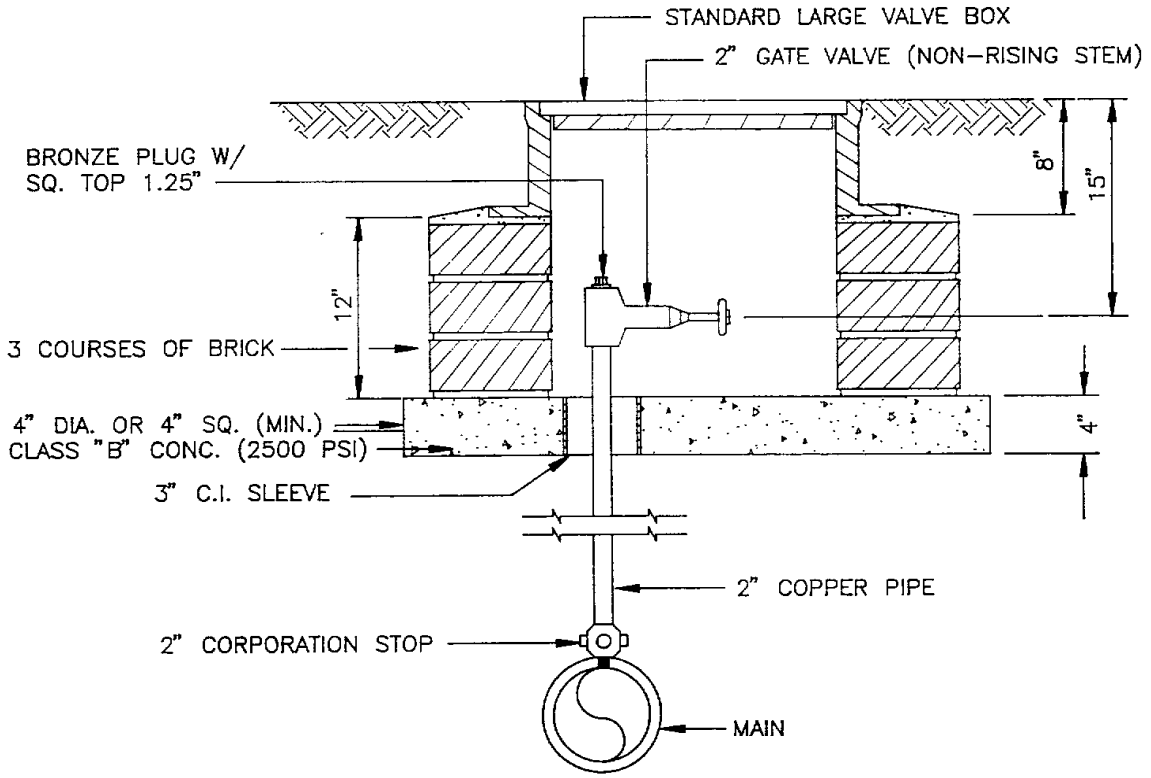
STANDARD VERTICAL RISER

NOT TO SCALE

S-9

NOTES

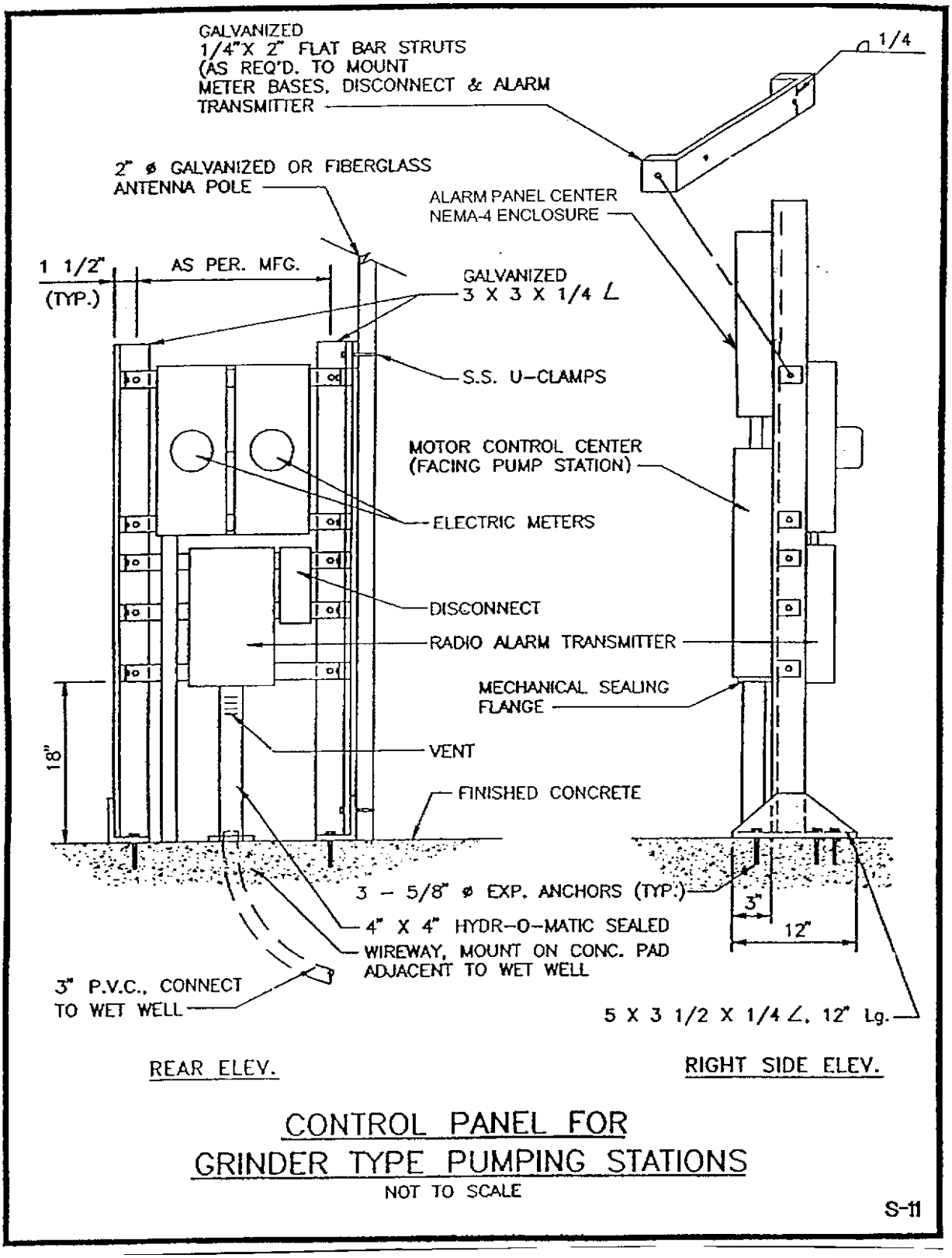
1. 2" TAP FOR AIR VENT SHALL BE STANDARD THREADED TAP OR SADDLE TAP DEPENDING ON MANUFACTURERS RECOMMENDATION FOR TYPE AND THICKNESS OF PIPE USED.
2. SELECT BEDDING MAY BE USED IN PLACE OF CONCRETE IN NON-TRAFFIC AREAS.
3. CASING TO BE ASTM A-48 CLASS 30.



AIR VENT DETAIL

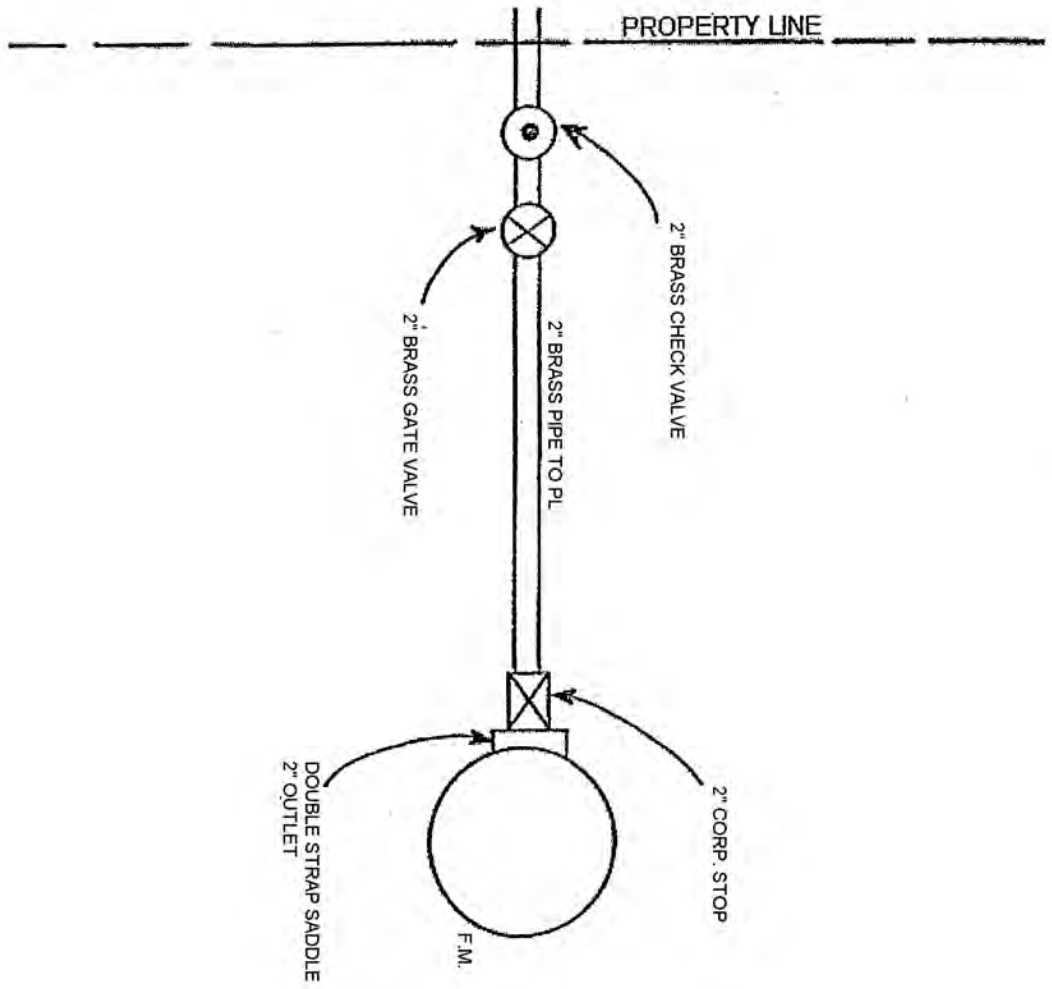
NO TO SCALE

S-10


GALVANIZED
1/4"X 2" FLAT BAR STRUTS
(AS REQ'D. TO MOUNT
METER BASES, DISCONNECT & ALARM
TRANSMITTER
1/4
2" ø GALVANIZED OR FIBERGLASS
ANTENNA POLE
ALARM PANEL CENTER
NEMA-4 ENCLOSURE
1 1/2"
(TYP.)
AS PER. MFG.
GALVANIZED
3 X 3 X 1/4 L
S.S. U-CLAMPS
MOTOR CONTROL CENTER
(FACING PUMP STATION)
ELECTRIC METERS
DISCONNECT
RADIO ALARM TRANSMITTER
MECHANICAL SEALING
FLANGE
18"
VENT
FINISHED CONCRETE
3 - 5/8" ø EXP. ANCHORS (TYP.)
3"
12"
4" X 4" HYDR-O-MATIC SEALED
WIREWAY, MOUNT ON CONC. PAD
ADJACENT TO WET WELL
3" P.V.C., CONNECT
TO WET WELL
5 X 3 1/2 X 1/4 L, 12" Lg.
REAR ELEV.
RIGHT SIDE ELEV.
CONTROL PANEL FOR
GRINDER TYPE PUMPING STATIONS
NOT TO SCALE
S-11

NOTE:

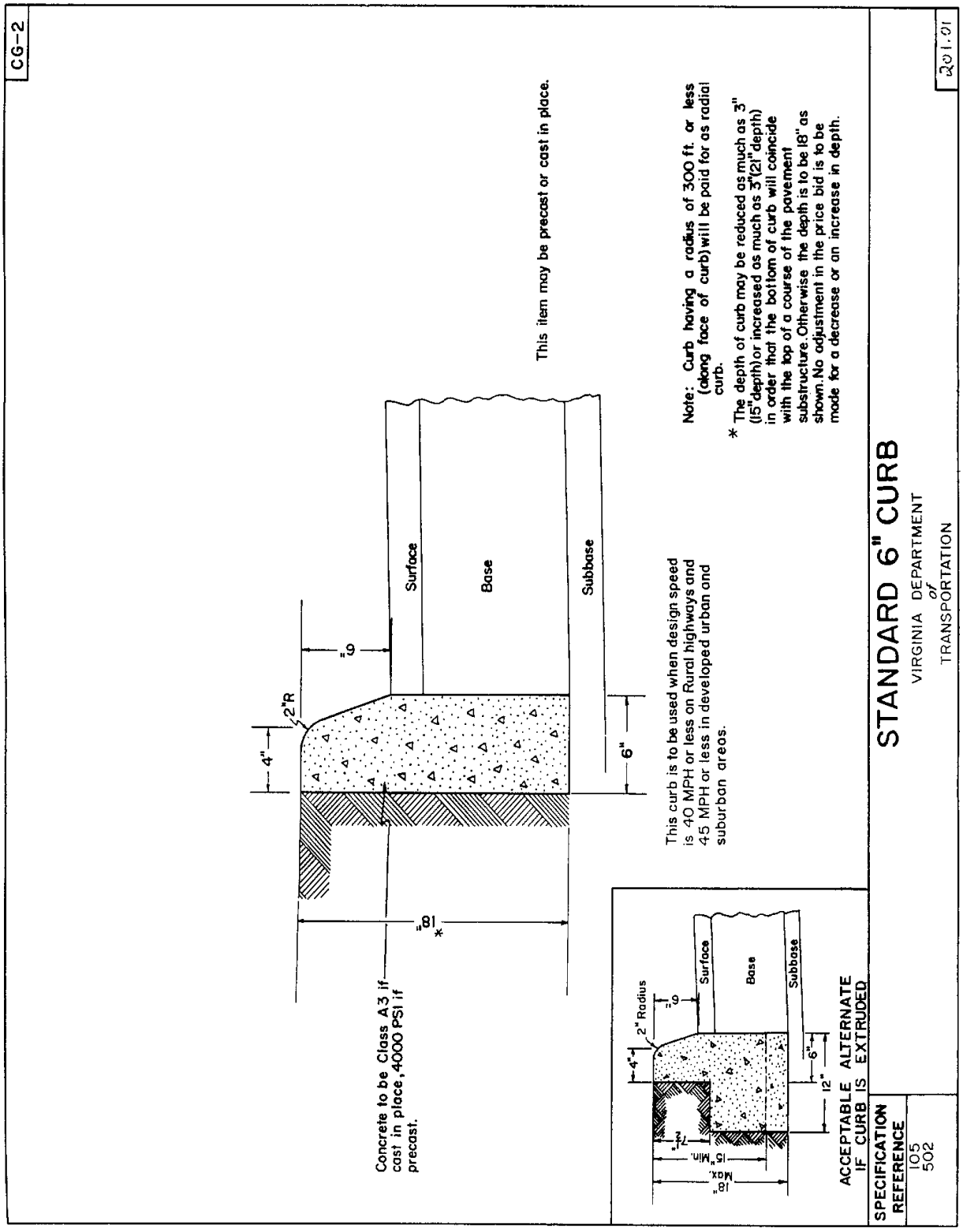
PRIOR TO INSTALLATION, CONTACT THE PUBLIC WORKS DEPT. AT (757) 365-4200.



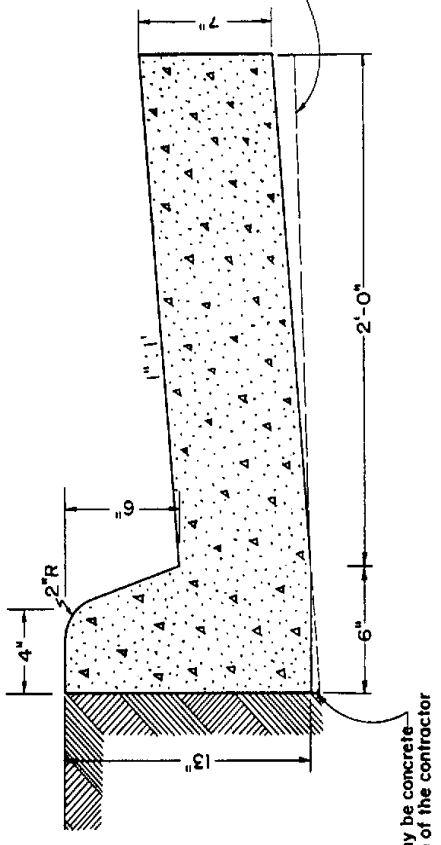
FORCE MAIN CONNECTION

NOT TO SCALE

S-12


CG-2
STANDARD 6" CURB
VIRGINIA DEPARTMENT
of
TRANSPORTATION
2001
Surface
Base
Subbase
4"
2"R
9"
6"
18"*
This item may be precast or cast in place.
Concrete to be Class A3 if cast in place, 4000 PSI if precast.
This curb is to be used when design speed is 40 MPH or less on Rural highways and 45 MPH or less in developed urban and suburban areas.
Note: Curb having a radius of 300 ft. or less (along face of curb) will be paid for as radial curb.
* The depth of curb may be reduced as much as 3" (15" depth) or increased as much as 3" (21" depth) in order that the bottom of curb will coincide with the top of a course of the pavement substructure. Otherwise the depth is to be 18" as shown. No adjustment in the price bid is to be made for a decrease or an increase in depth.
2" Radius
15" Min.
18" Max.
12"
ACCEPTABLE ALTERNATE IF CURB IS EXTRUDED
SPECIFICATION REFERENCE
105
502

CG-6



The bottom of the curb and gutter may be constructed parallel to the slope of sub-surface courses provided a minimum depth of 7" is maintained.

Note: Comb. curb & gutter having a radius of 300' or less (along face of curb) shall be paid for as radial combination curb & gutter.

This item may be precast or cast in place.

Concrete to be Class A3 if cast in place, 4000 PSI if precast.

This area may be concrete at the option of the contractor

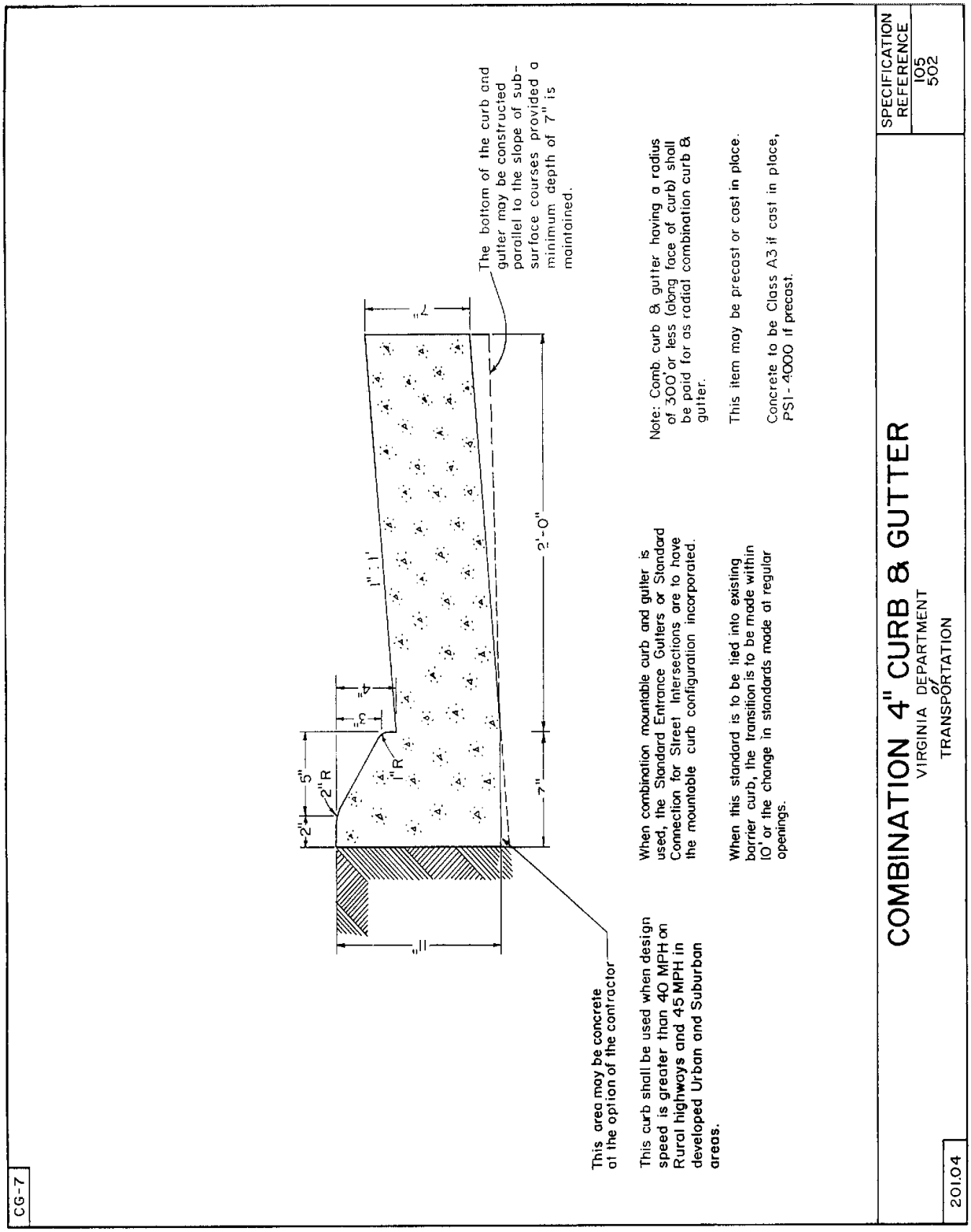
This curb is to be used when design speed is 40 MPH or less on Rural highways and 45 MPH or less in developed urban & suburban areas.

COMBINATION 6" CURB & GUTTER

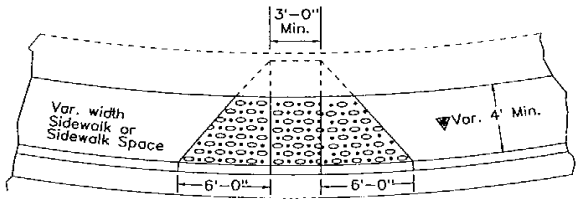
VIRGINIA DEPARTMENT of TRANSPORTATION

201.03

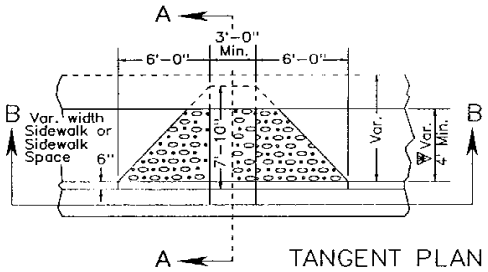
SPECIFICATION REFERENCE
105
502


CG-7
COMBINATION 4" CURB & GUTTER
VIRGINIA DEPARTMENT of TRANSPORTATION
201.04
SPECIFICATION REFERENCE
105
502
2"
5"
2"R
1"R
4"
1'-1"
2'-0"
7"
The bottom of the curb and gutter may be constructed parallel to the slope of sub-surface courses provided a minimum depth of 7" is maintained.
Note: Comb. curb & gutter having a radius of 300' or less (along face of curb) shall be paid for as radial combination curb & gutter.
This item may be precast or cast in place.
Concrete to be Class A3 if cast in place, PSI-4000 if precast.
When combination mountable curb and gutter is used, the Standard Entrance Gutters or Standard Connection for Street Intersections are to have the mountable curb configuration incorporated.
When this standard is to be tied into existing barrier curb, the transition is to be made within 10' or the change in standards made at regular openings.
This curb shall be used when design speed is greater than 40 MPH on Rural highways and 45 MPH in developed Urban and Suburban areas.
This area may be concrete at the option of the contractor

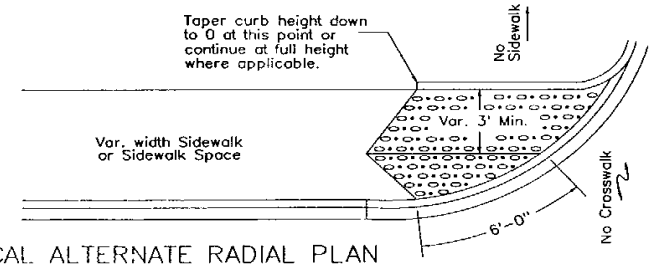
CG-12



RADIAL PLAN

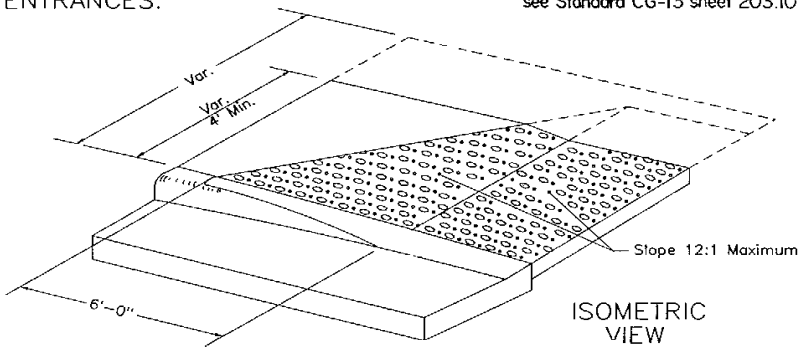


TANGENT PLAN

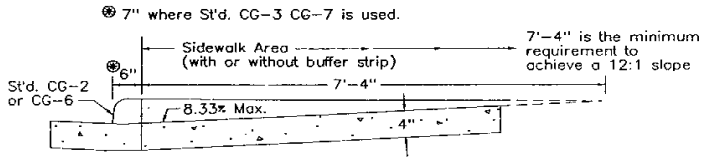


TYPICAL ALTERNATE RADIAL PLAN FOR USE AT APPLICABLE STREET CONNECTIONS AND COMMERCIAL ENTRANCES.

* For Commercial Entrance (Heavy Truck Traffic Anticipated) see Standard CG-13 sheet 203.10

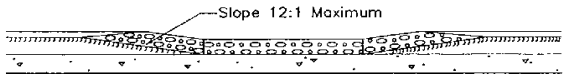


ISOMETRIC VIEW



SECTION A-A

This item may be precast or cast in place.



SECTION B-B

Limits of Exposed aggregate sidewalk

NOTES :

Curb ramp to be class A-3 Concrete with exposed aggregate finish. Ramp shall not exceed a maximum slope of 12:1.

Curb ramps are to be located as shown on the plans or as directed by the Engineer. They are to be provided at intersections wherever an accessible route ⊞ within the right-of-way of a highway facility crosses a curb regardless of whether sidewalk is existing, proposed or nonexistent. They may be offset from pedestrian crosswalks as shown on plans or as directed by the Engineer, but should not be located behind vehicle stop lines. Existing light poles, fire hydrants, drop inlets, etc. will also affect placement.

Curb ramps will be measured and paid for at the contract unit prices for Exposed aggregate sidewalk, complete-in-place.

Curb/curb and gutter slope transitions adjacent to curb ramps are included in payment for curb/curb and gutter.

When used in conjunction with Standard CG-3 or CG-7, the curb face on this Standard is to be adjusted to match the mountable curb configuration.

⊽ Treatment where width of sidewalk or sidewalk space is less than 7'-4"

⊞ Accessible route is defined as a continuous unobstructed, stable, firm and slip resistant path connecting all accessible elements of a facility that can be approached, entered and used by persons with mobility impairments.

CURB RAMP
(PERSONS WITH MOBILITY IMPAIRMENTS)

VIRGINIA DEPARTMENT OF TRANSPORTATION

203.09

SPECIFICATION REFERENCE
502
504

Design Basis For Water Consumption

Facility	Daily Water Consumption Rates (Gallons Per Day)
Residences, Per Person	100
Elementary Schools Without Showers, Per Person	10
High Schools and Community Colleges, Per Student and Faculty	15
Board Schools, Per Person	75
Motels @ 65 gals./Person, Minimum Per Room	130
Trailer Courts @ 3 Persons/ Trailer, Per Trailer	300
Interstate or Through Highway Restaurants, Per Seat	180
Restaurants, Per Seat	50
Service Stations, Per Vehicle Served	10
Factories, Per Person Per 8-Hour Shift	15-35
Shopping Centers, Per 1000 Sq. Ft. of Ultimate Floor Space	200-300

Facility	Daily Water Consumption Rates (Gallons Per Day)
Hospitals, Per Bed	300
Nursing Homes, Per Bed	200
Home for the Aged, Per Bed	100
Doctor's Office in Medical Center	500
Laundromats, 9 to 12# Machines, Per Machine	500
Swimming Pools, Per Swimmer	10
Theaters, Per Seat	5
Camps, Resort Day & Night with Limited Plumbing, Per Camp Site	50
Luxury Camps with Flush Toilets, Per Camp Site	100

Design Basis For New Sewage Works

Discharge Facility*	Design Units	Flow (gpd)	BOD_5 (#/day)	S.S. (#/day)	Flow Duration (Hour)
Dwellings	per person	100**	0.2	0.2	24
Schools with showers and cafeteria	per person	16	0.04	0.04	8
Schools without showers and with cafeteria	per person	10	0.025	0.025	8
Boarding Schools	per person	75	0.2	0.2	16
Motels at 65 gals/person (rooms only)	per room	130	0.26	0.26	24
Trailer Courts at 3 persons/trailer	per trailer	300	0.6	0.6	24
Restaurants	per seat	50	0.2	0.2	16
Interstate or through highway restaurants	per seat	180	0.7	0.7	16
Interstate Rest Areas	per person	5	0.01	0.01	24
Service Stations	per vehicle serviced	10	0.01	0.01	16
Factories	per person per 8-hr shift	15-35	0.03-0.07	0.03-0.07	Operating Period
Shopping Centers	per 1000 sq.ft. of ultimate floor space	200-300	0.1	0.1	12
Hospitals	per bed	300	0.6	0.6	24
Nursing Homes	per bed	200	0.3	0.3	24
Homes for the Aged	per bed	100	0.2	0.2	24
Doctors Office in Medical Center	per 1000 sq.ft.	500	0.1	0.1	12
Laundromats, 9 to 12 # machines	per machine	500	0.3	0.3	16
Community Colleges	per student and faculty	15	0.03	0.03	12
Swimming Pools	per swimmer	10	0.001	0.001	12
Theaters, Drive-In Type	per car	5	0.01	0.01	4
Theaters, Auditorium Type	per seat	5	0.01	0.01	12
Picnic Areas	per person	5	0.01	0.01	12
Camps, Resort Day & Night with limited plumbing	per camp site	50	0.05	0.05	24
Luxury Camps with flush toilets	per camp site	100	0.1	0.1	24

* Colleges, universities, and boarding institutions of special nature to be determined in accordance with Section 3.20B1b.

** Includes minimal infiltration/inflow (I/I) allowance and minor contributions from small commercial/industrial establishments

Taken from: Virginia "Sewerage Regulations"

Recommended Paved Private Entrance Installation

1. Applicants to whom permits are issued shall at all times indemnify and save harmless the Town of Smithfield, Virginia from responsibility for, damage to, or liability arising from the exercise of the privileges granted in such permit either during construction or at any time in the future.

2. A permit may be denied any applicant, and all permits issued by the Town of Smithfield may be revoked, whenever in the opinion of the Town Manager, the safety, use of maintenance of the highway, so requires.

3. The permittee agrees that if the work authorized by this permit, including any work necessary to restore shoulders, ditches and drainage structures to their original condition, is not completed by the applicant to the satisfaction of the Town, the Town of Smithfield will do whatever is necessary to restore the area within the right of way to its original condition, and the permittee will pay to the Town the actual cost of completing the work.

4. The absence of a Town representative does not in any way relieve the permittee of responsibility to perform the work in accordance with the provisions of this permit.

5. No trees are to be cut or trimmed within the right of way.

6. The entrance is to be constructed so as not to impair drainage within the right of way, with any and all drainpipe being supplied by the permittee.

7. All precautions will be taken for the protection of traffic, such as flagmen, signs, barricades, lights, etc. as necessary.

8. **Note:** The paved area (the area between the edge of the pavement/back of curb and the right of way line) shall consist of one of the following treatments in accordance with the current Virginia Department of Transportation specifications and/or approval by the Towns' Engineer:

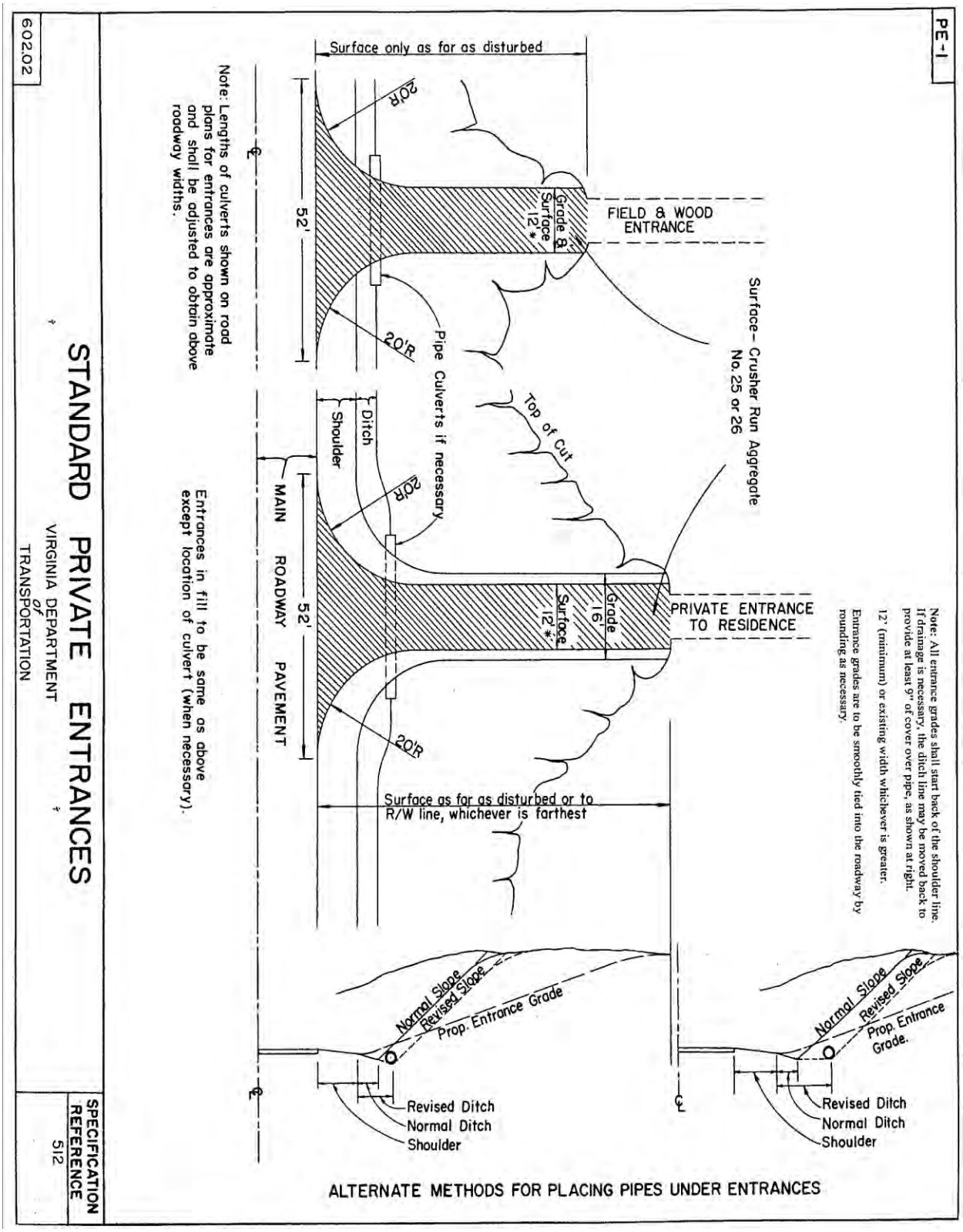
    a. Asphalt Entrance: The base course shall be crushed stone, Type I, No. 21A, 21B or 22, minimum 8" in depth compacted to 95% density at optimum moisture. The surface course shall consist of a prime with RC-250 at the rate of 0.3 gal. per sq. yd. and an application of bituminous concrete Type SM-2A at a rate of 220 lbs./sq. yd. geometrical

design of the entrance, if piped, should be the same as the attached PE-1. If it is a curb and gutter roadway section, minimum 2 - foot flares should be installed at the curb line.

b. Concrete Entrance: The paved area shall consist of Class A3 concrete 7" thick (minimum), current Virginia Department of Transportation Road and Bridge standards, Sections 201 and 203. Geometrical design of the entrance, if piped, should be the same as the attached PE-1. Allowance will be given on 20 - foot radial section of PE-1 with minimum 3 - foot flares. If it is a curb and gutter roadway section; minimum 2 - foot flares should be installed at the curb line.

Please contact Mr. Wayne Griffin, Civil Engineer, at 365-4200 prior to any installations of entrances. Effective 07/10/00

Revised 5.29.02


PE-1
Surface only as for as disturbed
20'R
52'
Grade & Surface 12'*
FIELD & WOOD ENTRANCE
Surface- Crusher Run Aggregate No. 25 or 26
20'R
Pipe Culverts if necessary
Top of Cut
Ditch
Shoulder
MAIN ROADWAY PAVEMENT
52'
Grade 16'
Surface 12'*
PRIVATE ENTRANCE TO RESIDENCE
20'R
Surface as for as disturbed or to R/W line, whichever is farthest
Note: Lengths of culverts shown on road plans for entrances are approximate and shall be adjusted to obtain above roadway widths.
Entrances in fill to be same as above except location of culvert (when necessary).
Note: All entrance grades shall start back of the shoulder line. If drainage is necessary, the ditch line may be moved back to provide at least 9" of cover over pipe, as shown at right.
12' (minimum) or existing width whichever is greater.
Entrance grades are to be smoothly tied into the roadway by rounding as necessary.
Normal Slope
Revised Slope
Prop. Entrance Grade
Revised Ditch
Normal Ditch
Shoulder
Normal Slope
Revised Slope
Prop. Entrance Grade.
Revised Ditch
Normal Ditch
Shoulder
ALTERNATE METHODS FOR PLACING PIPES UNDER ENTRANCES
STANDARD PRIVATE ENTRANCES
VIRGINIA DEPARTMENT OF TRANSPORTATION
602.02
SPECIFICATION REFERENCE
512

Pavement Cut / Repair Details
Special Provisions

1. All patches are to be replaced in accordance with the following regulations, detail on Figure 1 and/or direction of the Town's representative.

2. The residential/commercial owner or their representative will be required to replace the surface and base of the roads in accordance with the current VDOT Road and Bridge Standards and this Special Provision.

3. Backfill material shall include a minimum of four (4") inches of bedding materials (sand or #57 stone). The balance of the backfill shall be approved soil compacted to the bottom of the subbase layer (Type I, Size 21A or 21B). The entire backfill shall be free from wood, decaying material, asphalt, concrete, ice, frost, large clods, stones and debris.

4. Backfill material shall be compacted to a minimum of 95% of the theoretical maximum density at optimum moisture content, as determined by VDOT testing procedures. Use mechanical tamping throughout the depth of the trench in six (6") inch layers to insure that adequate support is provided for the subbase layer (Type I, Size 21A or 21B).

5. It shall be the option of the Towns' representative to request and review the backfill compaction test results and/or authorize the monitoring of the compaction.

6. Cuts in roads with Surface Course and Asphalt Concrete Base shall be replaced with ten (10") inches of Type I, Size 21A or 21B aggregate compacted to 100% of the theoretical maximum density at optimum moisture content covering the entire trench width in addition to a bench of six (6") inches from all sides, this layer shall serve as subbase. An Asphalt Concrete Base course of six (6") inch minimum thickness or matching the existing base thickness, shall be placed over the subbase. A Surface Asphalt Concrete course of a minimum 1½" shall be placed on top of the base covering the trench width. The Asphalt Concrete Surface course shall be slightly higher 1/8" to 1/4" than the existing surface to provide a smooth grade into the existing pavement surface.

7. Cuts in surface treated roads with aggregate base course shall be replaced with the same layers as roads with asphalt base except the subbase layer (Type I, Size 21A) is reduced to six (6") inches and the base asphalt layer to four (4") inches but still keeping a six (6") bench. The surface course shall be a surface treatment matching the existing surface.

8. The cut to be backfilled shall be dry as practicable at the time of the backfilling by pumping, bailing, draining or other approved dewatering methods.

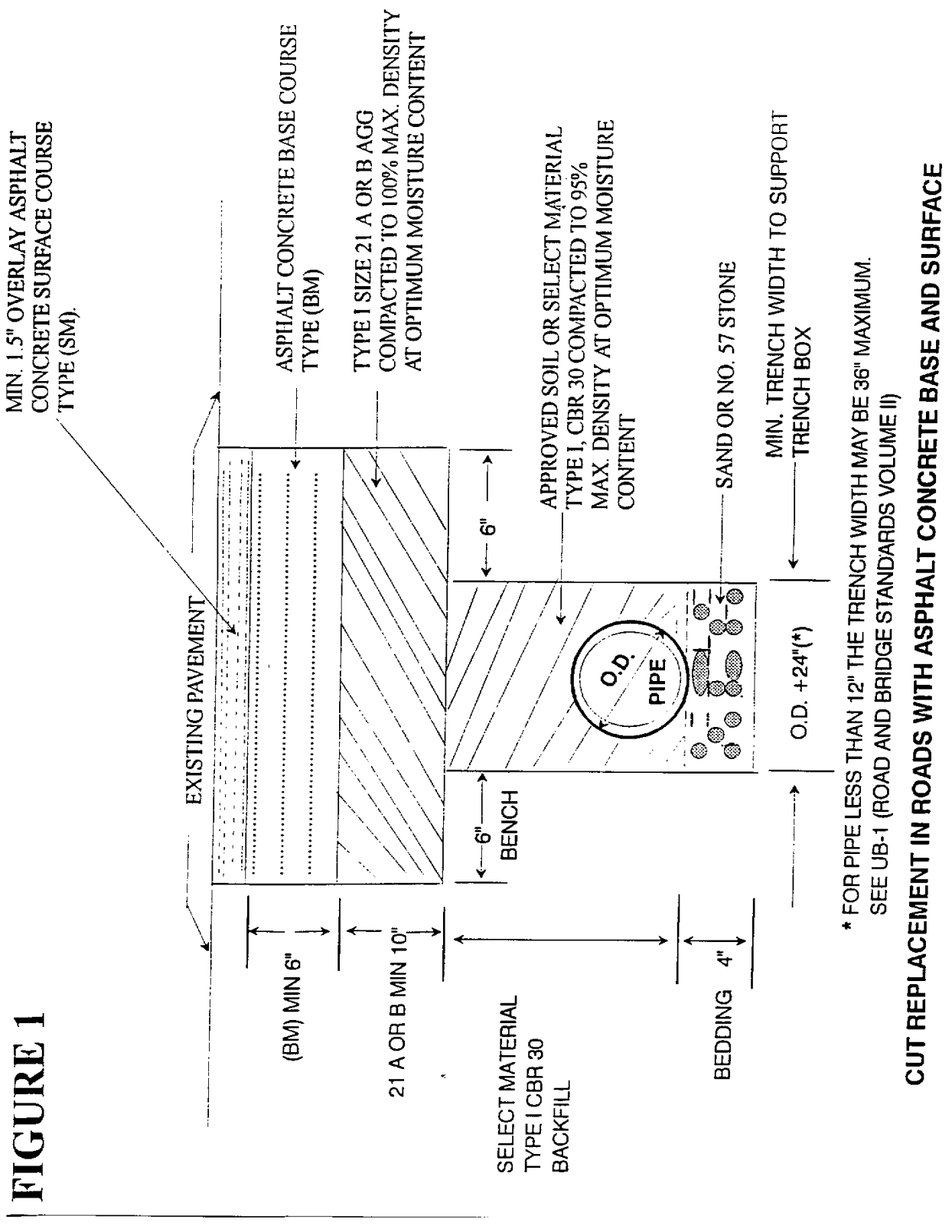
9. All cuts' sides shall be trimmed to neat straight lines and a tack coat shall be applied at a rate of 0.05 – 0.15 gallons per square yard of RC – 250 or CAE – 2 before placing the plant mix.

10. Replacement of pavement shall be from edge of pavement to edge of pavement except when individual cuts are made and not covering the entire width of the pavement.

11. Placement of all Asphalt Concrete and surface treated courses shall be rolled where possible with a unit having a manufacturer's rating of ten (10) tons and rolled until the aggregate is keyed into the bitumen. Where rolling is not possible, a mechanical tamp will be used. In all cuts stone is to be placed in the trench daily up to a maximum length of 500 feet, at which time the pavement shall be covered with a temporary or permanent asphalt patch. If the application of the bituminous layer is delayed for adverse weather conditions, the owner/contractor shall provide and maintain a base course that is acceptable to the Town until such time as the appropriate pavement patch can be applied and completion of the installation of the gas, sewer, water, lines, etc., the owner/contractor shall restore the pavement in the manner prescribed within ten (10) days.

12. The owner/contractor will be responsible for any depression greater than 1/4" that occurs within three (3) years of the completion of the patching. Correction shall consist of milling and replacing 1½" of the surface mix.

FIGURE 1



CUT REPLACEMENT IN ROADS WITH ASPHALT CONCRETE BASE AND SURFACE

United States Postal Regulations

United States Postal Service
USPS Notice to Rural Route Customers

Each year the U.S. Postal Service designates a Mailbox Improvement Week for customers served by rural delivery routes. During that week customers on rural routes are encouraged to examine and improve, where necessary, the appearance of their mailboxes. The third full week in May has been designated as Mailbox Improvement Week for this year.

The purpose of Mailbox Improvement Week is to call attention to the need for providing mail receptacles which are designed to protect the mail from weather and are neat in appearance, conveniently located and safe to use. Neat attractive mailboxes make a significant contribution to the appearance of the countryside and the streets in suburban areas.

Mailboxes that meet these four important requirements contribute to a more efficient delivery operation and the result is improved service to the entire route. There are two approved styles of boxes: (1) Traditional design in three standard sizes, (see exhibit A) and (2) contemporary design (see exhibit B).

Mailboxes of the approved traditional or contemporary design are required whenever a mailbox is newly installed or an unsuitable receptacle is replaced. Exception: Custom built rural type mailboxes may be used if prior approval is given by the postmaster.

Where box numbers are assigned, the box number must be shown on the side of the box visible to the approaching carrier or on the door where boxes are grouped. Customers are encouraged to group boxes wherever this is practicable especially at or near crossroads, at turnouts or at places where a considerable number of boxes are located.

In areas where snow removal is a problem, the use of a semi-arch or extended arm type of support is suggested (see exhibit C). this allows snowplows to sweep near or under boxes without damage to supports and provides easy access to the boxes by carrier and customers.

If the use of street names and house numbers has been authorized, the house number should be shown on the box. If the mailbox is located on a street other than the one on which the customer resides, the street name and house number must be inscribed on the box. In all instances, placing the owner’s name on the box is optional. Generally, boxes should be installed with the bottom of the box 31/2 and 4 feet

from the roadway. However, due to varying road and curb conditions and other factors, it is recommended that customers contact the postmaster or carrier prior to initially erecting or replacing their mailbox and support.

Mailboxes on rural routes must be located on the right-hand side of the road in the direction traveled by the carrier. The box must be placed and served to comply with state laws and highway and postal regulations. The carrier must have access without having to leave the vehicle. Supports for mailboxes should be of adequate strength and size to properly support the box.

Reports have been received that some mailbox supports are so massive that they are damaging the vehicles and causing serious injuries to people who accidentally strike them. The use of heavy metal posts, concrete posts and miscellaneous items of farm equipment, such as milk cans filled with concrete, should be avoided. The ideal support is an assembly which, if struck, will bend or fall away from the striking vehicle instead of severely damaging the vehicle and injuring its occupants. Boxes and supports should be kept painted and free from rust.

Your participation and cooperation in Mailbox Improvement Week will be greatly appreciated by your rural carrier and the Postal Service.

POSTMASTER

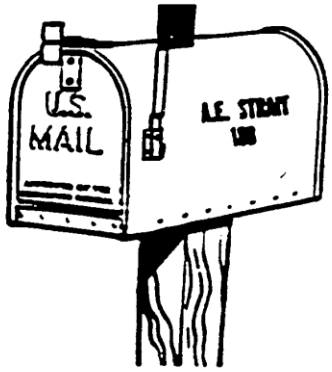


Exhibit A

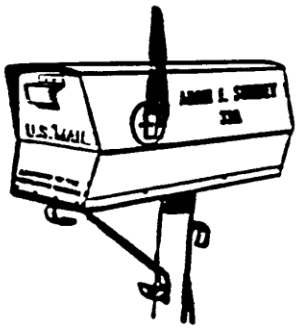


Exhibit B

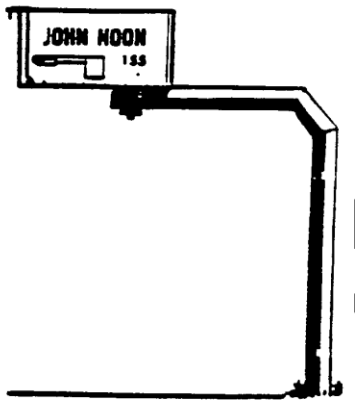


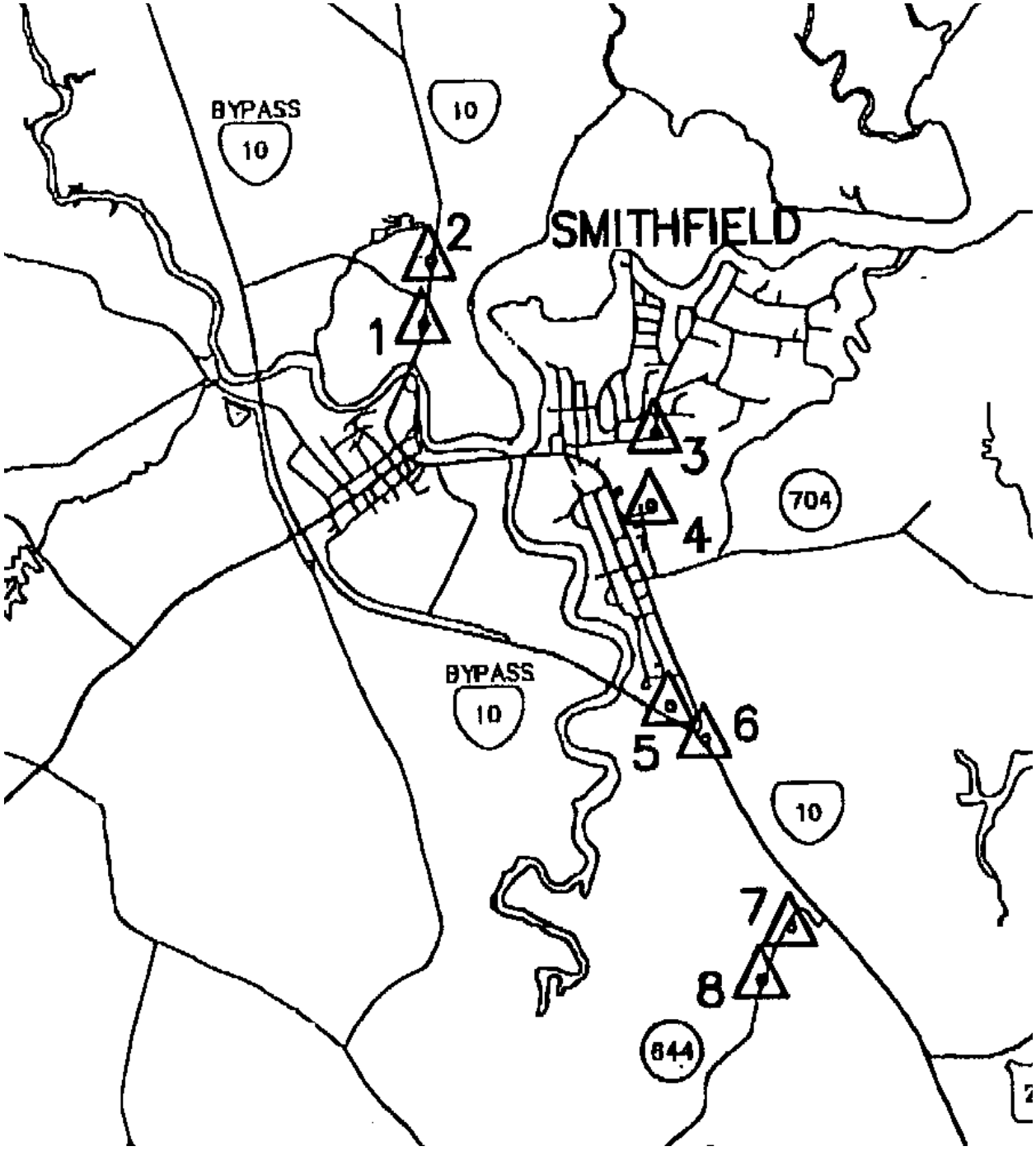
Exhibit C

GPO : 1986 O - 153-032

ISLE OF WIGHT SURVEY CONTROL

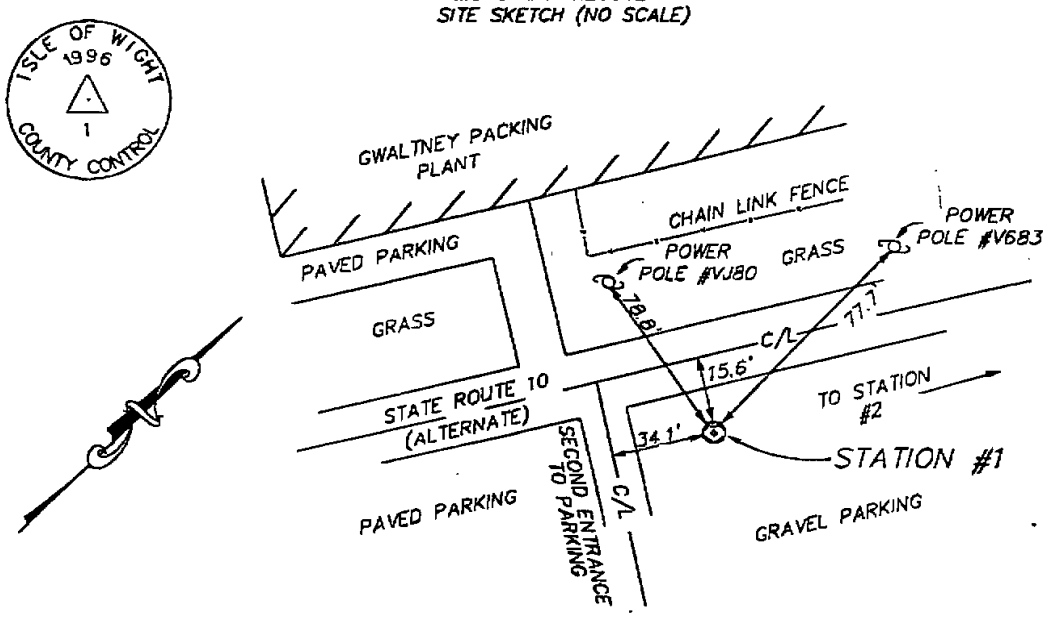
TIMMONS
ENGINEERS • ARCHITECTS • SURVEYORS • PLANNERS
CORPORATE HEADQUARTERS
711 N. COURTHOUSE ROAD
RICHMOND, VIRGINIA 23236-4099
TELEPHONE: (804) 794-3500 FAX: (804) 794-7639

DATE: JULY 1, 1996


BYPASS
10
10
SMITHFIELD
2
1
3
4
704
BYPASS
10
5
6
10
7
8
844

ISLE OF WIGHT SURVEY CONTROL

MONUMENT RECOVERY
SITE SKETCH (NO SCALE)



LOCATED:

5" X 5" CONCRETE MARKER WITH BRASS DISKED STAMPED ISLE OF WIGHT 1996 1 COUNTY CONTROL. MONUMENT IS 15.6' SW OF THE C/L OF ALTERNATE STATE ROUTE 10, 78.8' SE OF POWER POLE NO. VJ80, 77.7' SE OF POWER POLE NO. V683 AND 34.1' NE OF THE C/L OF A PARKING LOT ENTRANCE. MONUMENT IS SET FLUSH WITH GROUND.

GEODETIC COORDINATES: NAD 83
N 36°59'29.2959"
W 76°37'45.0518"

STATE PLANE COORDINATES: NAD 83 – SOUTH ZONE (U.S. SURVEY FOOT)
NORTHING (FT): 3,525,867.0599
EASTING (FT): 12,029,263.6445
SCALE FACTOR: 0.999967
CONVERGENCE: 1°08'07.6074"

PAIR #: 1
MONUMENT 1 TO 2
GRID AZIMUTH: 08°03'53.3101"
DISTANCE (FT): 1,626.69'

ELEVATION: NAVD 88
ELEVATION SHOWN WAS DETERMINED THROUGH GPS OBSERVATION, UNLESS OTHERWISE INDICATED.
ELEVATION (FT): 39.1

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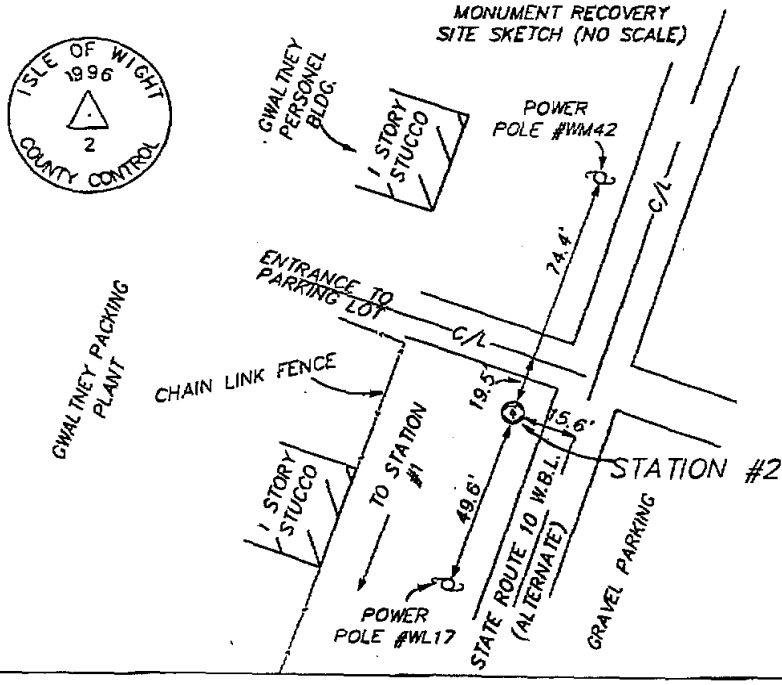
DATE: JULY 1, 1996

ISLE OF WIGHT SURVEY CONTROL

MONUMENT RECOVERY
SITE SKETCH (NO SCALE)



LOCATED:

5" X 5" CONCRETE MARKER WITH BRASS DISKED STAMPED ISLE OF WIGHT 1996 2 COUNTY CONTROL. MONUMENT IS 15.6' NW OF THE C/L OF ALTERNATE STATE ROUTE 10 W.B.L., 74.4' SOUTH OF POWER POLE NO. WM42, 49.6' NORTH OF POWER POLE NO. WL17, 19.5' SW OF THE C/L OF A PARKING LOT ENTRANCE. MONUMENT IS SET FLUSH WITH GROUND.

GEODETIC COORDINATES: NAD 83
N 36°59'45.1733"
W 76°37'41.8457"

STATE PLANE COORDINATES: NAD 83 – SOUTH ZONE (U.S. SURVEY FOOT)
NORTHING (FT): 3,527,477.6580
EASTING (FT): 12,029,491.8574
SCALE FACTOR: 0.999966
CONVERGENCE: 1°08'09.5533"

PAIR #: 1
MONUMENT 2 TO 1
GRID AZIMUTH: 188°03'53.3101"
DISTANCE (FT): 1,626.69'

ELEVATION: NAVD 88
ELEVATION SHOWN WAS DETERMINED THROUGH GPS OBSERVATION, UNLESS OTHERWISE INDICATED.
ELEVATION (FT): 40.6

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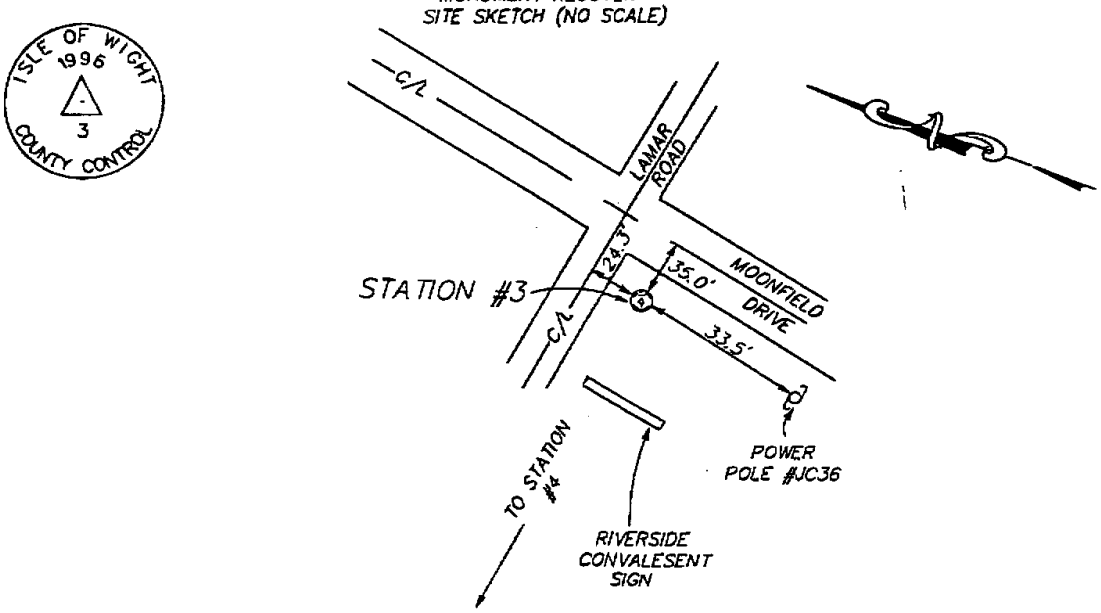
DATE: JULY 1, 1996

ISLE OF WIGHT SURVEY CONTROL

MONUMENT RECOVERY
SITE SKETCH (NO SCALE)



LOCATED:

5" X 5" CONCRETE MARKER WITH BRASS DISKED STAMPED ISLE OF WIGHT 1996 3 COUNTY CONTROL. MONUMENT IS 24.3' SOUTH OF THE C/L OF LAMAR ROAD, 35.0' WEST OF THE C/L OF MOONFIELD DRIVE, 35.5' NORTH OF POWER POLE NO. JC36. MONUMENT IS SET FLUSH WITH GROUND.

GEODETIC COORDINATES: NAD 83
N 36°58'58.9488"
W 76°36'30.6182"

STATE PLANE COORDINATES: NAD 83 – SOUTH ZONE (U.S. SURVEY FOOT)
NORTHING (FT): 3,522,918.8356
EASTING (FT): 12,035,362.4725
SCALE FACTOR: 0.999968
CONVERGENCE: 1°08'52.7830"

PAIR #: 2
MONUMENT 3 TO 4
GRID AZIMUTH: 184°49'05.3599"
DISTANCE (FT): 1,861.14'

ELEVATION: NAVD 88
ELEVATION SHOWN WAS DETERMINED THROUGH GPS OBSERVATION, UNLESS OTHERWISE INDICATED.
ELEVATION (FT): 29.7

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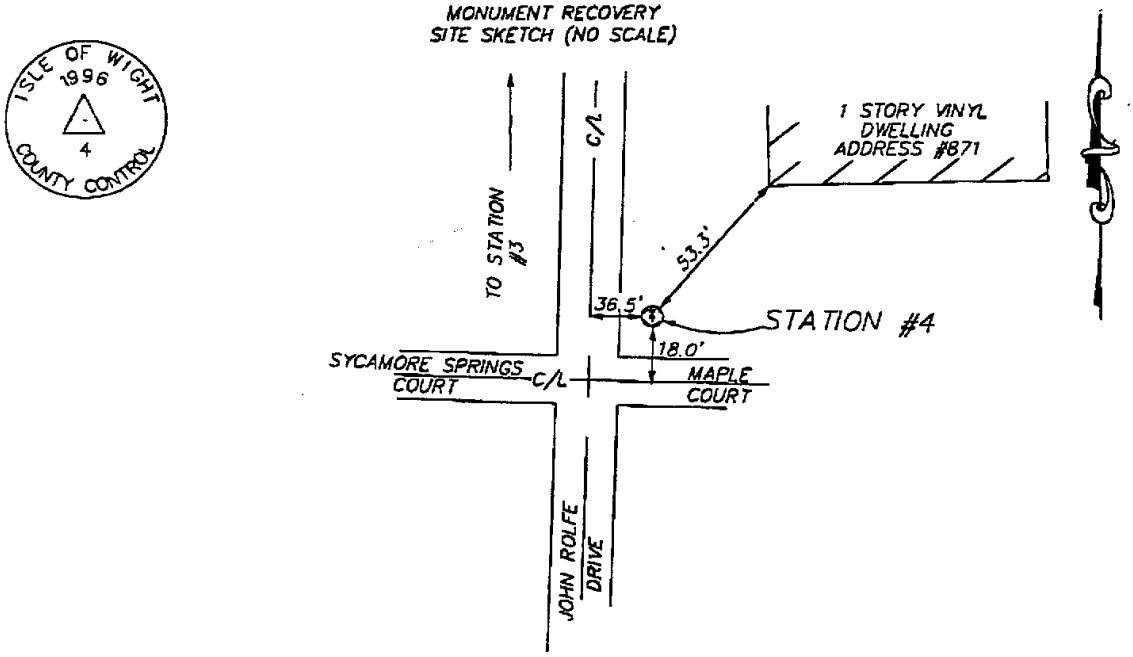
DATE: JULY 1, 1996

ISLE OF WIGHT SURVEY CONTROL

MONUMENT RECOVERY
SITE SKETCH (NO SCALE)



LOCATED:

5" X 5" CONCRETE MARKER WITH BRASS DISKED STAMPED ISLE OF WIGHT 1996 4 COUNTY CONTROL. MONUMENT IS 18.0' NORTH OF THE C/L OF MAPLE COURT, 36.5' EAST OF THE C/L OF JOHN ROLFE DRIVE, 53.3' SW OF THE SW CORNER OF A 1 STORY VINYL DWELLING (ADDRESS #871 MAPLE COURT). MONUMENT IS SET FLUSH WITH GROUND.

GEODETIC COORDINATES: NAD 83
N 36°58'40.6459"
W 76°36'33.0023"

STATE PLANE COORDINATES: NAD 83 – SOUTH ZONE (U.S. SURVEY FOOT)
NORTHING (FT): 3,521,064.2697
EASTING (FT): 12,035,206.1484
SCALE FACTOR: 0.999968
CONVERGENCE: 1°08'51.3360"

PAIR #: 2
MONUMENT 4 TO 3
GRID AZIMUTH: 04°49'05.3599"
DISTANCE (FT): 1,861.14'

ELEVATION: NAVD 88
ELEVATION SHOWN WAS DETERMINED THROUGH GPS OBSERVATION, UNLESS OTHERWISE INDICATED.
ELEVATION (FT): 33.2

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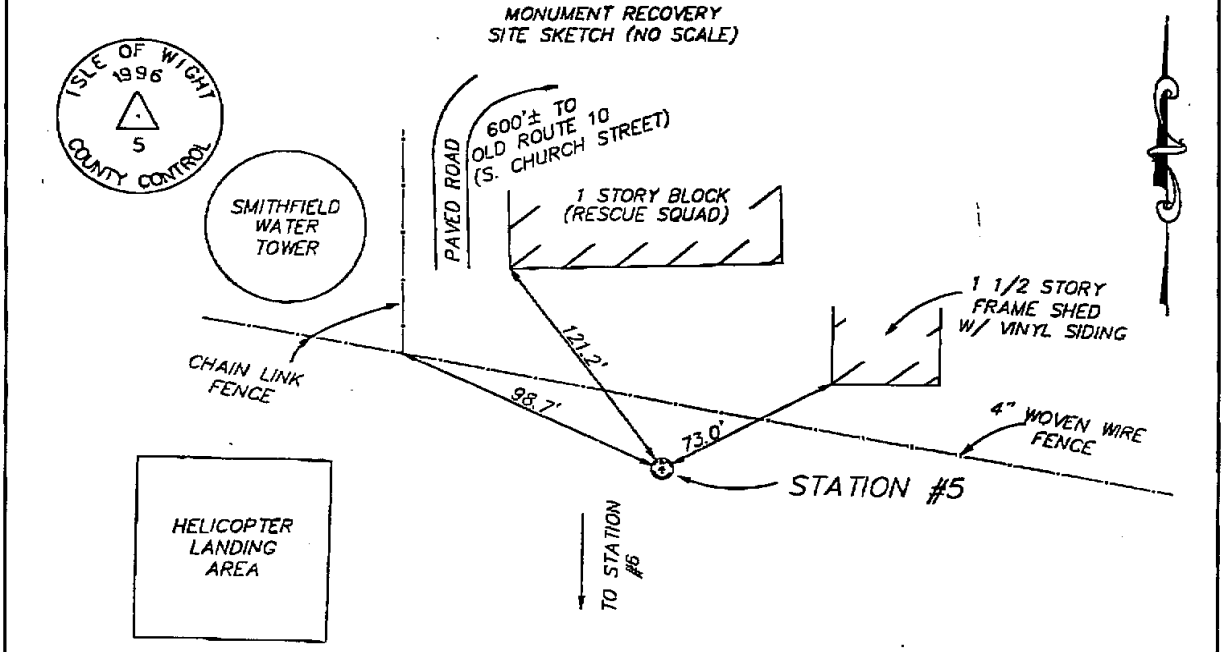
DATE: JULY 1, 1996

ISLE OF WIGHT SURVEY CONTROL

MONUMENT RECOVERY
SITE SKETCH (NO SCALE)



LOCATED:

5" X 5" CONCRETE MARKER WITH BRASS DISKED STAMPED ISLE OF WIGHT 1996 5 COUNTY CONTROL. MONUMENT IS 98.7' SE OF A FENCE CORNER AT THE SMITHFIELD WATER TOWER, 121.2' SE OF THE SW CORNER OF THE RESCUE SQUAD BUILDING, 73.0' SW OF THE SW CORNER OF A 1 1/2 STORY FRAME SHED. MONUMENT IS SET FLUSH WITH THE GROUND.

GEODETIC COORDINATES: NAD 83
N 36°57'48.7188"
W 76°36'29.3492"

STATE PLANE COORDINATES: NAD 83 – SOUTH ZONE (U.S. SURVEY FOOT)
NORTHING (FT): 3,515,819.6078
EASTING (FT): 12,035,607.7439
SCALE FACTOR: 0.999970
CONVERGENCE: 1°08'53.5532"

PAIR #: 3
MONUMENT 5 TO 6
GRID AZIMUTH: 134°12'13.7169"
DISTANCE (FT): 1,257.77'

ELEVATION: NAVD 88
ELEVATION SHOWN WAS DETERMINED THROUGH GPS OBSERVATION, UNLESS OTHERWISE INDICATED.
ELEVATION (FT): 43.4

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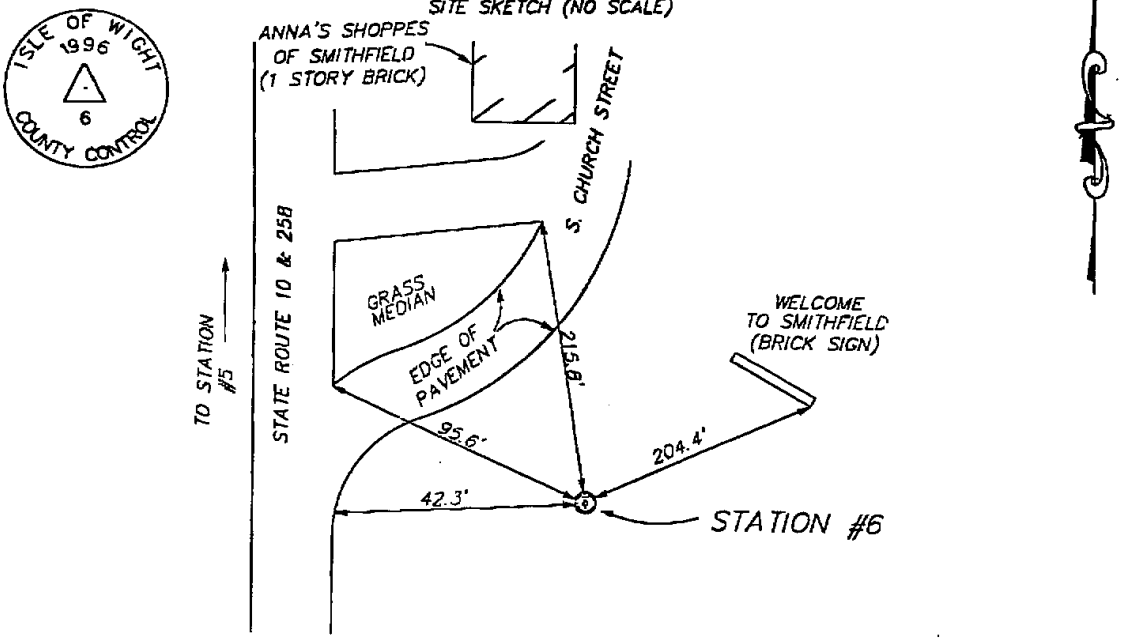
DATE: JULY 1, 1996

ISLE OF WIGHT SURVEY CONTROL

MONUMENT RECOVERY
SITE SKETCH (NO SCALE)



LOCATED:

5" X 5" CONCRETE MARKER WITH BRASS DISKED STAMPED ISLE OF WIGHT 1996 6 COUNTY CONTROL. MONUMENT IS 42.3' EAST OF THE EAST EDGE OF PAVEMENT OF STATE ROUTES 10 & 258, 95.6' SE FROM THE SOUTHREN TIP OF A GRASS MEDIAN, 215.8' SOUTH FROM THE NE TIP OF THE SAME GRASS MEDIAN, 204.4' SW OF THE SE CORNER OF A BRICK SIGN (WELCOME TO SMITHFIELD). MONUMENT IS SET FLUSH WITH GROUND.

GEODETIC COORDINATES: NAD 83
N 36°57'39.8708"
W 76°36'18.4582"

STATE PLANE COORDINATES: NAD 83 – SOUTH ZONE (U.S. SURVEY FOOT)
NORTHING (FT): 3,514,942.6740
EASTING (FT): 12,036,509.3948
SCALE FACTOR: 0.999970
CONVERGENCE: 1°09'00.1632"

PAIR #: 3
MONUMENT 6 TO 5
GRID AZIMUTH: 314°12'13.7169"
DISTANCE (FT): 1,257.77'

ELEVATION: NAVD 88
ELEVATION SHOWN WAS DETERMINED THROUGH GPS OBSERVATION, UNLESS OTHERWISE INDICATED.
ELEVATION (FT): 46.1

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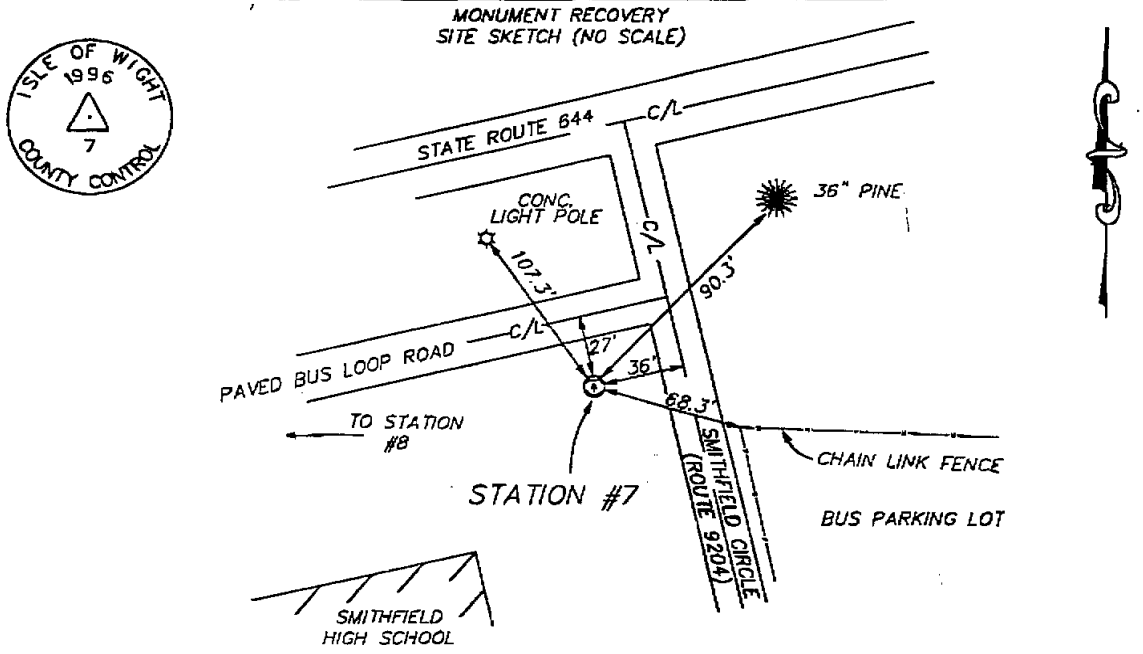
DATE: JULY 1, 1996

ISLE OF WIGHT SURVEY CONTROL

MONUMENT RECOVERY
SITE SKETCH (NO SCALE)



LOCATED:

5" X 5" CONCRETE MARKER WITH BRASS DISKED STAMPED ISLE OF WIGHT 1996 7 COUNTY CONTROL. MONUMENT IS 36' WEST OF THE C/L OF SMITHFIELD CIRCLE (ROUTE 9402), 27' SOUTH OF THE C\L OF A PAVED BUS LOOP ROAD, 107.3' SE OF A CONCRETE LIGHT POLE, 90.3' SW OF A 36" PINE, 68.3' NW OF THE NW FENCE CORNER OF A SCHOOL BUS PARKING LOT. MONUMENT IS SET FLUSH WITH GROUND.

GEODETIC COORDINATES: NAD 83
N 36°56'49.7948"
W 76°35'53.4968"

STATE PLANE COORDINATES: NAD 83 – SOUTH ZONE (U.S. SURVEY FOOT)
NORTHING (FT): 3,509,919.9959
EASTING (FT): 12,038,636.8536
SCALE FACTOR: 0.999972
CONVERGENCE: 1°09'15.3129"

PAIR #: 4
MONUMENT 7 TO 8
GRID AZIMUTH: 212°12'13.5276"
DISTANCE (FT): 1,218.81'

ELEVATION: NAVD 88
ELEVATION SHOWN WAS DETERMINED THROUGH GPS OBSERVATION, UNLESS OTHERWISE INDICATED.
ELEVATION (FT): 47.7

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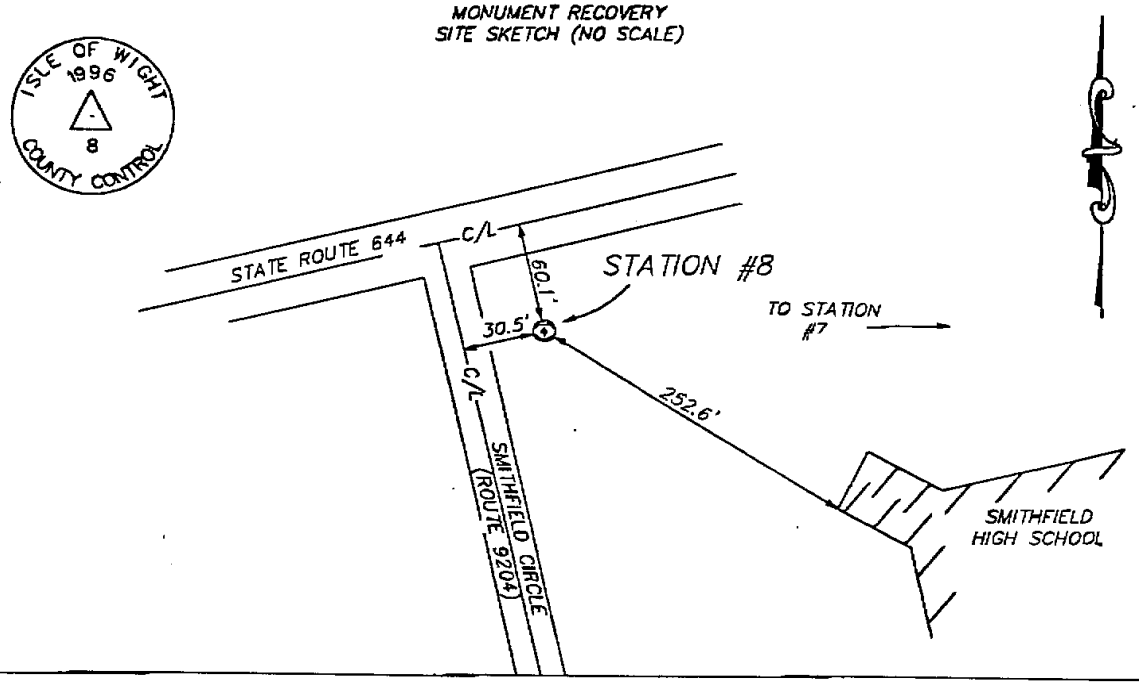
711 N. COURTHOUSE ROAD
RICHMOND, VIRGINIA 23236-4089
TELEPHONE: (804) 794-3500 FAX: (804) 794-7639

DATE: JULY 1, 1996

ISLE OF WIGHT SURVEY CONTROL

MONUMENT RECOVERY
SITE SKETCH (NO SCALE)



LOCATED:

5" X 5" CONCRETE MARKER WITH BRASS DISKED STAMPED ISLE OF WIGHT 1996 8 COUNTY CONTROL. MONUMENT IS 30.5' EAST OF THE C/L OF SMITHFIELD CIRCLE (ROUTE 9402), 60.1' SOUTH OF THE C\L OF ROUTE 644, 252.6' NW OF THE NW CORNER OF THE SMITHFIELD HIGH SCHOOL. MONUMENT IS SET FLUSH WITH GROUND.

GEODETIC COORDINATES: NAD 83
N 36°56'39.7288"
W 76°36'01.7526"

STATE PLANE COORDINATES: NAD 83 – SOUTH ZONE (U.S. SURVEY FOOT)
NORTHING (FT): 3,508,888.6895
EASTING (FT): 12,037,987.3109
SCALE FACTOR: 0.999972
CONVERGENCE: 1°09'10.3022"

PAIR #: 4
MONUMENT 8 TO 7
GRID AZIMUTH: 32°12'13.5276"
DISTANCE (FT): 1,218.81'

ELEVATION: NAVD 88
ELEVATION SHOWN WAS DETERMINED THROUGH GPS OBSERVATION, UNLESS OTHERWISE INDICATED.
ELEVATION (FT): 48.6

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TELEPHONE: (804) 794-3500 FAX: (804) 794-7639

DATE: JULY 1, 1996