Henry County
Public Service Authority

Standard Specifications

October 2019

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD SPECIFICATIONS

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HENRY COUNTY PUBLIC SERVICE AUTHORITY
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GENERAL REQUIREMENT-WATER FACILITIES

SECTION 1

1-01. GENERAL STATEMENT. The following standard specifications represent the minimum requirements for all public water systems within the service area of the Henry County Public Service Authority, hereafter "Authority" or "HCPSA". Standard construction details, specifications, and materials standards approved by the Authority shall be followed unless specific deviation therefrom is authorized in writing by the Authority. All plans and specifications shall be reviewed and approved by the Authority prior to construction.

A. All water systems shall be designed to meet or exceed Virginia Department of Health Office of Drinking Water, Water Works Regulations, latest edition.

B. Hazen-Williams Coefficient (C-Factor) of 120 shall be used in all hydraulic calculations and design when submitting plans and specification to the Virginia Department of Health Office of Drinking Water and HCPSA.

C. Water mains shall be located within Public rights-of-way or waterline easements, and shall be located no closer than five feet (5') from the edge of the easement or right-of-way line unless otherwise approved by the Authority.

D. Water supply systems, as described above, shall be designed by a Professional Engineer licensed by the Commonwealth of Virginia whose seal and signature shall be placed on each plan sheet. A Land Surveyor licensed by the Commonwealth of Virginia may design such portions of a water supply system as provided by the Code of Virginia, Title 54, Section 54-17.1, 3(b).

1-02. MINIMUM SIZES. Water lines shall be of sufficient size to convey peak design flows while maintaining a 20 psi minimum pressure at all points in the distribution system.

A. The minimum size pipe for water distribution systems shall be six inches in diameter. Pipe of lesser diameter may be authorized by the HCPSA when the run is less than 300 feet. Pipe size will be evaluated on a case-by-case basis and in no instance be less than two inch.

B. The minimum size pipe where fire protection is to be provided or required shall be six inches in diameter.

1-03. WATER LINE MATERIALS. Water lines 6-inch and larger shall be ductile iron or PVC as specified herein unless specific deviation therefrom is authorized in writing by the Authority. Other approved pipe materials may be used to repair existing pipelines of that material. No

appurtenance generally used for pipe repairs shall be used for new construction unless approved by HCPSA Engineer or Inspector.

1-04. FIRE HYDRANTS. Fire hydrants shall be located only on those systems capable of supplying fire flows, and on lines at least 6-inch nominal size. In general, fire hydrants shall be located at street intersections and at the ends of streets. The maximum distance between fire hydrants shall be 800 feet as measured along the street centerline. Water distribution systems shall be designed to supply the magnitude of fire flows that are commensurate with fire hazards of the surrounding area. In residential areas fire flow shall be considered to be no less than 250 gallons per minute at any single fire hydrant while maintaining a minimum residual pressure of 20 psi at all points in the distribution system, including during peak domestic demand.

1-05. DEAD-ENDS. Dead-ends within a distribution system shall be minimized by looping of water mains. Where dead-ends do occur, a blow-off assembly or fire hydrant shall be installed at the end of said system.

1-06. VALVES. Valves within the distribution system shall be located as required by the Authority. At tees at least 2 valves shall be provided; at crosses at least 3 valves shall be provided; but in no case shall the distance between valves exceed 2,000 feet as measured along the pipeline.

Valves shall be AWWA C509 resilient seat gate valves (sizes 14" and smaller) and AWWA C504 rubber seated butterfly valves (size: 16" and larger). All valves shall open left.

1-07. MINIMUM COVER. All pipe shall be installed with at least 36 inches minimum cover as measured from finished grade to the top of the pipe. Water pipe shall not be installed at depths exceeding six feet (6') unless specifically approved by the Authority.

1-08. SEPARATION OF WATER LINES AND SANITARY SEWERS.
There shall be no physical connection between any part of the public or private potable water supply system to any sanitary or storm sewer facility. No portion of any water supply facility shall pass through or be in contact with any sewer manhole. The minimum horizontal distance between any water supply line and a septic tank shall be 10 feet, and 30 feet between any septic tank drainfield lines.

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

1. The bottom of the water line shall be at least 18 inches above the top of the sewer line.

2. Where 18 inches of vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfilling.

3. The sewer manhole shall be of water-tight construction and tested in place.

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

1. The sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfill.

2. Water lines passing under sewer lines shall, in addition, be protected by providing:

(a) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.

(b) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.

(c) That the length of the water line be centered at the crossing so that joint shall be equidistant and as far as possible from the sewer.

(C) Extenuating Circumstances Where extenuating circumstances will not allow application of the options stated above, the Contractor, Authority, Virginia Department of Health, Office of Water Programs, and any other appropriate agency will address these situations on a case by case basis. An agreement between all parties shall be made in writing prior to installation of said water or sewer line.

1-09. WATER SUPPLY INTERCONNECTIONS. All physical connections between any Henry County Public Service Authority water system and any private water supply system shall be reviewed and approved by the Virginia Department of Health prior to connection.

1-10. CROSS-CONNECTION AND BACKFLOW PREVENTION CONTROL DEVICES. Any cross-connection or backflow prevention control devices that are installed on or on lines connected to the distribution system shall be in accordance with the Authority's Cross-Connection and Backflow Prevention Control program.

1-11. SEPARATION OF WATER LINES AND GAS LINES. Water lines, fittings and appurtenances shall be laid no closer than 2 feet from any gas pipeline or appurtenances thereto. Any disturbance of the gas line facilities including scratching, marring, or damage of any kind of extent shall be reported to the Authority and the gas company prior to backfilling.

1-12. SURFACE WATER CROSSINGS. Surface water crossings, both over and under water, present special problems and should be discussed with the Virginia Department of Health, Office of Water Programs before final plans are prepared.

(A) Aerial crossings shall conform to Section 3.12 of these Standard Specifications.

(B) Water lines crossing underwater shall have easily accessible valves and permanent sample taps on each end of the crossing, as shown in the standard details. The valves and sample taps shall not be subject to flooding. Pipe for underwater crossing shall have flexible joints with intransigent joint restraint. See Standard Detail W-17.

1-13. STEEL CASING PIPE FOR RAILROAD, HIGHWAY, AND AERIAL CROSSINGS. Casing pipe shall be spiral welded steel pipe and shall conform to the requirements of ASTM A139 with a minimum wall thickness of 0.500 inch or ASTM A53 standard weight class and shall have beveled edges suitable for welding or be threaded. Refer to VDOT 2007 Road and Bridge specifications Section No. 232.02, or current edition.

Steel casing required for all carrier pipes 2" diameter and larger. PVC and HDPE casing pipe may be used for service lines under 2" diameter if allowed by VDOT.

1-14. BLASTING The Contractor shall be responsible for obtaining any and all permits as required by all local, state, and federal agencies. All work shall be performed in compliance with current requirements of all local, state, and federal agencies, particularly with regard to FIRE PREVENTION CODE OF HENRY COUNTY, Article I. Fire Code, Sections 9-100 through 9-112, and VIRGINIA STATEWIDE FIRE PREVENTION CODE/2012, Chapter 56 and any revisions or addendums thereto.

The Contractor shall be responsible for supplying a copy of the blasting records to the Authority. The records will contain, at a minimum, all the same information required by Chapter 56 of the VA SFPC, and any revisions of addendums thereto.

1-15. AIR RELEASE ASSEMBLY Air release valves shall be installed at high points along water line and all other locations where air may get trapped within system. A HCPSA representative shall identify and approve all air release valve locations prior to installation.

1-16. EASEMENT VEGETATION Water line easement areas shall be vegetated in a turf maintainable manner. No shrubs or trees with deep root systems that can damage water line shall be planted within HCPSA easement or within five (5) feet of a fire hydrant.

SECTION 2

WATER MAIN PIPE, FITTINGS, AND ACCESSORIES

2-01. GENERAL REQUIREMENTS. Unless otherwise approved in writing by the Authority, or as specifically indicated on plans approved by the Authority, all pipe, fittings, and accessories used within water transmission and distribution systems shall be as defined in this section.

(A) APPLICABLE ANSI/AWWA STANDARDS

The following ANSI/AWWA Standards (latest revision) are hereby incorporated by reference. Where a conflict exists between these written standards, and the standards incorporated by reference, the Authority will determine which standard shall apply. In general, the Authority will select the Standard that gives a final product that is in best interest of the Authority. Applicant shall provide the Authority with manufacturer's certification that materials meet these standards.

A100 Standard for water wells.
C104 Standard for cement-mortar lined for ductile-iron and gray-iron pipe and fittings.
C110 Standard for ductile-iron and gray-iron fittings.
C111 Standard for rubber gasket joints for ductile-iron and gray-iron pipe and fittings.
C115 Standard for flanged ductile-iron and gray-iron pipe with threaded flanges.
C150 Standard for thickness design of ductile-iron pipe
C151 Standard for ductile-iron pipe
C502 Standard for dry-barrel fire hydrants
C504 Standard for rubber-seated butterfly valves (approved for 14 inch or larger)
C506 Standard for backflow prevention devices
C508 Standard for swing-check valves
C509 Standard for resilient-seated gate valves
C515 Reduced-wall, resilient-seated gate valves
C550 Standard for protective interior coatings for valves and hydrants
C600 Standard for installation and testing of ductile-iron water mains and their appurtenances
C602 Standard for cement-mortar lining of water pipe lines in place
C651 Standard for disinfecting water mains
C652 Standard for disinfection of water storage facilities
C900 Polyvinyl chloride (PVC) pressure pipe & fabricated fittings, 4 In. Through 12 In. for water transmission and distribution.
C905 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. for water transmission and distribution.

2-02. WATER MAIN PIPE MATERIALS.

(A) Ductile Iron Pipe. Ductile iron pipe shall be centrifugally cast and manufactured in accordance with ANSI/AWWA C151/A21.51. Ductile iron pipe and fittings shall be cement-mortar lined in accordance with ANSI/AWWA C104/A21.4. Interior of pipe and fittings shall have a standard coating of cementitious material and exterior of bituminous material.

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

1. Push-on Joints with Rubber Gaskets. Push-on joints and jointing materials shall comply with ANSI/AWWA C111/A21.11.

2. Mechanical Joints. Mechanical joints and jointing material shall comply with ANSI/AWWA C111/A21.11.

3. Locked Type Mechanical Joints. The locked type of mechanical joint shall only be used when integral joint restraint is required. No locking system involving set-screws or field welding shall be used when locked type of joint is the sole means of joint restraint.

4. Flanged Joints. Flanged joints shall be used in meter and valve vaults and where required by the Authority. Flanges and jointing materials shall comply with ANSI/AWWA C115/A21.15.

5. Gasket Lubricant. Gasket lubricant shall be a tasteless non-toxic, non bacterial supporting grease and meet NSF Standard 61 Certification. Gasket lubricant shall be supplied by the pipe manufacturer.

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

7. River Crossing Pipe. River crossing pipe shall be Griffin SNAP-LOK or equal, and manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Push-on joints for such pipe shall meet the requirements of ANSI/AWWA C111/A21.11, allow deflection of up to 15°, and shall have cement mortar lining and seal coating, where applicable, in accordance with ANSI/AWWA C104/A21.4

(B) Polyvinyl-Chloride Pipe. Polyvinyl-Chloride (PVC) pipe 12-inches in diameter and less and joint materials shall comply with AWWA C900. Polyvinyl-Chloride (PVC) pipe 14-

inches in diameter through 48-inches in diameter and joint material shall comply with AWWA C905. PVC pipe shall have outside diameters equal to that of cast iron pipe. All PVC pipe shall be DR14 unless otherwise noted.

PVC pipe shall have bell type joints. The bell shall consist of an integral wall section with a solid cross section elastomeric ring which meets the requirements of ASTM-D-3139 and F-477. PVC pipe shall be clearly marked with Class, Size, OD base, Manufacturer's name, and NSF-61. Jointing lubricant, shall be a tasteless, odorless, non-toxic, non-bacterial supporting lubricant and meet NSF Standard 61 Certification. Lubricants and gaskets shall be supplied by the pipe manufacturer. Solvent weld joints are prohibited.

(C) ASTM D2241 PVC Pipe. PVC pipe per ASTM D2241 shall be used only when approved by the Authority and only for pipe sizes under 4" diameter. When approved, the pipe shall conform to ASTM D2241 and D1784 and shall be Class 200 SDR 21 with integral bell joints. Pipe shall be clearly marked with Class, Size, Manufacturer's name, and NSF-61. Jointing lubricant shall be tasteless, odorless, non-toxic, and non-bacterial supporting and meet NSF Standard 61 Certification. Gaskets and lubricants shall be supplied by the pipe manufacturer. Solvent weld joints are prohibited.

NOTE: Items (B) and (C) above shall be bedded per the manufacturer's recommendations.

(D) Galvanized Steel Pipe. Galvanized steel pipe and fittings shall conform to ASTM A120, and the applicable section of AWWA C200, C206, C207, and C209 and shall only be used inside vaults and pump stations, not for direct bury applications.

(E) Brass Pipe. Brass pipe and fittings to be Red Brass Alloy, Type CDA 230, and shall conform to ASTM Specifications B43-91, B687-88, and MS51846. Threads to conform to NPT Screw Thread Standards for Federal Services Handbook H-28.

NOTE: All Contractors and Sub-contractors of the Henry County PSA shall adhere to all OSHA and EPA requirements for the removal and disposal of Asbestos Cement Pipe. The OSHA regulations for the safe removal of AC pipe is under 29 CFR 1926.1101, and the proper disposal of AC pipe is under the NESHAP regulation 40 CFR Part 61 Subpart M.

2-03. MAIN LINE FITTINGS. Tees, crosses, bends, reducers, sleeves, plugs, and caps shall have ANSI/AWWA C111/A21.11 mechanical ends. Fittings shall be manufactured of cast or ductile iron and shall comply with ANSI/AWWA C110/A21.10. Compact or short-body ductile iron fittings shall comply with ANSI/AWWA C153/A21.53. Fittings shall have the same interior and exterior coatings as ductile iron pipe.

2-04. SERVICE CONNECTION PIPING. In addition to water main pipe materials, the following shall be used.

(A) Copper Pipe - Copper pipe for service connections shall be at least Type K in accordance with ASTM B88 and shall be used with standard waterworks fittings.

(B) Polyethylene Tubing (CTS) - Polyethylene tubing shall conform to AWWA C901 and ASTM D2737. Tubing shall have a uniform wall thickness and have outside diameters equal to that of copper tubing of equal nominal size. Polyethylene tubing (CTS) shall be PE4710 and SDR 9 (Class 200psi). The tubing shall be clearly marked as to Class, Material, Size, Manufacturer's name and NSF-61.

All connections shall use approved CTS compression connection fittings. Pipe stiffeners/inserts for PE tubing shall be used in accordance with manufacturer's recommendations.

(C) Polyethylene Pipe (IPS) - Piping to be installed on meter setter outlet (customer side). Polyethylene piping shall conform to AWWA C901 and ASTM D2239. Polyethylene piping (IPS) shall be PE4710 and SIDR 9. The piping shall be clearly marked as to Class, Material, Size, Manufacturer's name and NSF-61.

2-05. Valves.

(A) Two- Inch Gate Valves.

1. For non-buried installations with sizes 2" or smaller, the gate valves shall be solid bronze, traveling stem, screwed ends (FIPT or MIPT), and shall be rated at minimum 250 psi working pressure. Valves shall open left.

2. For buried installation, gate valves smaller than two-inch shall not be used.

3. For buried installations two-inch gate valves shall be AWWA approved and shall be iron bodied, bronze mounted double disc, non-rising stem with dual O-ring seals. Valves shall open left and shall have a TEE-HEAD operating nut. Valves shall be rated at minimum 200 psi working pressure and shall have mechanical joint or threaded ends. Valves installed in locations having working pressures in excess of 200 psi shall be rated for the higher working pressure.

4. For buried installations bronze bodied gate valves with hand wheels or operating levers are prohibited.

(B) Gate Valves Four-Inch and Larger.

1. Buried gate valves three-inch and larger shall conform to AWWA C500 and shall be iron bodied, bronze mounted double disc, non-rising stem with dual O-ring seals. Valves shall open left and shall have a 2-inch square operating nut.

Valves shall be rated at minimum 200 psi working pressure and shall have mechanical joint ends. Valves installed in locations having working pressures in excess of 200 psi shall be rated for the higher working pressure.

2. Non-buried gate valves three-inch and larger shall conform to AWWA C500 and shall be rated at minimum 200 psi working pressure. Valves installed in locations having working pressures in excess of 200 psi shall be rated for the higher working pressure. Valves shall be iron bodied, bronze mounted, outside screw and yoke with double disc and bronze stem. Valves shall open left.

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

(D) Butterfly Valves. Butterfly valves shall be cast or ductile bodies with mechanical joint ends if in buried installations and flanged ends if non-buried. Butterfly valves shall be rubber seated, bubble-tight closure Class 150B conforming to AWWA/ANSI C504. Valves shall be suitable for buried service and buried valves shall include traveling nut or worm gear operator shall be sealed, gasketed, and lubricated for underground service operator torque rating throughout entire travel.

(E) Ball Valves. All buried valves two-inch and smaller shall be bronze ball curb stops. The bronze shall conform to AWWA standards, have dual rubber 0-rings, and shall be keyed into the ball. The valves shall have tee-head operating nuts and female IPS threaded ends.

(F) Miscellaneous Valves. Miscellaneous valves such as air release valves, vacuum valves, combination air/vacuum valves, globe valves, check valves, automatic control valves, pressure relief valves, etc. shall be approved by the Authority.

(G) Valve Boxes. All buried valves shall be provided with an adjustable cast iron valve box with a flared base section of a size suitable for the valve on which it is to be used. The shaft of the box shall have a minimum diameter of 5.25 inches. The covers shall be round and have the word "WATER" cast upon it. Boxes shall be given a heavy bituminous coating.

2-06. FIRE HYDRANTS. Fire hydrants installed within the distribution system shall conform to AWWA C502 in every respect and shall be approved by the Virginia State Inspection Bureau and the National Board of Fire Underwriters. Hydrants shall be designed for not less than 200 psi working pressure and 400 psi test pressure.

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

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

Hydrants shall have 6-inch mechanical joint inlet shoes. Hydrants shall have two 2.5-inch hose nozzles and a 4.5-inch pumper nozzle. Nozzles shall have National Standard Hose Threads. Nozzle caps and hydrant operating nuts shall be standard 1.5-inch pentagons.

Hydrants shall open left and the direction of opening shall be cast on the hydrant. Hydrants shall have 5.25-inch main valve openings or able to meet the AWWA flow and pressure drop requirements for 5.25-inch valve openings. Hydrant valves shall be left in the open position upon completion of the project.

Hydrants shall be powder coated OSHA yellow from the manufacturer unless approved otherwise by HCPSA engineer. Hydrant caps to be color-coded per flow capacity. **Note: See Drawing W-5 for color code**. Neither the primer nor the paint shall foul nozzle threads, nozzle cap chains, or any lubrication fittings.

2-07. SERVICE CONNECTION MATERIALS. Service connection materials shall comply with the Uniform Statewide Building Code and with the following:

(A) Corporation Stops. Corporation stops shall be used at each service connection for sizes up to 2-inch. Corporation stops shall be made of either ground key or ball type valves. Inlet threads shall be CC (AWWA) threads. Corporation stops shall have straight couplings with MIPT or FIPT outlet threads for 2-inch stops and pack joints for stops less than 2-inch.

(B) Service Saddles. Service saddles for Ductile Iron pipe and 2-inch Taps shall be fabricated steel bodied with double straps. Service saddles for PVC shall be fabricated steel bodied with single strap. Service saddles shall have cemented in place neoprene gaskets and CC or IPT inlet threads. Saddles shall be used on all taps to ductile iron and PVC mains and for all 2-inch taps.

(C) Service Connection Piping. Service connection piping shall be as specified in Section 2-04 above.

(D) Copper Setters. Copper setters shall be as shown on the standard details.

1. For meters up to and including 1-inch nominal size, copper setters shall have an inlet ball valve with padlock wing and outlet check valve.

2. For 2-inch meters, the setter shall have integral cut-off valves on the inlet and outlet side of the meter and shall have an integral valved meter bypass line. The inlet cut-off and the bypass valve shall have lock wings. Meter connections shall have elliptical flanges.

3. Locations where working pressures exceed 150 psi a tandem copper setter with PRV shall be installed on all water service connecting to protect meter. Residential customers will be supplied a ¾" PRV one time, to protect their plumbing and property.

(E) Water Meters All water meters shall be Sensus Metering Systems with Touch Read Pit Lid (TR/PL). All meters shall have straight reading registers that read in U.S. Gallons and calibrated to register usage in 1000 gallon increments. Meters shall be of a frost proof design rated for 200 psi, shall have low flow indicators, shall have an arrow on the case to indicate the direction of flow, and each meter shall have the manufacturer's serial number stamped on the register lid. Meters shall comply with the following AWWA standards as may be appropriate: C700 for positive displacement meters, C701 for turbine meters, C702 for compound meters, and C708 for multi-jet meters. Upon completion of a project the water meters shall be turned over to the Authority for installation and maintenance. Only Authority personnel or persons approved by the Authority shall install water meters. No water meter installation shall take place prior to an application being made through the Authority's Customer Service Department.

(F) Radio Transceiver All radio transceivers shall be Sensus SmartPoint 520M, single port. Dual port units may be used in vaults and areas where two meters are located.

(G) Meter Boxes Meter boxes shall be the size, material, and the configuration as shown on the standard details.

(F) Pressure Reducing Valve (PRV) For pressure ranging between 80-150 psi, The HCPSA recommends that a PRV be installed on the private side of the water meter assembly to protect private plumbing, and to ensure compliance with local and State Building codes. For pressures 150 psi and greater, a tandem meter setter shall be used that incorporates a ¾" pressure reducing valve with the water meter installation.

SECTION 3

WATER LINE CONSTRUCTION

3-01. GENERAL REQUIREMENTS. The water lines shall be laid and maintained to the required lines and grades with all appurtenances set at the required locations as shown on the approved plans or the project or as directed by the Authority. All valves and fire hydrants shall be set plumb.

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

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

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

3-02. WORK WITHIN HIGHWAY RIGHTS OF WAY. All work performed within or requiring utilization of any Virginia Department of Transportation's (VDOT's) rights of way shall comply in every respect with the latest edition of VDOT's Road and Bridge Specifications, the applicable subsections of Division II. General Provisions of the VDOT's Land Use Permit, current edition, and with any special provisions attached to any VDOT's approved permit.

3-03. PROTECTION OF EXISTING UNDERGROUND FACILITIES. All work shall be performed in compliance with the "Underground Utility Damage Prevention Act", Title 56, Chapter 10.3, Sections 56-265.14 through 56-265.29 of the Code of Virginia, as amended.

3-04. DISRUPTION OF WATER SERVICES DURING CONSTRUCTION. Prior to any planned disruption of existing water service, the Authority shall be notified at least three full working days prior to the disruption. The Authority may require rescheduling of the disruption.

Should the Contractor encounter an unforeseen probable disruption, no disruption shall occur without the Authority’s approval. The Authority may reschedule the disruption.

Should an accidental or unintentional disruption occur, the Authority shall be immediately notified. The Authority may issue specific instructions which the Contractor shall implement as required.

3-05. OCCUPATIONAL SAFETY AND HEALTH. All work shall be performed in accordance of the U.S. Department of Labor’s Occupational Safety and Health Administration.

3-06. EXCAVATION. All Excavation shall be performed in a manner to minimize the effects of sedimentation and Erosion. The work shall be done in accordance with all applicable sedimentation and erosion control ordinances. The trench shall be excavated to the alignment,

depth, and grade as shown on the plans or as required by the Authority. The maximum length that a trench can be opened including backfilled trenches which are not suitable for traffic shall be 200 feet. Trench widths shall be sufficient to allow for proper jointing of the pipe, for proper installation of backfill and bedding, and for installation of valves or other appurtenances.

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

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

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

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

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

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

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

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

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

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

3-07. BACKFILL. Unless bedding type dictates otherwise, backfill material shall consist of selected material from the excavation, and shall be free of large clods, cinders, ashes, refuse, vegetable or

organic material, boulders, frozen or excessively wet soil, stone, rocks, or broken concrete rubble.

The backfill from the trench bottom to at least one foot over the top of the pipe shall be select fill as described in the previous paragraph. It shall be hand placed and thoroughly compacted in layers not to exceed six inches in depth. Backfill from 1 foot over the top of the pipe to the original ground surface shall contain no stones larger than 5 inches in its largest dimension. The remainder of the backfill may be placed in one-foot layers and shall be thoroughly compacted by mechanical means.

Where excavation has been made through pavement, curbs, driveways, and sidewalks the backfill shall consist entirely of aggregate VDOT No.25/26 or other approved select backfill material shall be compacted in six inch layers to a minimum of 95% theoretical density at optimum moisture content.

Where excavation has been made in roadway shoulders or other traveled portions of the roadway which are not paved, the top 10 inches of trench shall be backfilled with good bank gravel or crusher-run stone with a capping of crusher-run material over the entire shoulder.

3-08. PIPE INSTALLATION. Pipe fittings, valves, hydrants and other accessories and appurtenances shall be loaded and unloaded by lifting with hoists or by skidding so as to avoid shock or damage. Under no circumstances shall these materials be dropped or skidded or rolled against any pipe already on the ground or already installed. Pipe and fitting shall be handled so that the coatings an linings shall not be damaged. No damaged pipe, fittings, valves, hydrants, or other accessories and appurtenances shall be installed.

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

During pipe laying the trench shall be kept free of water.

The pipe may be strung prior to installation if conditions allow and with approval of the Authority, subject to VDOT Use Permit. Maximum length pipe may be strung if approved shall be 1000’.

As each length of pipe is placed in the trench each joint shall be assembled according to the manufacturer's recommendations and the pipe shall be brought to the specified line and grade. When hydraulic equipment is used to push the pipe a block of wood shall be placed between the pipe and pushing device to prevent damage to the pipe.

When pipe materials other than ductile iron are used, the use of lifting or hydraulic equipment to push the pipe is prohibited. Once the joint is made the pipe shall be secured in place with approved backfill material.

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

Cutting of the pipe shall be done without damage to the linings of pipes, and shall be done only by experienced workmen. All cuts shall leave a smooth end and shall be made at right angles to the axis of the pipe. All cutting debris shall be removed from the pipe. Tapping bits, drills, and saws shall be type recommended by the manufacturers' for the type of pipe material being tapped.

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

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

3-09. VALVE, HYDRANT, AND FITTING INSTALLATION. Prior to installation valves, hydrants, and fittings shall be inspected for defects, direction of opening, number of turns to open, freedom of operation, tightness of pressure containing bolting and test plugs, and cleanliness of all valve ports and seating surfaces. Valves and hydrants shall be set plumb.

Valve operating nuts shall be at least one foot but no greater than three feet beneath finished grade. Stem extensions shall be installed if required. Valve boxes shall be set plumb, shall be centered over the valve operation nut, shall have the box lids flush with finished grade, and shall not be set so as to transmit shock or stress to the valve. In no case shall valves be used to bring misaligned pipe into alignment.

Until ready for use, hydrants which have been installed shall be securely covered with a burlap bag or other approved covering.

At tees and crosses, valves shall be rodded to the tees or crosses using 3/4 inch galvanized or bituminous coated all-thread rod or other approved restraining devices. Valves installed on dead-end lines shall be restrained by installing a suitable length of pipe beyond the valve, by rodding or restraining to a concrete anchor block, or by rodding or restraining to the pipe a suitable distance on the pressurized side of the valve.

All tees, plugs, caps, bends, tapping sleeves, and hydrants shall be suitably restrained to resist thrust forces by providing reaction backing as shown on the standard details, refer to drawings W-5, W-6, W-7, and W-8.

Fire hydrant drains shall be drained to dry wells provided exclusively for this purpose. Drywells shall be a minimum of 2 foot x 2 foot x 2 foot and be backfilled with crushed stone.

3-10. TAPPING FOR SERVICE CONNECTIONS.

A. Wet Taps. Service saddles or mechanical joint tapping sleeves shall be used for all tap sizes and all pipe materials. Service saddle taps shall be located at either the ten o'clock

or the two o'clock position on the pipe circumference. After installation of the saddle, it shall be water tested at the saddle's working pressure for a minimum of ten minutes, prior to the actual tap being made.

B. Dry Taps. Dry taps shall be made as described above. Mechanical joint tees and valves conforming to Section 2 may be used in lieu of tapping sleeves and valves.

3-11. RAILROAD AND HIGHWAY CROSSINGS. Unless otherwise approved by the Authority, pipe lines crossing railroads or highways shall be installed by boring, jacking, or tunneling. The pipeline shall be installed within a casing of sufficient size to allow the unrestrained passage of the pipe bells and spiders through the casing. Within the casing the pipe shall be supported on steel spiders so that the pipe shall not rest on the pipe joints or couplings. See Standard Detail W-10 for quantity and spacing requirements. Service line road crossings shall be encased. Approved casing materials include galvanized steel, black-steel, metallic electrical conduit, pvc, or HDPE. Nominal casing sizes shall be 2" diameter for ¾" and1" service line.

Care shall be taken to maintain the integrity of the pipe joints during the installation of the pipe in the casing, and in no cases shall pipe with non-locked joints be pulled by the pipe through the casing. The casing and spiders shall be as shown on the standard details. Carrier pipelines 3-inch and larger nominal shall be as shown on the approved plans. On 3-inch and larger carrier pipelines having a joint or coupling within the casing, each protruding pipeline end shall be rodded to the end of the casing. Railroad and/or highway crossings shall be installed according to the requirements and permit provisions imposed by the applicable agency.

All boring, jacking and tunneling shall be completed prior to the construction of adjacent sections. Approved casing materials shall be used where required. On any oversize boring the cavity between the casing and the bore shall be pneumatically grouted as shall any unfinished boring. Within the casing, the water line shall be installed so as to preserve the integrity of the joints.

3-12. AERIAL CROSSINGS. Aerial crossings, where allowed, shall be adequately supported using hanging and supporting systems suitable for use with the structure supporting the pipeline and shall be reflected in the approved plans for the project. Pipelines attached to highway or railway structures shall be installed according to the requirements of the applicable agency. Aerial crossings shall be protected against freezing, shall be accessible for repair, and shall be located above the 100-year flood level. Aerial pipelines shall be ductile iron pipe with factory fabricated integral locking joints. Field welding and restraining systems using set screws are prohibited. All pipe joining systems, restraints, and expansion fittings are to be approved by the Authority.

3-13. RESTORATION. All areas within the construction limits or utilized during construction shall upon completion of the work within a section be completely restored to a condition equal or better than that which existed prior to construction. Restoration shall include, but not be limited to pavement, concrete, grassed plots, fences, signs, ornamental plantings, drainage structures or other public or private improvements.

Driveway restoration shall be completed using same type material as existing (concrete, asphalt, stone, etc.). Hard surface driveways shall be saw-cut in a neat manner prior to excavation. Contractor may substitute material type, but shall have written consent from the property owner and Authority prior to restoration.

Roadway pavement restoration shall be in accordance with the Virginia Department of Transportation's Land Use Permit Requirements. Restoration shall be finished in a neat and uniform condition and within a schedule acceptable to the Authority.

All restoration to be under a warranty period not to exceed a year from date of project completion.

3-14. PRESSURE AND LEAKAGE TESTING. After the pipe and appurtenances have been installed, all newly laid pipe or any valved sections shall be subjected to hydrostatic pressure and leakage test.

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

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

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

The test pressure shall be at least 1.5 times the rated working pressure of the pipe or minimum of 100psi at the test point and at least 1.25 times the rated working pressure of the pipe at the highest elevation within the test section, but the test pressure shall not exceed twice the rated pressure of closed hydrants and shall not exceed the rated pressure of closed resilient seat gate or butterfly valves when such hydrants and valves are on the pressure boundary.

The pressure shall be maintained for at least two hours and the test pressure shall not vary more than five psi from the test pressure. Water may be added to the line being tested to maintain the test pressure, so long as the amount added does not exceed the allowable leakage. The leakage shall be defined as that volume of water that must be added to maintain the test pressure for the test duration as shown in AWWA C600. The leakage shall not exceed that determined by the following formula:

$$L = \frac{S * D * \text{Square Root of } P}{148{,}000}$$

where: L= the allowable leakage in gallons per hour;
S= the length of pipe tested in feet;
D= the nominal pipe diameter in inches; and
P= the average test pressure in psi during the test

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

If any test of pipe laid discloses leakage greater than that specified above, the Contractor shall at his expense, locate and make repairs as necessary to reduce the leakage to the specified allowance. Any leaking joint shall be cut off and repaired using appropriate sleeves. Use of Bell clamps are prohibited.

3-15. DISINFECTION. Before being placed into service, all newly installed mains, pump stations, fittings, appurtenances, and service connections shall be disinfected in accordance with ANSI/AWWA C651. During the disinfection procedure all hydrants and valves including meter stops shall be operated. Prior to disinfection all lines shall be filled to eliminate air pockets and flushed to remove any particulate unless the Tablet method is used. The flushing velocity shall be at least 3.0 feet per second.

The chlorine shall be applied by one of the following methods:

(A) Continuous Feed Method. Potable water shall be introduced into pipe at a constant flow rate. Chlorine shall be added at a constant rate to this flow in such a manner that the water has a chlorine concentration of at least 50 mg/l. The chlorinated water shall remain in the pipe at least 24 hours, after which time the chlorine concentration shall be at least 10 mg/l.

(B) Slug Method. Potable water shall be introduced at a constant rate. This water shall receive a chlorine dosage which shall result in a chlorine concentration of at least 100mg/l in a "slug" of water. The chlorine shall be added long enough to insure that all portions of the pipeline are exposed to the 100 mg/l chlorine solution for at least three hours. The chlorine residual shall be checked at regular intervals not to exceed 2000 feet to insure that an adequate residual is maintained.

(C) Tablet or Granule Method. This method shall be used only if the pipeline and appurtenances have been kept clean and dry during construction and the water temperature is greater than 5°C(41°F). During installation of the pipeline or appurtenances calcium hypochlorite tablets or granules containing 65% available chlorine by weight shall be placed in the pipeline. Granules shall be placed at the upstream end of the line, in the upstream end of each branch main, and at intervals of 500 feet. The quantity of granules at each placing shall be:

Pipe Diameter – Inches	Granules - Ounces
4	1.7
6	3.8
8	6.7
12	15.1
14 and larger	D^2 x 15.1

* D is the inside pipe diameter in feet D=d/12

Tablets (5g) when used shall be attached to the top of each joint of pipe. The tablets shall be attached with food-grade adhesive such as Permatex Form-a-Gasket No 2, Permatex Clear RTV Silicone Adhesive Sealant or approved equal. Tablets shall also be attached to or crunched in each appurtenance. The number of tablets required at each joint of pipe shall be:

Pipe Diameter	*Number of 5g Tablets per Section*	
In Inches	18 ft.	20 ft.
4	1	1
6	1	1
8	2	2
10	3	3
12	4	4
16	6	7
18	8	9

Potable water shall be introduced into the pipeline at a velocity of less than 1 ft./sec. The water shall remain in the line for at least 24 hours.

After the applicable retention period the chlorinated water shall be flushed from the line at a velocity of at least 3.0 ft./sec using potable water until the chlorine residual leaving the line is no higher than that generally prevailing in the system or is acceptable for residential use as determined by the Authority.

The heavily chlorinated disinfection water shall be disposed of in a manner in compliance with AWWA Standard C655-09, and in such a manner as to prevent adverse environmental impacts, including but not limited to: erosion, damage to vegetation, damage to natural habitats, or water courses. Prior to discharge, the heavily chlorinated water shall be dechlorinated to eliminate the chlorine residual. Prior to discharge, the Contractor shall select the discharge point(s) so as to minimize the risk of erosion and to minimize the risk of runoff into any stream or body of water. The Contractor shall provide a chemical medium to dechlorinate the water and shall document the performance by recording the chlorine residual of all flushing discharges. Provide documentation of test results to the Authority

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

3-16. BACTERIOLOGICAL TESTING. After the pipeline has been disinfected and flushed, two successive bacteriological samples, shall be collected and tested at intervals not to exceed **1200 feet** throughout the pipeline, at the end of the line, and each branch. There are two options for collecting bacteriological samples: 1) Collect the initial set of samples then collect the second set of samples from the same locations at least 16 hours apart. 2) Allow the water main to sit without water movement for at least 16 hours, then collect two sets of samples from the same locations at least 15 minutes apart. These samples must be processed by a laboratory certified by the Division of Consolidated Laboratory Services (DCLS). The results of these samples must indicate no coliform contamination before the pipeline is placed into service. If coliform contamination is present, then the disinfection procedure shall be repeated until no coliform contamination is indicated. Only written results supplied by the certified private laboratory will be accepted as proof of no coliform contamination.

3-17. BACTERIOLOGICAL SAMPLING. Bacteriological sampling shall take place on all new line construction projects, on all major rehabilitation projects, and for certain maintenance and repair situations as directed by the Authority. Contractor shall be responsible for collecting and paying for all bacteriological samples. Sampling locations must be clearly indicated on the samples associated paperwork. It shall be contractor's responsibility to transport the sample to their certified private laboratory.

3-18. TRACER WIRE All new water line construction shall be completed using tracer wire to facilitate future water line locating.

Materials

General - Tracer wire shall be used with all non-metallic pipe installations. All trace wire and trace wire products shall be domestically manufactured in the U.S.A.
All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

Trace wire

- Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 275 lb. break load, with minimum 30 mil HDPE insulation thickness.
- In lieu of copper clad steel, Contractor can utilize #12 solid soft drawn copper with a minimum 170 lb. break load and 30 mil HDPE insulation. Must meet other Specifications.

Connectors

- All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector or a direct bury twist on connectors with strain relief. At Crosses, the four wires shall be joined using a 4-way connector or a direct bury twist on connectors with strain relief. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.
- Direct bury wire connectors shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Direct bury twist on connectors with strain relief are also acceptable. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
- See "Products" for acceptable connectors.

Termination/Access

- Water meter boxes shall act as trace wire access boxes.
- A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.
- Fire Hydrants trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange. (affixing with tape or plastic ties shall not be acceptable).
- Long-runs, in excess of 500 linear feet without water meters or hydrants, trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48" polyethylene marker post, color coded per APWA standard for the specific utility being marked.

Grounding

- Trace wire must be properly grounded at all dead ends/stubs (not to include dead ends in meter boxes)
- Trace wire must be properly grounded with grounding anode rod at least every 1,000 feet along the main line.
- Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 10 ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.
- When grounding the trace wire at dead ends/stubs, the grounding anode shall be

installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.

- When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
- Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.
- Do not have to provide grounding at all access boxes. Do not have to provide grounding at water meter boxes.

Installation

General

- Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
- Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.
- Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire, and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
- Trace wire must be properly grounded as specified.
- Trace wire on all service lines must terminate at an approved trace wire access box located directly above the utility (meter boxes are an approved access box), at the edge of the road right-of-way, but out of the roadway. (See Trace wire Termination/Access)
- At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding)
- Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead- end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.

- All service line trace wires shall be a single wire, connected to the mainline trace wire using an approved connector.
- For water line replacement projects: where an existing service is being connected to the newly installed main line or where a service is being connected to another existing water line; and where the service line or a portion of the service line is being replaced – the newly installed service line must have tracer wire installed. If only a small portion (< 24") of the existing service line must be replaced before it transitions to copper or if the meter is within 24" of the main line, then the requirement for tracer wire to be installed with this short section of new service line is eliminated
- In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved connectors, and shall be properly grounded at the splice location as specified.
- Tracer Wire shall not be installed in direct contact of the water line. Contractor shall install tracer wire alongside of the installed pipe, horizontal to the spring line of the pipe. It shall be at least 2" horizontally from pipe, but no further than 4" horizontally from pipe.

Water System

- A mainline trace wire must be installed, with all service line trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
- Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the North or East side.
- Trace wire on all water service lines must terminate at the meter box.
- Above-ground tracer wire access boxes will be installed on all fire hydrants.
- All non-conductive service lines shall include tracer wire.

Prohibited Products and Methods

The following products and methods shall not be allowed or acceptable:

- Uninsulated trace wire
- Trace wire insulations other than HDPE
- Trace wires not domestically manufactured
- Brass or copper ground rods
- Wire connections utilizing taping or spray-on waterproofing
- Looped wire or continuous wire installations, that has multiple wires laid side-

by-side or in close proximity to one another
- Trace wire wrapped around the corresponding utility
- Brass fittings with trace wire connection lugs
- Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
- Connecting trace wire to existing conductive utilities

Testing

All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project. Continuity testing in lieu of actual line tracing shall not be accepted.

Products

- Copper clad Steel (CCS) trace wire
    - Open Trench – Copperhead #12 High Strength part # 1230-HS or approved equal.
    - In lieu of copper clad steel, Contractor can utilize #12 solid soft drawn copper with a minimum 30 mil HDPE insulation. Must meet other Specifications.
- Connectors
    - Copperhead 3-way locking connector part # LSC1230* or approved equal.
    - DryConn 3- way Direct Bury Lug: Copperhead Part # 3WB-01 or approved equal.
    - Direct bury twist on connectors with strain relief are acceptable connectors (Copperhead Part # SCB-01SR or approved equal). Must comply with other Specifications.
    - Direct bury wire connectors without strain relief are not acceptable.
- Termination/Access
    - Non-Roadway access boxes applications: Trace wire access boxes Grade level Copperhead adjustable lite duty Part # LD14*TP or approved equal.
    - Concrete / Driveway access box applications: Trace wire access boxes Grade level Copperhead Part # CD14*TP 14” or approved equal.
    - Fire hydrant trace wire access box applications: Above ground two terminal with 1” conduit. Copperhead part # T3-75-F (Cobra T3 Test Station, denoting “F” includes mounting flange) or approved equal.
- Grounding
    - Drive in Magnesium Anode: Copperhead Part # ANO-1005 (1.5 lb) or approved equal.

SECTION 4

GENERAL REQUIREMENTS-SEWER FACILITIES

4-01. GENERAL STATEMENT Standard construction details, specifications, and materials standards approved by the Authority shall be followed unless specific deviation therefrom is authorized in writing by the Authority.

4-02. TYPE OF SEWER All sewer systems shall be designed and constructed to achieve total containment. Combined storm and sanitary sewers are prohibited.

4-03. MINIMUM SIZES The minimum nominal size for public sanitary sewers shall be eight-inch for gravity lines except that laterals serving up to six residential connections on cul-de-sacs or sidewalk collector lines may be six-inch nominal size; and four-inch for force mains excepting grinder pump discharge piping.

4-04. VELOCITY, SLOPE, AND ALIGNMENT Gravity sewers shall be designed for a minimum full-flow velocity of two feet per second. In those gravity sewers in which velocities in excess of 15 feet per second are expected, the pipe shall conform to ASTM or AWWA specifications which provide protection against internal erosion. Velocity in force mains shall be no less than two feet per second but no greater than eight feet per second.

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

Sewers with slopes of 20 percent or greater shall be securely anchored with concrete anchors or other approved methods. Anchorage shall be provided on maximum 36-foot centers for slopes 20 to 35 percent; maximum 24-foot centers for slopes 35 to 50 percent; and maximum of 13-foot centers for slopes exceeding 50 percent.

Gravity sewers shall be installed with straight horizontal alignment between manholes. All gravity sewers shall be designed and constructed with continuous and uniform slope or grade between manholes.

The following minimum slopes shall be provided; however, greater slopes are desirable:

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

Velocities in force mains shall be 2 feet per second minimum, and have a maximum velocity of 8 feet per second.

4-05. MINIMUM COVER All sewers and force mains shall have 3 feet of minimum cover from the top of the pipe to the finished grade.

4-06. MANHOLE AND CLEANOUT LOCATIONS Manholes shall be installed at every change in pipe size, slope, or alignment, and no distance between manholes shall be greater than 400 feet for sewers up to 15-inch nominal size, and 500 feet for sewers greater than 15-inch nominal size. A cleanout shall be installed at the end of a cul-de-sac or sidewalk collector line as described in Section 6-03 above.

4-07. LOCATION OF SEWERS Sewers shall be located within public rights-of-way or within permanent easements not less than 10 feet in width for collectors and not less than 20 feet in width for interceptors.

4-08. SEPARATION BETWEEN SEWERS AND POTABLE WATER FACILITIES Separation between water lines and sanitary sewers shall be as described in Section 1-08 of these Construction Specifications and Standards. The minimum separation between a sewer line or sewer lateral and a Class I or II well shall be 50 feet. In addition to the minimum separation between wells of lesser class and any sewer line or lateral of 50 feet, no manhole shall be located within 100 feet of such wells and any sewer within 100 feet of such wells shall be constructed of an AWWA approved water pipe which shall be pressure tested in place with zero leakage.

4-09. LOCATION OF SEWERS IN RELATION TO STREAMS AND LAKES Sewers shall be designed to remain fully operational during 25 year recurrence interval floods. Within the 25 year flood plain, manholes shall have watertight frames and covers. Ventilation of sewers shall be provided for continuous watertight sections 1000-feet in length or greater. Vents shall be at least 4-inches in diameter, and shall be screened. Vent openings shall have openings above the 100 year recurrence interval flood level. Sewers and their appurtenances located along streams or lakes shall be protected against the 100 year recurrence interval flood.

4-10. MANHOLE RING & COVERS. Manhole rings & covers shall be as approved by the Authority. See Standard Details S-4 through S-7.

4-11. EASEMENT VEGETATION Sewer line easement areas shall be vegetated in a turf maintainable manner. No shrubs or trees with deep root systems that can damage sewer line shall be planted within HCPSA easement or within five (5) feet of a manhole.

SECTION 5

SEWERAGE FACILITIES MATERIALS

5-01. GENERAL REQUIREMENTS Unless otherwise approved in writing by the Authority, or specifically indicated on plans approved by the Authority, all pipe, fittings, and accessories used within sewerage systems shall be as defined in this herein.

5-02. PIPE Pipe specifications shall be as noted herein unless otherwise specifically addressed on plans approved by the Authority or contract documents approved by the Authority. Specific type, size, class shall be shown on Authority approved plans or bid documents.

1. Ductile Iron Pipe - Ductile iron pipe shall be manufactured in accordance with ANSI/AWWA C151/A21.51, latest revision. Slip joint or mechanical joint pipe shall be used for gravity sewers. Slip joint pipe shall be designed in accordance with ANSI/AWWA C150/A21.50 and specified according to ANSI/AWWA C111/A21.11. Ductile iron fittings shall conform to ANSI/AWWA C153/A21.53. Class 350 pipe shall be minimum strength used in all sewer applications. All ductile iron pipe and fittings shall be lined with Protecto 401TM Epoxy, or approved equal. Cement lining is not acceptable. Gaskets shall be furnished by the manufacturer and installed in accordance with their recommendations. Ductile iron pipe shall be used in exposed pipe installations, or where approved by the Participating Utility when other pipe materials are subject to crushing.

2. Polyvinyl Chloride (PVC) - PVC sewer pipe shall be manufactured in accordance with ASTM Designation 3034-77 (SDR 35). Gravity sewer pipe shall be unplasticized polyvinyl chloride with integral rubber ring wall bell and spigot joints. Installation of PVC gravity sewer pipe and fittings shall be in accordance with ASTM Designation D 2321 and manufacturer's recommendations.

   a. PVC sewer pipe shall be stored in accordance with manufacturer's recommendations on flat, even surfaces and shall remain racked on the pallets as delivered to the job site until such time as the trench is ready for placement of the pipe; i.e., PVC pipe shall not be laid along proposed alignment in excess of one day’s work.
   b. Additional strength PVC pipe including ASTM D3034 SDR-26, ASTM D2241 SDR-21, C900 DR-18 or concrete encasement of SDR-35, or both, shall be required where depth exceeds twelve feet (12') or where additional protection is required for the pipe as determined by the Henry County Public Service Authority.
   c. Force main pipe shall be in total accordance with AWWA C900 or C901 and shall conform to iron pipe outside diameter. Class 100 pipe shall meet the requirements of DR25; Class 150 shall meet the requirements of DR18; and Class 200 shall meet the requirements of DR 14. A force main’s minimum diameter shall be 2” if grinder pumps are used, and minimum 4” without grinder pumps.

3. PVC (Ribbed Pipe) - Ultra-Rib pipe with smooth-wall interior and meeting ASTM F-794 with a stiffness factor of 46 may be used on Henry County Public Service Authority projects. Installation shall be in strict compliance with manufacturer's written instructions. All fittings used shall be designed specifically for pipe used and be approved for use by same manufacturer of pipe. Connections to manholes shall be made by manufacturer's recommended methods and approved by the Henry County Public Service Authority.

4. PE Pipe - PE Pipe may be allowed by the Henry County Public Service Authority based on project type and conditions. Polyethylene plastic pipe shall be high density polyethylene pipe which meets the applicable requirements of ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-PR) based on Outside Diameter, and ASTM D3350 cell classification 345464E.

   a. Dimension Ratios: The minimum wall thickness of the polyethylene pipe used as gravity sewer line shall be a minimum of SDR 17. Additional strength pipe material may be required for deep sewer lines.
   b. All pipes shall be made of virgin material. No rework except that obtained from manufacturer's own production of the same formulation shall be used.
   c. The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters, or other deleterious faults. For sewer installations, interior of pipe shall have a light reflective color to enhance viewing for television inspection.
   d. PE pipe for sewer installations of four inch (4") diameter or larger shall be straight pipe sections of 40' or shorter. Rolled pipe is not approved for use.
   e. All service line connections to PE pipe shall be made using a fused service saddle. No direct tap to PE pipe shall be permitted.
   f. PE pipe shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections shall not be permitted. All equipment and procedures used shall be used in strict compliance with the manufacturer's recommendations.
   g. Qualifications of Personnel - HDPE pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the HDPE pipe. Training shall be performed by a qualified representative.
   h. Butt-fused joint shall be true alignment and shall have uniform roll-back beads resulting from the use of proper temperature and pressure. Joint shall be allowed adequate cooling time before removal of pressure. Fused joint shall be watertight and shall have tensile strength equal to that of the pipe. All joints shall be subject to acceptance by the Henry County Public Service Authority and/or his representative prior to insertion. All defective joints shall be cut out and replaced at no cost to the Henry County Public Service Authority. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%)

of the wall thickness, shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above. In addition, any section of pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Henry County Public Service Authority and/or his representative shall be discarded and not used.

5-03. MANHOLES AND CLEANOUTS

GENERAL REQUIREMENTS On a given project manholes shall be of the same construction and all cleanouts shall be of the same construction.

MATERIALS

(A) Concrete All concrete work shall be in accordance with Section 7 of these specifications.

(B) Brickwork Brick and masonry units shall be used only to form inverts or to provide vertical spacing or adjustment between the highest precast section or spacer and the manhole frame.

1. Common bricks shall be machine made, clean and unused and shall conform to ASTM C32, Grade MA. Common bricks shall have square edges and be of uniform size.

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

3. Mortar for parging masonry walls below grade, brick masonry, concrete masonry units, and for bedding cast iron frames in masonry shall conform to Type M or ASTM C270, mixed in the proportions of 1 part Portland cement and 3 parts clean, dry sand.

4. Masonry shall be laid at temperatures above 40°F, and shall not be subjected to freezing temperatures for a period of 48 hours after and during installation.

(C) Precast Concrete Manholes Precast concrete manhole base sections, risers, flat top eccentric taper units, and grade rings shall be constructed of reinforced concrete in accordance with ASTM C478. Manholes shall be set on a layer of VDOT #57 stone with a minimum thickness of 6 inches.

The base section shall be the extended type and shall be cast monolithic with the first riser section. All sections shall have a minimum wall thickness of 5 inches. Joints shall

be tongue and groove with an "O" ring rubber gasket or Bitumastic 50 sealing material or approved equal, conforming with ASTM C443.

Pipe openings in the manhole wall shall be as shown on the approved plans and shall be provided with flexible watertight connector sleeves conforming to ASTM C923. The connector sleeves shall be cast in as a permanent, integral part of the monolithic base casting and shall be fitted with stainless steel pipe locking bands.

All manhole surfaces shall be smooth and exhibit no honeycombing or other deterioration. All lifting holes shall be filled flush with mortar.

(D) Inverts Invert channels shall be smooth and semicircular and shall be constructed of brick and mortar or concrete. Invert channels shall conform to the inside of the adjoining sewer pipe. Transitions in channel size and direction shall be gradual. The bench shall be smooth and slope toward the invert at a slope of one to two inched per foot.

(E) Accessories

1. Frames, Covers and Lids Frames, covers and lids shall be cast to the size, thickness, and shape as shown on the standard details or approved plans and shall be cast of the best quality gray iron in accordance with ASTM A48. The castings shall be sound, true to form, machined on all bearing and mating surfaces and sand blasted clean of all rust and scale and shall be coated with one coat of black asphalt paint.

2. Steps Manhole steps shall be made of fiberglass construction, cast iron, or steel and shall have a plastic coating. Steps shall be spaced sixteen inches (16”) apart. The first step shall be within twelve inches (12”) of the cover. The bottom step shall be within twenty-four inches (24”) of the bottom of the manhole.

(F) Sealing of Frame Sealing of the frame to either a concrete or masonry manhole shall be accomplished by using Bitumastic 50 sealing material or approved equal.

SECTION 6

SEWER LINE CONSTRUCTION

6-01. GENERAL REQUIREMENTS The sewer line shall be laid and maintained to the required lines and grades with all appurtenances set at the required locations as shown on the approved plans for the project or as directed by the Authority.

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

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

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

6-02. WORK WITHIN HIGHWAY RIGHTS OF WAY All work performed within or requiring utilization of any Virginia Department of Transportation's (VDOT) rights of way shall comply with Section 3-02 above.

6-03. PROTECTION OF EXISTING UNDERGROUND UTILITIES All work shall be performed in compliance with Section 1-09 and 3-03 above.

6-04. DISRUPTION OF WATER SERVICE DURING CONSTRUCTION Water service disruption during sewer construction shall comply with Section 3-04 above.

6-05. OCCUPATIONAL SAFETY AND HEALTH All work shall be performed in compliance with Section 3-05 above.

6-06. CLEARING AND GRUBBING Where clearing and grubbing is required, the Contractor shall clear the required work area of all trees, shrubs, brush, rubbish, and other materials. Only those areas in which the work is to be performed and those areas which must be utilized to gain access to the work shall be cleared. The contractor shall make every effort to minimize the area to be cleared and grubbed and explosives shall not be used during the clearing. The debris from the clearing and grubbing operations shall be removed from the site or disposed of in an approved manner.

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

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

6-07. EXCAVATION The trench shall be excavated to the alignment, depth, and grade as shown on the plans or as required by the Authority. The maximum length that a trench can be open including backfilled trenches which are not suitable for traffic shall be 200 feet. Trench widths shall be sufficient to allow for proper jointing of the pipe, for proper installation of backfill and bedding, and for installation of manholes or other appurtenances.

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

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

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

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

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

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

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

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

6-08. BACKFILL Unless bedding type dictates otherwise, backfill material shall consist of selected material from the excavation, and shall be free of large clods, cinders, ashes, refuse, vegetable or organic material, boulders, frozen or excessively wet soil, stones, rocks, or broken concrete rubble.

The backfill from the trench bottom to at least one foot over the top of the pipe shall be free of earth clods or stones greater than one inch in diameter and shall be hand placed and thoroughly compacted in layers not to exceed six inches in depth. The remainder of the backfill may be placed in one foot layers and shall be thoroughly compacted by mechanical means and shall be free of rocks or stones larger than 5 inches in their greatest dimension.

Where the excavation has been made through pavement, curbs, driveways, and sidewalks the backfill shall consist entirely of graded aggregate VDOT No. 25/26 or other approved select backfill material and shall be compacted in six-inch layers to a minimum of 95% theoretical density at optimum moisture content.

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

6-09. PIPE INSTALLATION Unless otherwise shown on the plans or otherwise required by the Authority, sewers shall be laid using the standard gravel bedding shown in the standard details unless otherwise directed in writing by the Engineer.

Pipe fittings, and other accessories and appurtenances shall be loaded and unloaded by lifting with hoists or by skidding so as to avoid shock or damage. Under no circumstances shall these materials be dropped or skidded or rolled against any pipe already on the ground or already installed. Pipe and fittings shall be handled so that the coatings and linings shall not be damaged. No damaged pipe, fittings, or other accessories and appurtenances shall be installed.

The pipe may be strung prior to installation if conditions allow and with approval of the Authority. The sewer pipe shall be installed with bells upstream and such that the completed pipe shall have a smooth invert.

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

equipment to push home the pipe is prohibited. Once the joint is made the pipe shall be secured in place with approved backfill material.

Tracer wire shall be used with all non-metalic pipe installations. All trace wire and trace wire products shall be domestically manufactured in the USA. All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked. Refer to section 3-18 of this document for tracer wire specifications.

6-10. MANHOLE INSTALLATION. Manholes shall be installed according to the locations, depths, and heights as shown on the approved plans. The base sections shall be installed on a 6-inch bed of crushed stone.

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

Where allowed, brick or masonry unit components shall be constructed in accordance with the dimensions shown in the standard details. Bricks and masonry units shall be laid in a full mortar bed with joints 1/2-inch thick and shall be laid only at temperatures greater than 40°F, and shall be protected from freezing for 48 hours. Invert channels, benches, and pipe holes shall be constructed as described in Section 5-04.D above. The interior and exterior shall be parged with 1/2-inch thick mortar.

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

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

Force mains shall enter manholes through saxophone bends as shown in the Standard Details.

6-11. SERVICE CONNECTION OR LATERALS. Laterals shall be installed as indicated on Drawing S-2 of the attached Standard Details. Connections shall be made to the main sewer by means of wyes of the same material as the main, or by using approved strapped sewer service saddles.

When sewer saddles are used, the hole in the main sewer shall be cut using a hole saw, ole shall not be made by chipping the wall section out with a hammer.

The recommended minimum grade on a lateral shall be 1/4-inch per foot and each service connection shall terminate with a cleanout to be located at the easement boundary or

property line. Each service connection shall be capped or plugged as directed by the Authority.

6-12. HIGHWAY AND RAILROAD CROSSINGS. Unless otherwise approved by the Authority, sewers crossing highways shall be installed by jacking, boring, or tunneling in accordance with requirements of the Virginia Department of Transportation.

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

All boring, jacking and tunneling shall be completed prior to the construction of adjacent sections. Approved casing materials shall be used where required. On any oversize borings the cavity between the casing and the bore shall be pneumatically grouted as shall any unfinished borings. Within the casing, the sewer shall be installed so as to preserve the integrity of the joints.

6-13. BURIED STREAM CROSSINGS. Buried stream crossings shall be installed using mechanical joint ductile iron pipe with a nominal size equal to that of the adjoining sewer pipe, or the next larger nominal size if equal sizes are not available. The crossing shall be tested in place and shall exhibit zero leakage. The ductile iron pipe shall extend at least 10 feet beyond each bank and shall be installed with concrete anchors as required by the Authority. The tops of all sewers entering or crossing streams shall be at least 3 feet below the bottom of the stream bed. Should 3 feet of cover not be obtainable, the sewer shall be encased in concrete.

6-14. AERIAL CROSSINGS. Aerial crossings of any kind shall consist of a carrier sewer installed within a bituminous coated continuously welded steel casing pipe which is properly supported.

6-15. RESTORATION. Restoration of disturbed areas shall be in accordance with Section 3-13 above.

6-16. ACCEPTANCE TESTING OF GRAVITY SEWERS. Low-pressure air, deflection, and infiltration testing will be performed as directed by and in the presence of the Authority. Should any section of pipe fail any required test, that section shall be repaired or replaced as directed by the Authority.

(A) Low-Pressure Air. Where required by the Authority, the Contractor shall provide all equipment, material and labor to perform an air test. The air test shall be performed in accordance with ASTM F1417 for PVC & PE and ASTM C924 for Ductile Iron Pipe. The air testing equipment and air hose configuration shall be subject to approval by the Authority.

The CONTRACTOR shall thoroughly clean and remove all debris, silt, earth or other materials from the sewer prior to acceptance testing.

Proper test plugs shall be supplied and installed by the CONTRACTOR. Test gauges used in air test procedure shall have a range of 0-10 psi and shall be calibrated in divisions of 0.10 psi with an accuracy of +/- one percent. Test gauges shall be calibrated at least once a year and the date and results displayed on the equipment including date of calibration. Calibrations shall be certified by an independent testing lab. Test gauges shall be located outside of manhole during testing.

If pipe to be tested is expected to be below ground water table, the CONTRACTOR shall either:

- Install a small diameter perforated vertical pipe from invert elevation of the sewer to the surface prior to backfilling; or
- Insert a pipe probe by boring or driving into the backfilling material adjacent to the invert elevation of the pipe, and determine the depth of the ground water level above the pipe invert immediately prior to acceptance testing the sewer.
- All gauge pressures for test shall be increased by the amount of this back pressure due to ground water over the invert of the pipe. Back pressure to be calculated by multiplying height (in feet) of groundwater above pipe invert x 0.433 to obtain back pressure in units of PSI.

The CONTRACTOR shall add air slowly to the portion of the pipe under test until the internal air pressure is raised to 4.0 psi gauge plus the ground water pressure.

As a safety precaution, no one shall be allowed in manhole after air pressure is increased in the sewer line. If the inspector suspects that the test plug may be leaking, pressure shall first be relieved before any adjustments are made to eliminate air leakage at the plug.

The CONTRACTOR shall allow air temperature to stabilize for at least two (2) minutes with the pipe subjected to an internal pressure of 4.0 psi by adding only the amount of air required to maintain the pressure between 3.5 and 4.0 psi.

After temperature stabilization, the test will begin. If the internal air pressure decreases, the time required for the pressure to drop from 3.5 to 2.5 psi gauge will be observed and recorded. The time interval shall be compared with the established standards in accordance with **Table 6-1** for time and length of test section for various diameters of the sewer. All pipes fifteen inches (15”) or less shall be tested for a pressure drop of 1.0 psi gauge.

Pipe which fails to maintain the stipulated pressure for a period equal to or greater than the holding time shown in the above referenced tables shall be deemed to have failed the low pressure air test and is unsatisfactory for acceptance by the Participating Utility. Any sewer that fails to pass this test shall be replaced by the CONTRACTOR at his expense. A single coupling or pair of repair clamps shall be allowed between manholes to facilitate replacement of defective materials or workmanship.

Table 6-1
LOW-PRESSURE AIR TESTING TABLE

MINIMUM SPECIFIED TIME RQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR A SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

1 PIPE DIAMETER (IN)	2 MINIMUM TIME (MIN:SEC)	3 LENGTH FOR MINIMUM TIME (FT)	4 TIME FOR LONGER LENGTH (SEC)	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)							
				100FT	150FT	200FT	250FT	300FT	350FT	400FT	450FT
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46
42	39:48	57	41.883 L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07
48	45:34	50	54.705 L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
54	51:02	44	69.236 L	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16
60	56:40	40	85.476 L	142:28	213:41	284:55	356:09	427:23	498:37	569:50	641:04

(B) Deflection Testing. Sewers constructed of PVC Pipe shall be subjected to a deflection test throughout their entire length using a go, no-go mandrel. Testing shall be performed after all other work is completed, including filling, compaction, testing grading, concreting, restoration, and the placement of any superimposed dead or live loads.

The deflection of the pipe after all external loading has been applied shall not exceed 5% of the pipes average inside diameter + or - manufacturer's tolerances.

The pull through device shall be a nine arm mandrel with a proving ring sized at 5% less than the inside dimension of the pipe as shown be ASTM D3034 for SDR 35 PVC Pipe. Said mandrel shall be approved by the Authority prior to its use for testing.

The mandrel shall be pulled through the pipe and shall pass freely through each joint of pipe. If the mandrel fails to pass freely through said pipe then the section with excess deflection shall be replaced and retested as required by the Authority.

A warranty period deflection test may be performed by the Authority just prior to the end of the one year warranty period. Should the pipe deflection exceed 5%, the contractor shall be required to replace the section of pipe with excess deflection in accordance with the project specifications.

(C) Vacuum Testing of Manholes.

Each manhole shall be tested after assembly (Preferably prior to backfilling) using an approved vacuum tester.

All lift holes shall be plugged with an approved non-shrink grout.

All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.

The test head shall be placed at the top of manhole casting and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if time is greater than the values in the table below:

MINIMUM TIME ELAPSED FOR A DROP OF 1 INCH IN A COLUMN OF MERCURY

MANHOLE DEPTH	DIAMETER OF MANHOLE 48"DIA.	60"DIA.	72"DIA.
10 FT OR LESS	60 SEC	75 SEC	90 SEC
>10 FT BUT <15 FT	75 SEC	90 SEC	105 SEC
>15 FT BUT <25 FT	90 SEC	105 SEC	120 SEC

If a manhole fails the initial test, necessary repairs shall be made with a suitable non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

6-17. ACCEPTANCE TESTING OF FORCE MAINS.

(A) Main piping shall be filled slowly from the low point in the force main with air expelled from the high point as filling proceeds. Once the force main is filled and all air is dispelled, the pipe shall be left for 24 hours. At the end of this period, a hydrostatic pressure equal to the rated working pressure of the pipe--i.e., 150 or 200 psi--shall be induced. This pressure shall be maintained for two hours. Leakage shall not exceed the amount given by:

$$L=\frac{S*D*\sqrt{P}}{148{,}000}$$

Where: L is allowable leakage in gallons per hour;
S is the length of pipe tested in feet
D is the pipe diameter in inches;
P is the test pressure in psi.

(B) Repairs. If the flow of water is in excess of the allowable limits, or if leaks of appreciable size are encountered, the Contractor shall repair or rebuild, at his expense, those portions of the piping which are faulty. These tests will be repeated until the work is deemed acceptable in accordance with the allowable limits. Leaking joints shall be cut out and repaired using appropriate sleeves. Use of Bell Clamps are prohibited.

(C) Test Water. Water for testing purposes will be supplied by the Owner at the nearest source to this project. Pumping, if necessary, loading, hauling, and discharging of the water shall be the Contractor's responsibility.

(D) Extent of Test. Force main shall be tested from just outside of pumping station to just outside of discharge manhole.

(E) Testing Restraints. The Contractor shall be responsible for making sure that each end of the force main is securely restrained prior to test pressures being applied.

SECTION 7

CONCRETE

7-01. GENERAL REQUIREMENTS Unless otherwise approved in writing by the Authority, or as specifically indicated on plans approved by the Authority, all concrete work shall conform to this section and to the latest edition Building Code Requirements for Reinforced Concrete, ACI 318.

7-02. MATERIALS

(A) Concrete Concrete for structures shall be proportioned and mixed in accordance with the Road and Bridge Specifications, Virginia Department of Transportation, Current Edition, General Use Concrete, Class A3, Table II-15, Section 219. Concrete for miscellaneous purposes such as fill concrete, thrust blocks, concrete encasement, etc., shall have a 28 day compressive strength of 3000 psi. The mix proportions and test data for this concrete shall be submitted to the Authority for approval.

(B) Cement Cement shall be Type II Portland cement manufactured in accordance with ASTM C150.

(C) Steel Reinforcement Reinforcement bars shall be deformed new billet steel conforming to ASTM A615-40. Bars shall be formed to the dimensions indicated on the approved drawings. The Contractor shall submit shop drawings to the Authority or its Engineer for approval.

(D) Wire Reinforcement Welded wire fabric shall conform to ASTM A185.

(E) Curing Compound Curing compound shall conform to ASTM C309 Type 2.

(F) Joint Filler Expansion joint material shall be preformed and shall conform to AASHTO M213.

(G) Joint Sealant All concrete joints shall be prepared as shown on the approved drawings and sealed with an approved joint sealant compound.

(H) Waterstops Flexible waterstops shall be manufactured from virgin polyvinyl-chloride compound which conforms to the Corps of Engineers' Specifications CRD-C572. Waterstops shall be capable of withstanding a head of water equal to the depth of installation or 30 feet, whichever is greater.

(I) Admixtures and Coatings Where indicated on the approved plans, approved admixtures and coatings shall be used

7-03. Slump Slump shall be from 2 to 4 inches and will be determined in accordance with ASTM C 143. Samples for slump shall be taken from the concrete during placement in the forms.

7-04. TESTING The 28 day compressive strengths will be verified during the progress of the work by

testing standard concrete cylinders. Three cylinders shall be required from each item of work or from each 50 cubic yards of concrete placed. The Authority shall determine when concrete cylinders shall be taken. The Contractor shall furnish the necessary labor and facilities for taking the samples and handling and storing the cylinders at the work site. The Authority will mold, ship and provide for the testing of cylinders. The making, curing and testing of the specimens will be in accordance with ASTM C31 and C39. For the first 24 hours after molding, the cylinders shall be kept moist in a storage box constructed and located so that its interior air temperature will be between 60^0 and 80^0 F.

Should the concrete specimens fail to meet the required compressive strengths, the Authority may require sample cores to be cut from the suspect concrete, load testing per ACI 318, or the installation of additional support or remeasure work, all at the Contractor's expense.

7-05. FORMS All concrete shall be formed. Forms shall be true to line and grade and shall be mortar-tight. All exposed joints, edges and external corners shall have 3/4 inch chamfer. Forms shall be of wood, plywood or steel. Form design shall be approved by the Authority, but adequacy of ties, supports, etc. shall remain the responsibility of the Contractor. Embedded wall ties shall be set 1.5 inches from exposed concrete surfaces. In conventional thickness walls, the heights of forms for each vertical lift shall not exceed 10 feet. Forms for continuous surfaces shall be fitted over the completed surface to assure accurate alignment and to prevent leakage of mortar. All forms shall be constructed to allow the forms to be removed without damage to the concrete. Prior to the placing of concrete, the contact surfaces of forms shall be cleaned and coated with a non-staining oil.

Forms for columns, walls, sides of beams and other members not supporting the weight of concrete may be removed 36 hours after placement of the concrete. Forms for beams, girders and slabs shall remain in place until the concrete has obtained its required 28 day strength. Reshoring of such members will only be permitted for just cause and after review and approval by the Authority's Engineer.

7-06. PLACING REINFORCEMENT Steel reinforcement bars shall be placed in accordance with the approved plans or shop drawings and shall be supported by concrete blocks or metal chairs and shall be securely held in place to prevent dislocation during concrete placement. Reinforcement shall be free from loose rust, mill scale, oil or grease or other material that would destroy proper concrete bond.

7-07. DELIVERY OF CONCRETE Concrete mixing equipment and methods shall be subject to approval. Each truck load of ready-mixed concrete shall be accompanied by a ticket indicating mix design, mix starting time, and batch weights. No concrete that has been in the ready mix truck longer than two hours when the temperature is less than 80°F. shall be placed.

7-08. CONCRETE PLACEMENT Concrete placing equipment and methods shall be subject to approval. Poor quality subgrades which would contaminate the concrete shall be covered with building paper or other approved material. All surfaces upon which concrete is to be placed shall be thoroughly cleaned and dampened. At contact surfaces between old and new concrete, a one inch layer of cement-sand grout 1:3 by weight shall be placed. The maximum free fall of

concrete during placement shall be 6 feet. Chutes, slides or other approved methods shall be used for greater heights. Concrete shall be placed in 12 to 18-inch horizontal layers as near as possible to its ultimate position and shall be worked around the reinforcement and embedded fixtures and into the corners or forms with care being taken to avoid segregation. Cold joints between successive layers shall be avoided. Concrete shall be placed in the dry and placement will not be permitted during adverse weather conditions. Concrete shall not be placed under water. Without specific authorization, concrete shall not be placed when the air temperature is less than $40\,^{0}$F.

7-09. VIBRATION All concrete shall be properly consolidated using internal mechanical vibrators supplemented by hand tamping and spading. Vibrators shall have vibratory elements with a frequency of at least 7000 impulses per minute when submerged in the concrete. Vibrators shall not be used to transport concrete in the forms. Vibration of forms and reinforcement shall not be permitted. Where concrete is placed in more than one lift, the vibrator shall penetrate into the previous lift to prevent formation of cold joints.

7-10. CONSTRUCTION JOINTS Construction joints shall be provided where indicated on the approved plans, but in no case shall construction joints on wetted surfaces be located within two feet of design water level. Construction joint surfaces shall be thoroughly cleaned prior to concrete placement. All laitence, coatings, stains, debris and other foreign material shall be removed from the surface, and the surface shall be broomed with neat Portland cement grout immediately prior to placing new concrete.

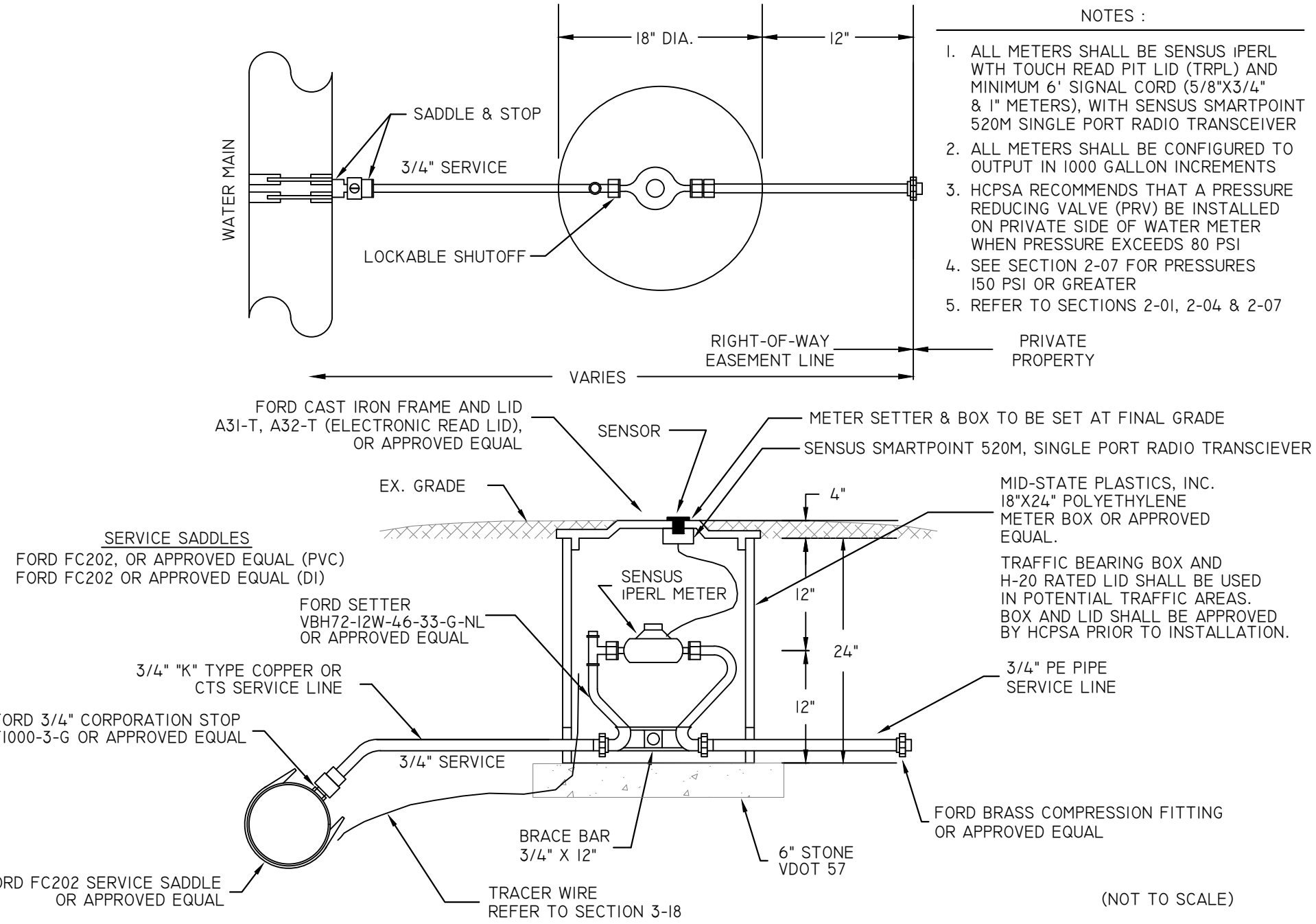
Waterstops and shear keys shall be provided at construction joints where indicated. Joints in metal waterstops shall be brazed, soldered or welded. Joints in rubber waterstops shall be vulcanized. Waterstops shall be installed so as to form a continuous watertight seal in each joint. Shear keys shall be installed for ease of removal of the form. Blockouts for pipe sleeves, if approved by the Authority, shall be provided with keyway and waterstops and shall be detailed as a plug.

7-11. SURFACE FINISHING Surface defects shall be repaired immediately after form removal. Honeycombed and other defective concrete shall be removed to sound concrete. Form ties, tie wire and other loose hardware shall be removed from the concrete surface and tie holes and all damaged surfaces shall be cleaned, dampened and patched with an approved fast setting non-shrink patching mortar. Patched surfaces shall be water cured and patches shall be flush with adjacent concrete surfaces. Finishing of exposed surfaces shall be as required by the Authority.

7-12. PROTECTION AND CURING Concrete shall be protected adequately from injurious action by the sun, rain flowing water, frost, and mechanical injury, and shall be accomplished by water curing or by application of curing compound, except that compound shall not be used on surfaces to be rubbed or where its appearance would be objectionable or where coverings are to be bonded to the concrete. Vertical wall forms shall be kept continuously wet while the forms are in place.

APPENDIX A
WATER DETAILS

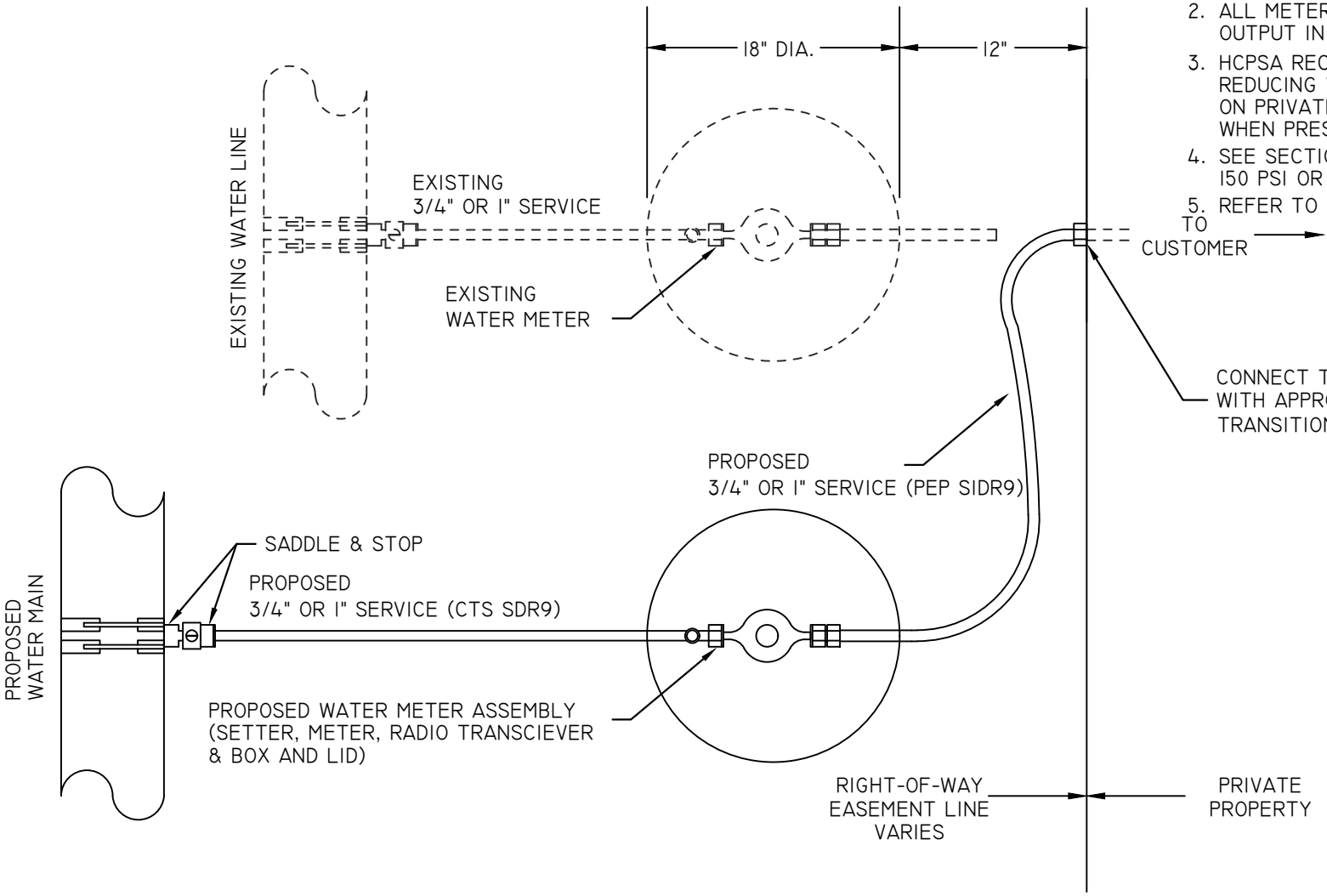
W-1	Meter Setting for ¾" & 1" Meters
W-2	¾" & 1" Meter Settings for System Rehabilitation/Replacement
W-3	Meter Setting for 2" Meters
W-4	Water Service Connections Up To 2"
W-5	Fire Hydrant Assembly
W-6	Valve Box Installation and Valve Setting
W-7	Concrete Thrust Block
W-8	Mechanical Joint Restraint
W-9	Pipe Bedding
W-10	Steel Encasement
W-11	Blow-off & Sample Tap Assemblies
W-12	1" Combination Air Release Assembly
W-13	2" Combination Air Release Assembly
W-14	Pavement Restoration
W-15	Thrust Collar
W-16	Double Detector Check Valve Assembly
W-17	Subsurface Water Crossing
W-18	Directionally Drilled Stream Crossing
W-19	Open Cut Flume Pipe Stream Crossing
W-20	Setting for Meters 3" and Greater
W-21	Main Line Pressure Reducing Valve – Option A
W-22	Main Line Pressure Reducing Valve – Option B



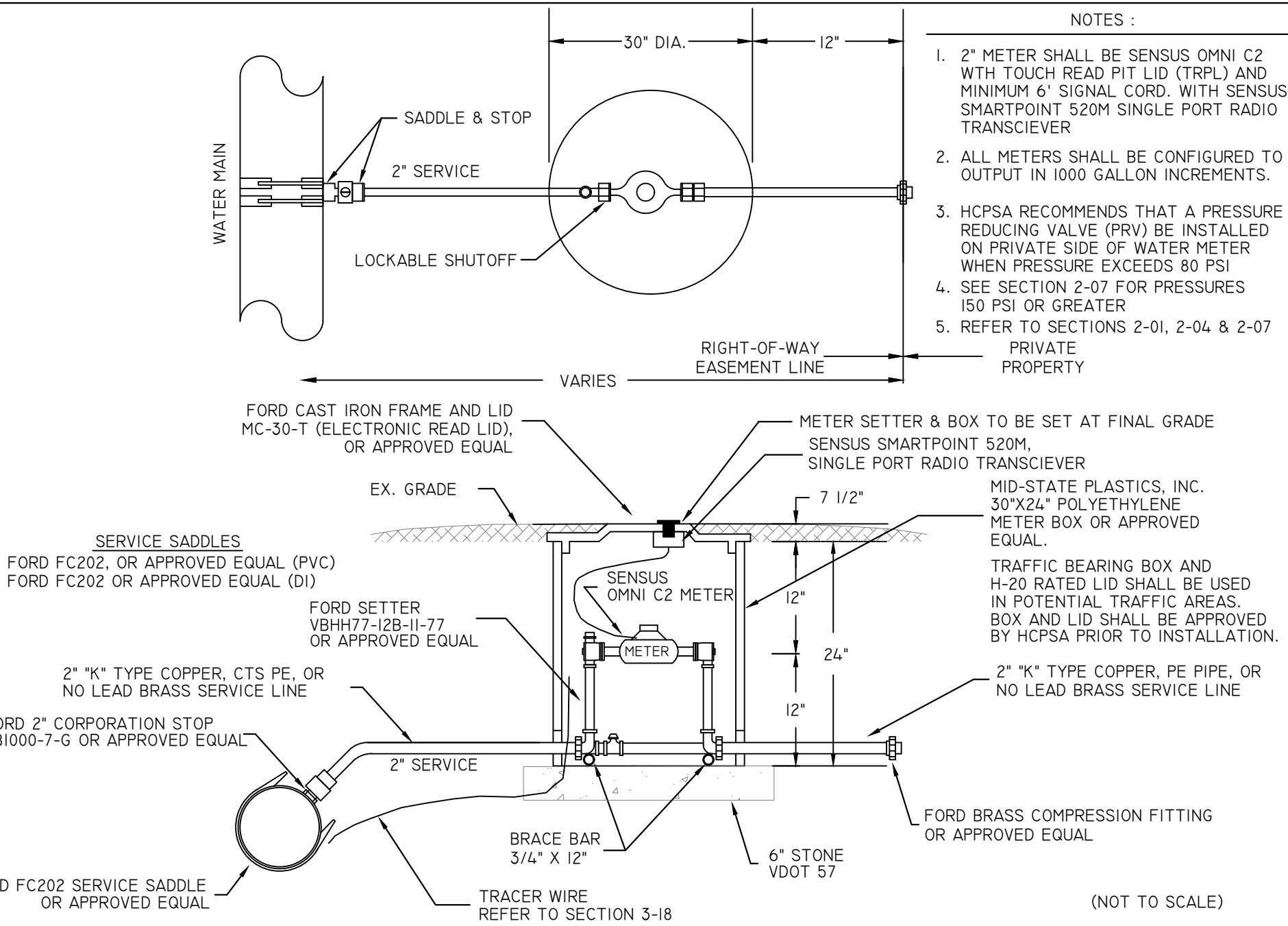
Henry County Public Service Authority	Meter Setting for 3/4" & 1" Meters	Date: October 2019	W-1

NOTES :

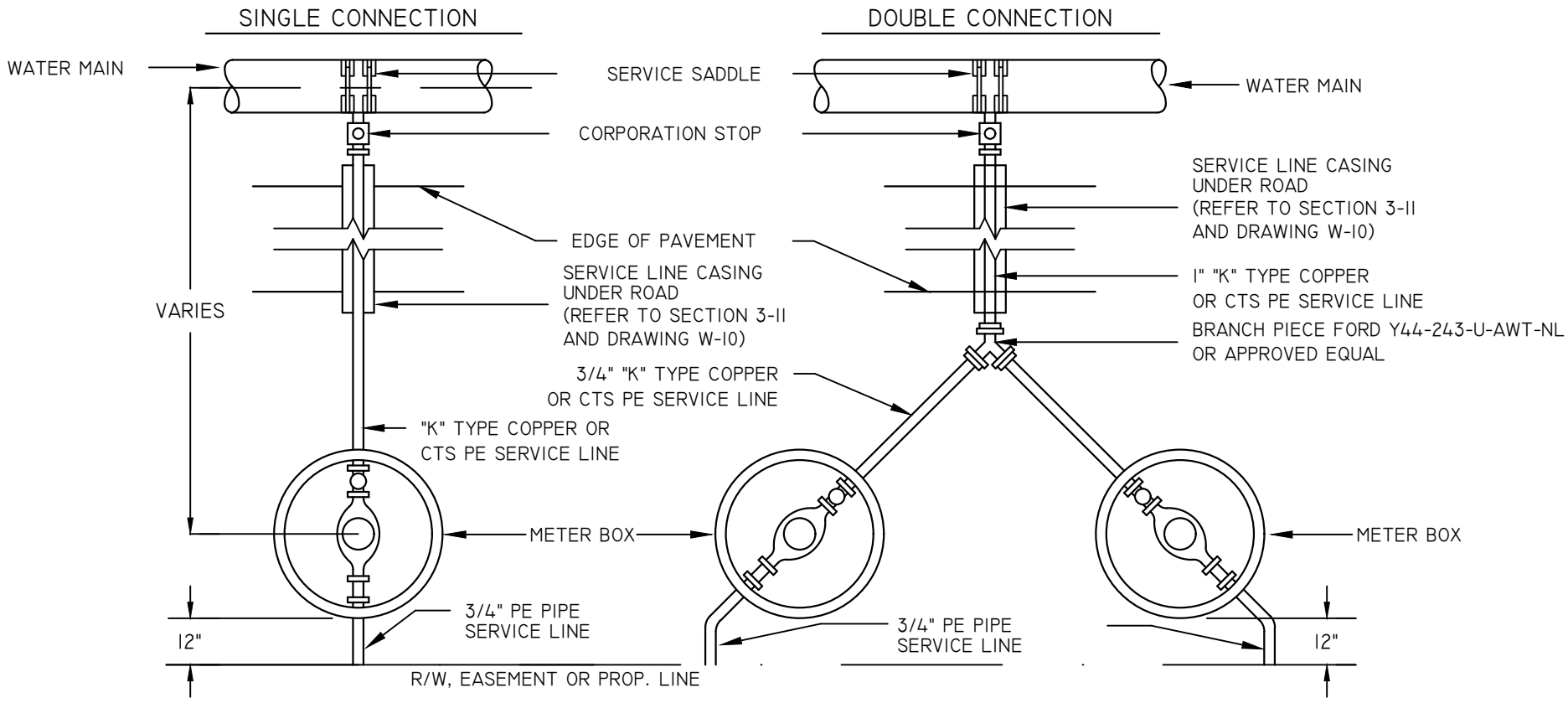
1. ALL METERS SHALL BE SENSUS iPERL WTH TOUCH READ PIT LID (TRPL) AND MINIMUM 6' SIGNAL CORD (5/8"X3/4" & 1" METERS), WITH SENSUS SMARTPOINT 520M SINGLE PORT RADIO TRANSCEIVER
2. ALL METERS SHALL BE CONFIGURED TO OUTPUT IN 1000 GALLON INCREMENTS
3. HCPSA RECOMMENDS THAT A PRESSURE REDUCING VALVE (PRV) BE INSTALLED ON PRIVATE SIDE OF WATER METER WHEN PRESSURE EXCEEDS 80 PSI
4. SEE SECTION 2-07 FOR PRESSURES 150 PSI OR GREATER
5. REFER TO SECTIONS 2-01, 2-04 & 2-07



Henry County Public Service Authority	3/4" & 1" Meter Settings for System Rehab. & Replacement	Date: October 2019	W-2



Henry County Public Service Authority	Meter Setting for 2" Meters	Date: October 2019	W-3



1. CORPORATION STOPS SHALL BE FORD F1000-3 OR F1000-4 RATED @ 100 PSI OR FB1000-3 OR FB1000-4 RATED @ 300 PSI OR APPROVED EQUAL CC INLETS FOR ALL SIZES

SIZE - (IN)	OUTLET
3/4	PACK JOINT
1	PACK JOINT
2	MIPT OR FIPT

2. SERVICE SADDLES SHALL BE USED WITH ALL PLASTIC AND DUCTILE IRON PIPE PLASTIC PIPE SADDLES SHALL BE FORD FC202, OR APPROVED EQUAL. D.I. PIPE SADDLES SHALL BE FORD F202 OR APPROVED EQUAL.

3. REFER TO SECTIONS 2-01, 2-04 & 2-07

Henry County Public Service Authority	Water Service Connections up to 2"	Date: October 2019	W-4

FIRE HYDRANTS SHALL BE POWDER COATED OSHA YELLOW FROM THE MANUFACTURER - UNLESS OTHERWISE APPROVED BY BY HCPSA ENGINEER. CONTRACTOR SHALL TOUCH-UP ANY SCRATCHES, SCUFFS, SCRAPES MADE DURING INSTALLATION. FIRE HYDRANT BONNETS PER MANUFACTURERS RECOMMENDATIONS. USING COLOR CODE SHOWN ON DETAIL.

NOZZLE CAP COLOR CODE:

BLUE - 1500GPM OR MORE
GREEN - 1000GPM-1499GPM
ORANGE - 500GPM-999GPM
RED - 250GPM-499GPM
BLACK - LESS THAN 250GPM

PSA MAINTAINED FIRE HYDRANTS SHALL HAVE A BASE COLOR OF YELLOW

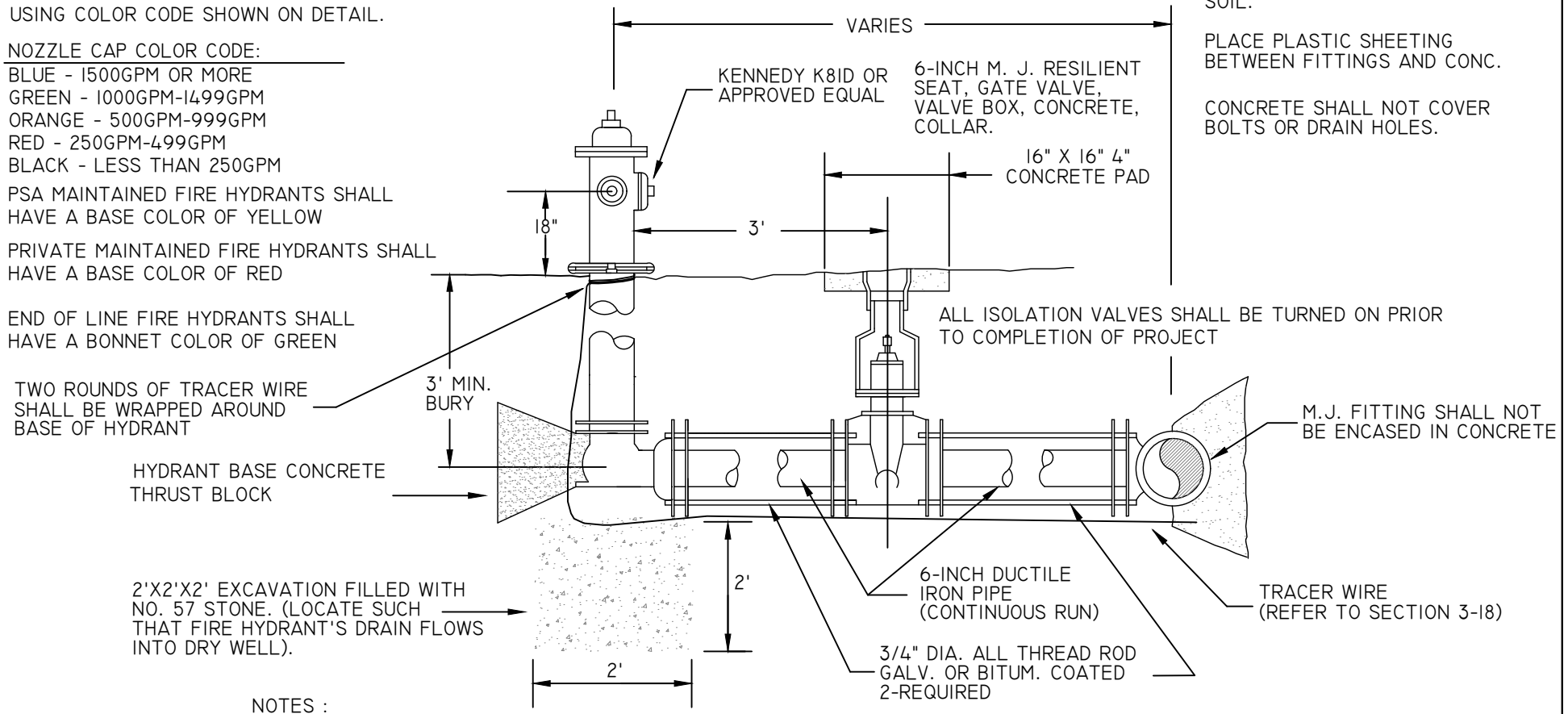
PRIVATE MAINTAINED FIRE HYDRANTS SHALL HAVE A BASE COLOR OF RED

END OF LINE FIRE HYDRANTS SHALL HAVE A BONNET COLOR OF GREEN

THRUST BLOCKS SHALL BE POURED AGAINST UNDISTURBED SOIL.

PLACE PLASTIC SHEETING BETWEEN FITTINGS AND CONC.

CONCRETE SHALL NOT COVER BOLTS OR DRAIN HOLES.



(NOT TO SCALE)

NOTES :

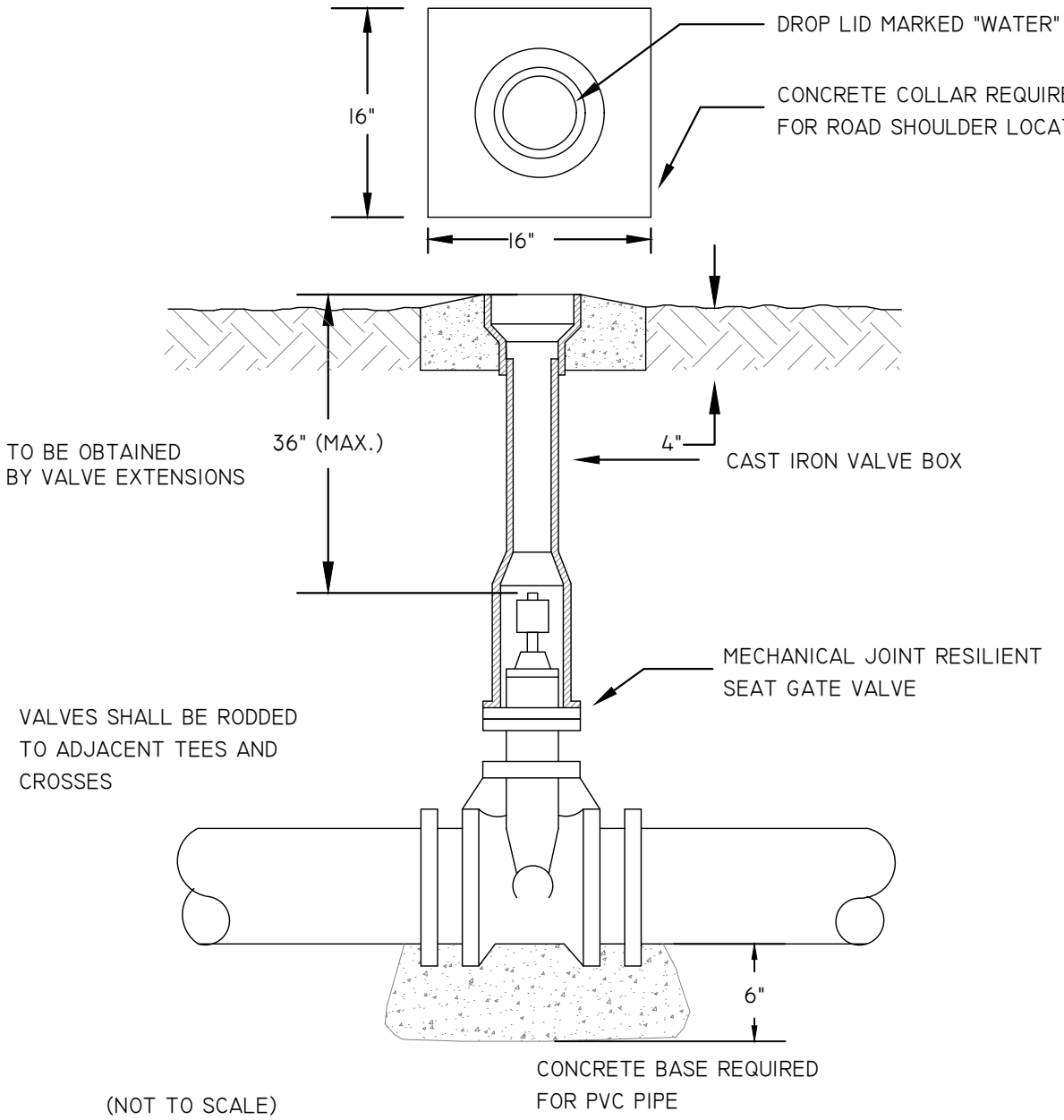
APPROVED M.J. GLAND RESTRAINT (I.E. MEGALUGS, GRIP RINGS, OR UNI-FLANGE) MAY BE SUBSTITUTED FOR CONCRETE THRUST BLOCKS, REFER TO DRAWING W-8).

CONCRETE THRUST BLOCKS REQUIRED WHEN WORKING PRESSURE IS GREATER THAN 200 PSI.

HYDRANT WEEPHOLES SHALL BE PLUGGED WHEN LOCATED WHERE SATURATED SOIL EXISTS AND AREA SUBJECT TO FLOODING.

REFER TO SECTIONS 2-01, 2-02, 2-05 & 2-06

Henry County Public Service Authority	Fire Hydrant Assembly	Date: October 2019	W-5



(NOT TO SCALE)

NOTE :

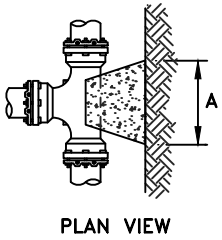
APPROVED M.J. RESTRAINTS (I.E. MEGALUGS, GRIP RINGS, OR UNI-FLANGE) MAY BE SUBSTITUTED FOR CONCRETE THRUST BLOCKS, REFER TO DRAWING W-8.

REFER TO SECTIONS 2-01 & 2-05

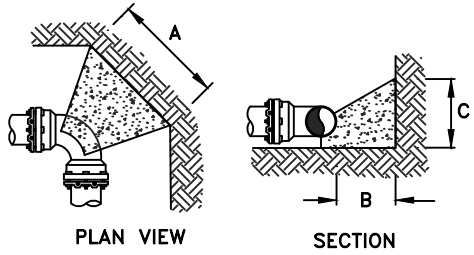
Henry County Public Service Authority	Valve Box Installation and Valve Setting	Date: October 2019	W-6

PIPELINE CONCRETE THRUST BLOCK DATA

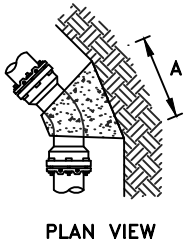
PIPE SIZE	TEES			90° BEND, HORIZONTAL			45° BEND, HORIZONTAL			22 1/2° BEND, HORIZONTAL			11 1/4° BEND, HORIZONTAL			45° BEND, UPPER VERTICAL			22 1/2° BEND, UPPER VERTICAL			11 1/4° BEND, UPPER VERTICAL			45° BEND, LOWER VERTICAL			22 1/2° BEND, LOWER VERTICAL			11 1/4° BEND, LOWER VERTICAL			DEAD-ENDS AND PLUGS		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
4"-6"	1.5'	1.33'	1.10'	2.33'	1.67'	1.2'	1.25'	1.2'	0.75'	0.75'	1.2'	0.75'	0.5'	1.2'	0.75'	1.25'	1.2'	0.6'	0.75'	1.2'	0.6'	0.5'	1.2'	0.6'	3.0'	3.0'	2.5'	1.85'	2.5'	2.0'	1.25'	2.0'	1.5'	1.5'	0.5'	1.2'
8"	2.0'	1.67'	1.10'	3.20'	1.75'	1.5'	2.0'	1.33'	0.75'	1.0'	1.33'	0.75'	0.67'	1.33'	0.75'	2.1'	1.5'	0.85'	1.0'	1.33'	0.67'	0.67'	1.33'	0.6'	3.25'	4.5'	3.25'	2.25'	3.25'	3.33'	1.75'	2.5'	2.0'	2.25'	0.67'	1.5'
10"	2.5'	2.0'	1.20'	3.34'	1.75'	2.1'	2.5'	1.5'	1.0'	1.5'	1.5'	0.85'	0.85'	1.5'	0.75'	2.1'	1.67	0.85'	1.5'	1.67	0.67'	0.85'	1.5'	0.67'	3.67'	4.75'	4.0'	2.5'	3.85'	3.67'	1.75'	2.75'	2.5'	2.5'	0.67'	2.0'
12"	2.85'	2.5'	1.33'	4.0'	2.0'	2.5'	3.0'	1.85'	1.2'	1.75'	1.85'	1.0'	1.0'	1.67'	0.75'	2.5'	1.85'	1.0'	1.75'	1.67	0.67'	1.0'	1.67'	0.67'	3.67'	5.0'	4.5'	2.5'	4.0'	4.0'	2.0'	3.0'	3.0'	3.25'	0.85'	2.33'
16"	3.66'	3.34'	1.17'	4.16'	2.17'	3.00'	3.67'	2.5'	1.42'	2.33'	2.0'	1.17'	1.33'	2.0'	0.75'	3.33'	2.5'	1.25'	2.25'	1.67'	0.75'	1.33'	2.0'	0.75'	3.67'	5.0'	4.5'	2.5'	4.0'	4.0'	2.0'	3.0'	3.0'	4.17'	1.0'	2.92'



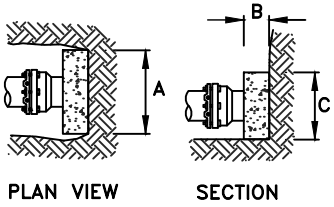
TEES



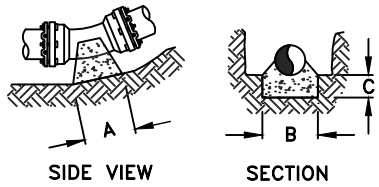
HORIZONTAL 90° BENDS



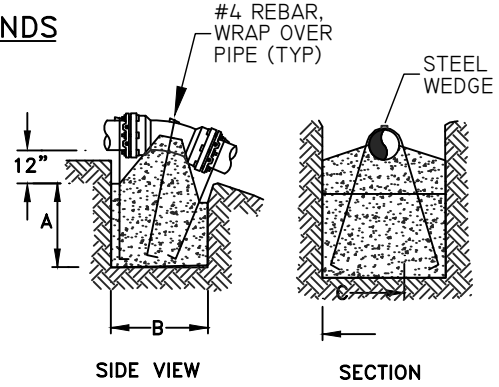
HORIZONTAL BENDS



DEAD ENDS



UPPER VERTICAL BENDS



LOWER VERTICAL BENDS

CONCRETE THRUST BLOCK INFO & CONSTRUCTION NOTES:

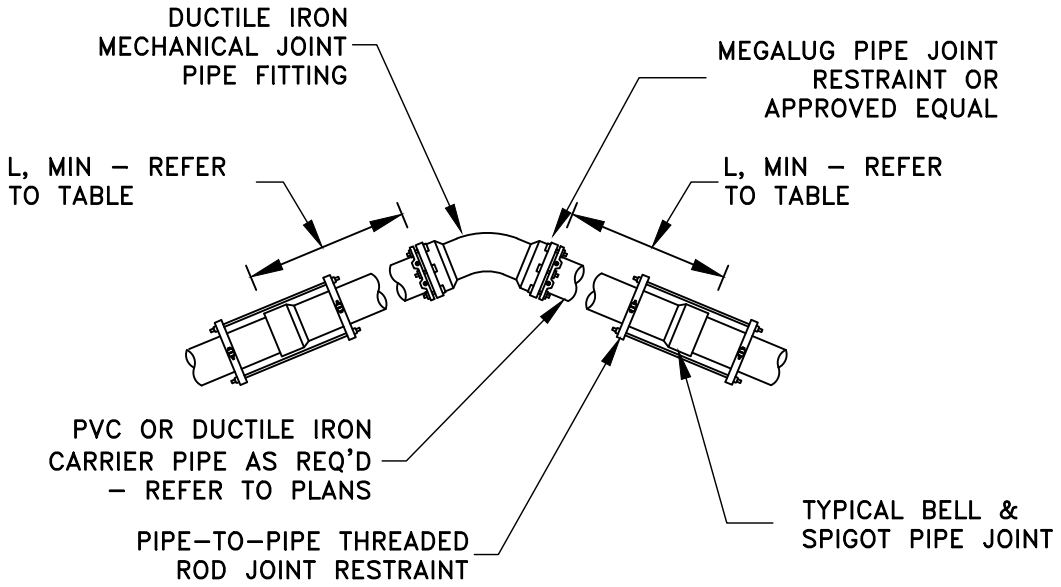
1. ALL CONCRETE USED FOR THRUST BLOCKS SHALL BE 3000PSI STRENGTH, POURED AGAINST STABLE, COMPACTED GROUND.
2. PIPES SHALL NOT BE PRESSURIZED UNTIL AT LEAST 7 DAYS AFTER THE THRUST BLOCKS HAVE BEEN POURED.
3. THRUST BLOCKS AT REDUCING FITTINGS SHALL BE SIZED BASED UPON THE LARGER PIPE SIZE.
4. ALL FITTINGS SHALL BE SECURED TO PIPE USING MEGALUG JOINT RESTRAINTS OR APPROVED EQUAL.
5. IN LOCATIONS WITH WET OR OTHERWISE UNSTABLE GROUND, THE CONTRACTOR SHALL USE MEGALUG JOINT RESTRAINTS OR MECHANICAL JOINT FITTINGS WITH TIE RODS INSTEAD OF CONCRETE THRUST BLOCKS.
6. WRAP FITTINGS WITH PLASTIC SHEETING CONCRETE SHALL NOT INTERFERE WITH FITTING JOINTS.
7. THE CONTRACTOR MAY ELECT TO USE MECHANICAL JOINT RESTRAINTS IN LIEU OF CONCRETE THRUST BLOCKS. MECHANICAL JOINT RESTRAINTS SHALL BE SERIES 1100 MEGALUG RESTRAINTS OR APPROVED EQUAL FOR DUCTILE IRON PIPE OR SERIES 2000 PV MEGALUG RESTRAINTS OR APPROVED EQUAL FOR PVC PIPE. MECHANICAL JOINT RESTRAINTS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER RECOMMENDATIONS & THE APPROPRIATE STANDARD DETAIL. SEE DRAWING W-8.
8. REFER TO SECTION 7 FOR CONCRETE SPECIFICATIONS

PIPELINE MECHANICAL JOINT RESTRAINT DATA																			
150PSI WORKING PRESSURE										200PSI WORKING PRESSURE									
TYPE OF PIPE	PIPE SIZE	TEE	90° BEND	45° BEND, HORZ	22-1/2° BEND, HORZ	11-1/4° BEND, HORZ	45° BEND, VERT	22-1/2° BEND, VERT	11-1/4° BEND, VERT	TEE	90° BEND	45° BEND, HORZ	22-1/2° BEND, HORZ	11-1/4° BEND, HORZ	45° BEND, VERT	22-1/2° BEND, VERT	11-1/4° BEND, VERT	PIPE SIZE	TYPE OF PIPE
PVC PIPE	4"	32	51	21	11	5	38	19	10	50	61	26	13	6	46	22	11	4"	PVC PIPE
	6"	67	71	30	15	7	54	26	13	92	85	36	17	9	64	31	16	6"	
	8"	105	93	39	19	10	70	34	17	137	111	46	23	11	84	41	20	8"	
	10"	136	110	46	22	11	84	41	20	175	132	55	27	13	101	49	24	10"	
	12"	170	129	54	26	13	99	48	24	215	155	64	31	16	119	57	29	12"	
	14"	200	146	61	30	15	113	54	27	252	176	73	35	18	135	65	33	14"	
	16"	232	164	68	33	17	127	61	31	290	197	82	40	20	152	73	37	16"	
DUCTILE IRON	4"	22	39	16	8	4	25	12	6	33	47	20	10	5	29	14	7	4"	DUCTILE IRON
	6"	45	54	23	11	6	34	17	9	61	65	27	13	7	41	20	10	6"	
	8"	70	71	30	14	7	45	22	11	91	85	35	17	9	54	26	13	8"	
	10"	90	84	35	17	9	54	26	13	116	101	42	20	10	64	31	16	10"	
	12"	112	98	41	20	10	63	30	15	143	118	49	24	12	75	36	18	12"	
	14"	133	111	46	23	11	71	35	17	167	134	56	27	14	86	41	21	14"	
	16"	154	125	52	25	13	80	39	19	192	150	62	30	15	96	46	23	16"	
MINIMUM DISTANCE, ("L", FEET) JOINTS REQUIRED TO BE RESTRAINED BEYOND FITTING																			

MECHANICALLY RESTRAINED JOINT DETAIL:

1. CONTRACTOR MAY ELECT TO USE MECHANICALLY RESTRAINED JOINTS WITHOUT CONCRETE THRUST BLOCKS IN LOCATIONS WHERE WORKING PRESSURE IS LESS THAN 200 PSI.
2. PIPE SHALL BE RESTRAINED TO FITTING USING MEGALUG OR APPROVED EQUAL JOINT RESTRAINTS.
3. ALL PIPE JOINTS FOR A DISTANCE, "L" FEET BEYOND FITTING IN ALL DIRECTIONS SHALL BE RESTRAINED TO NEXT JOINT AFTER DISTANCE "L". REFER TO TABLE FOR APPROPRIATE FITTING TYPE AND LENGTH.
4. CONCRETE THRUST BLOCKS REQUIRED FOR ALL LOCATIONS WITH WORKING PRESSURES OF 200PSI AND HIGHER.
5. MECHANICAL JOINT RESTRAINT CHART CHART APPLIES TO ALL FIRE HYDRANT TEES.
6. REFER TO SECTIONS 2-01 & 3-09

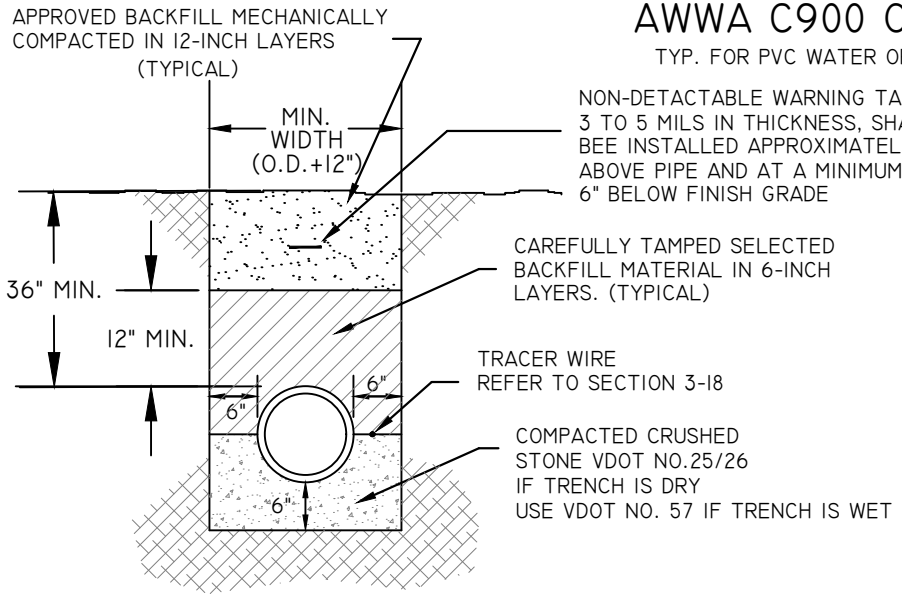
DETAIL



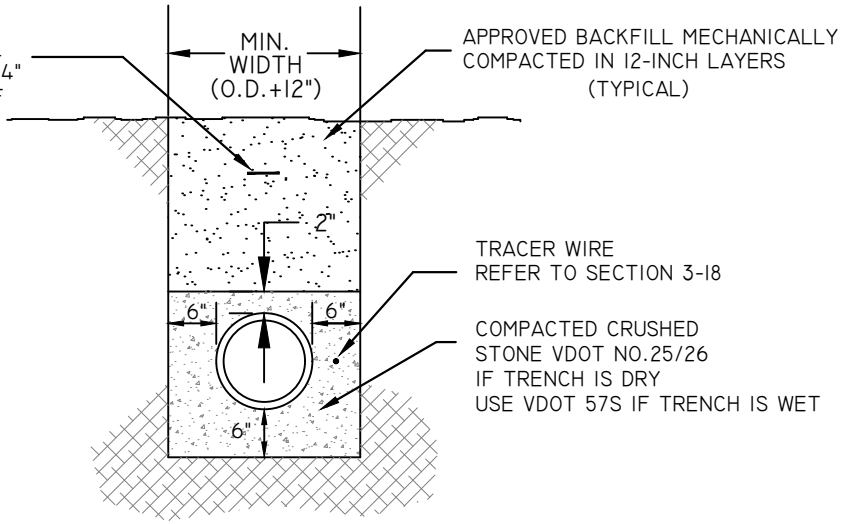
Henry County Public Service Authority	Mechanical Joint Restraint	Date: October 2019	W-8

AWWA C900 OR SDR35

TYP. FOR PVC WATER OR SEWER LINES



0'-6' DEPTHS

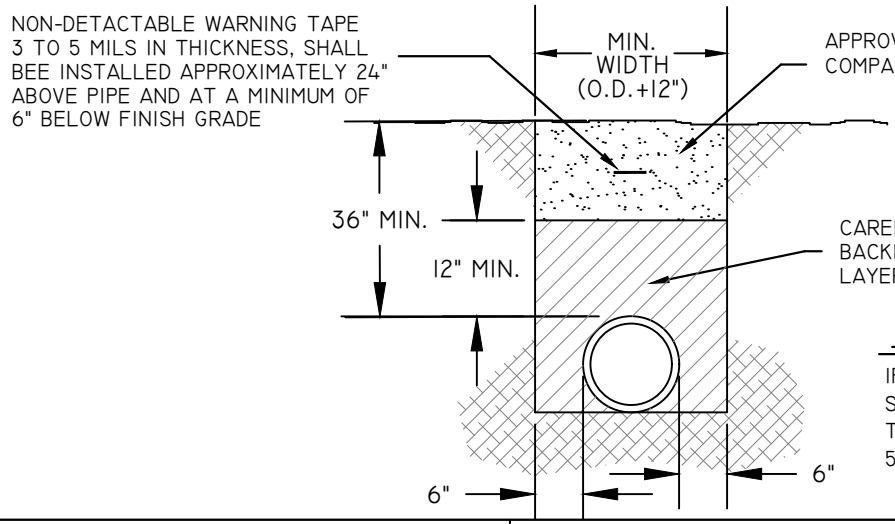


6'-14' DEPTHS

DEPTHS OVER 14' REQUIRE DUCTILE IRON

AWWA C600

TYP. FOR D.I. WATER OR SEWER LINES



NOTE :

IF SUBGRADE IS ROCK, DITCH SHALL BE OVERCUT 6" AND THEN BACKFILLED WITH VDOT 57S.

NOTES :

TRENCH SHALL BE SHAPED TO ACCOMMODATE PIPE BELLS

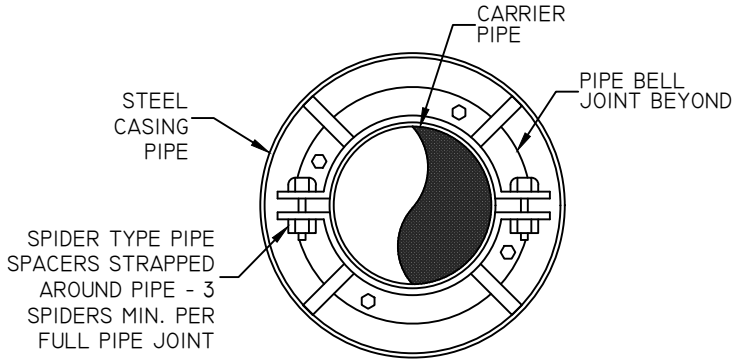
A 4" OR 6" TRENCHER MAY BE USED FOR 2" PIPE AND SERVICE LINES.

REFER TO SECTION 3-07

Henry County Public Service Authority	Pipe Bedding	Date: October 2019	W-9

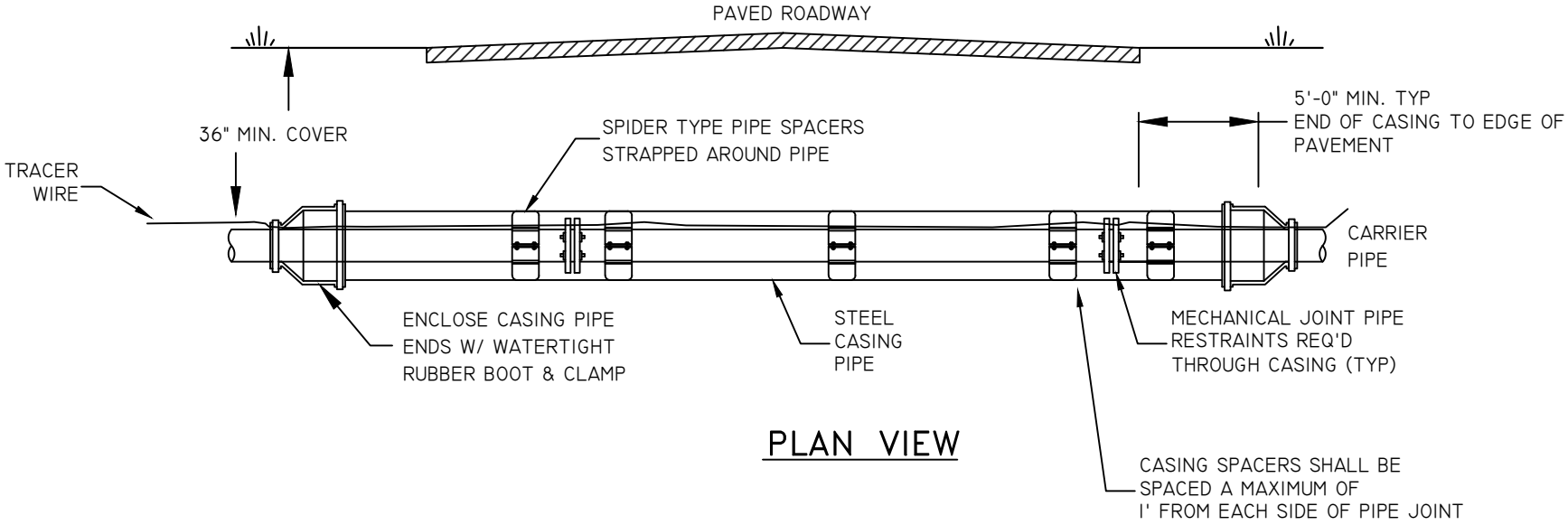
NOTES:

1. PIPE SKIDS SHALL BE FABRICATED FROM MANUFACTURED SPIDER-TYPE" SPACERS.
2. PIPE SKIDS SHALL BE FIRMLY ATTACHED TO THE CARRIER PIPE TO PREVENT PIPE DEFLECTION AND PREVENT CARRIER PIPE FROM COMING IN CONTACT WITH CASING PIPE.
3. MULTIPLE JOINTS OF STEEL ENCASEMENT PIPE SHALL BE JOINED BY WELDING - PIPE ALIGNMENT SHALL BE STRAIGHT AND TRUE.
4. ENCASEMENT PIPE SHALL BE USED FOR ALL VDOT UTILITY ROAD CROSSINGS, WITH 36" MIN. COVER. THE MIN. THICKNESS FOR ENCASEMENT PIPE SHALL BE IN ACCORDANCE WITH EP-1 OF THE 2008 VDOT ROAD AND BRIDGE STANDARDS.
5. 3/4" AND 1" SERVICE LINE ROAD CROSSINGS SHALL BE ENCASED USING 2" GALVANIZED STEEL, BLACK STEEL, METALLIC ELECTRICAL CONDUIT, SCH 40 PVC, OR DR9 HDPE.
6. REFER TO SECTIONS 1-13, 2-01 & 3-11.



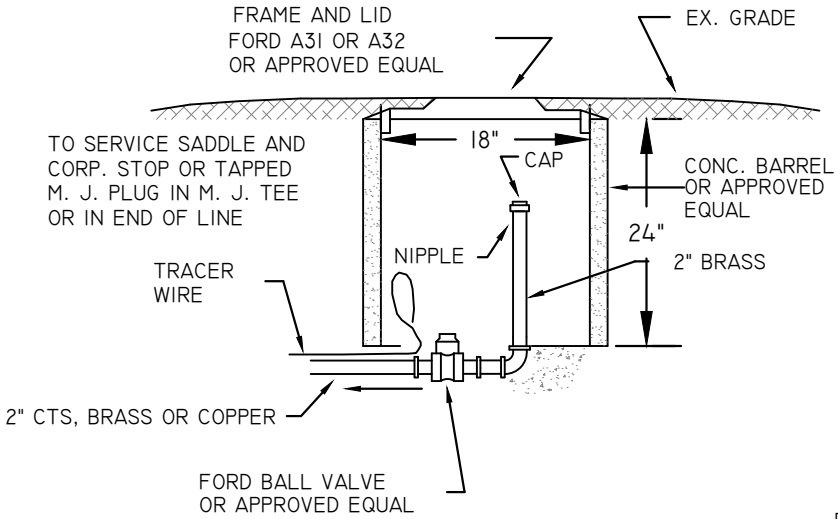
END VIEW

ENCASEMENT TABLE	
CARRIER PIPE DIAM.	MINIMUM CASING PIPE DIAM.
3/4",1"	2"
2"	6"
3"	10"
4"	12"
6"	14"
8"	16"
10"	18"
12"	24"
16"	30"

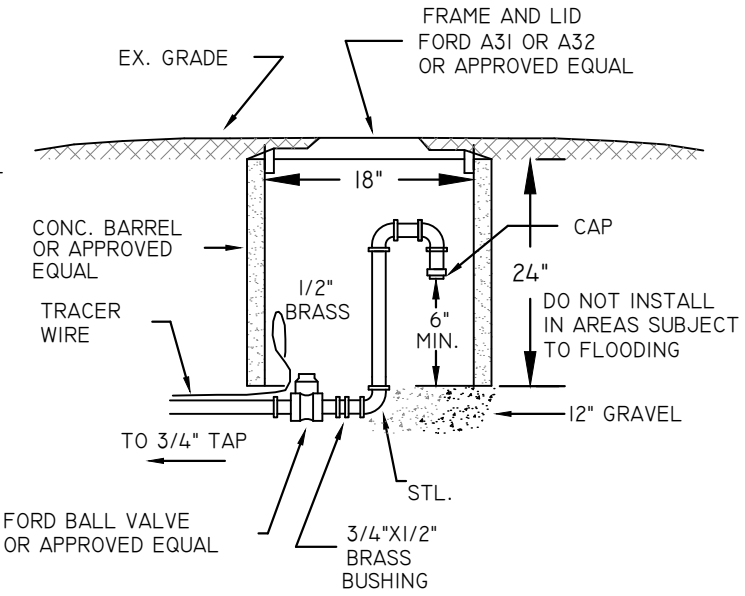


PLAN VIEW

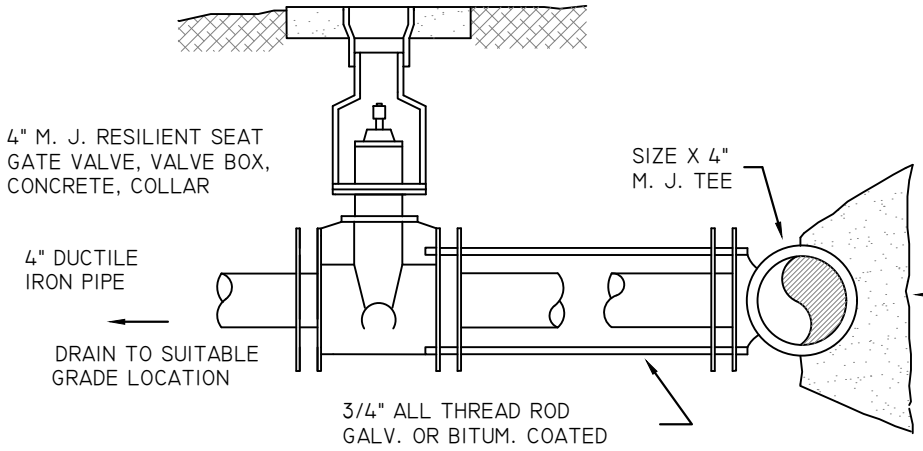
Henry County Public Service Authority	Steel Encasement Detail	Date: October 2019	W-10



BLOW-OFF ASSEMBLY FOR WATER LINES UP TO 8" NOMINAL SIZE



SAMPLE TAP



BLOW-OFF ASSEMBLY FOR WATER LINES 10" AND LARGER

THRUST BLOCKS SHALL BE POURED AGAINST UNDISTURBED SOIL.

PLACE PLASTIC SHEETING BETWEEN FITTINGS AND CONCRETE

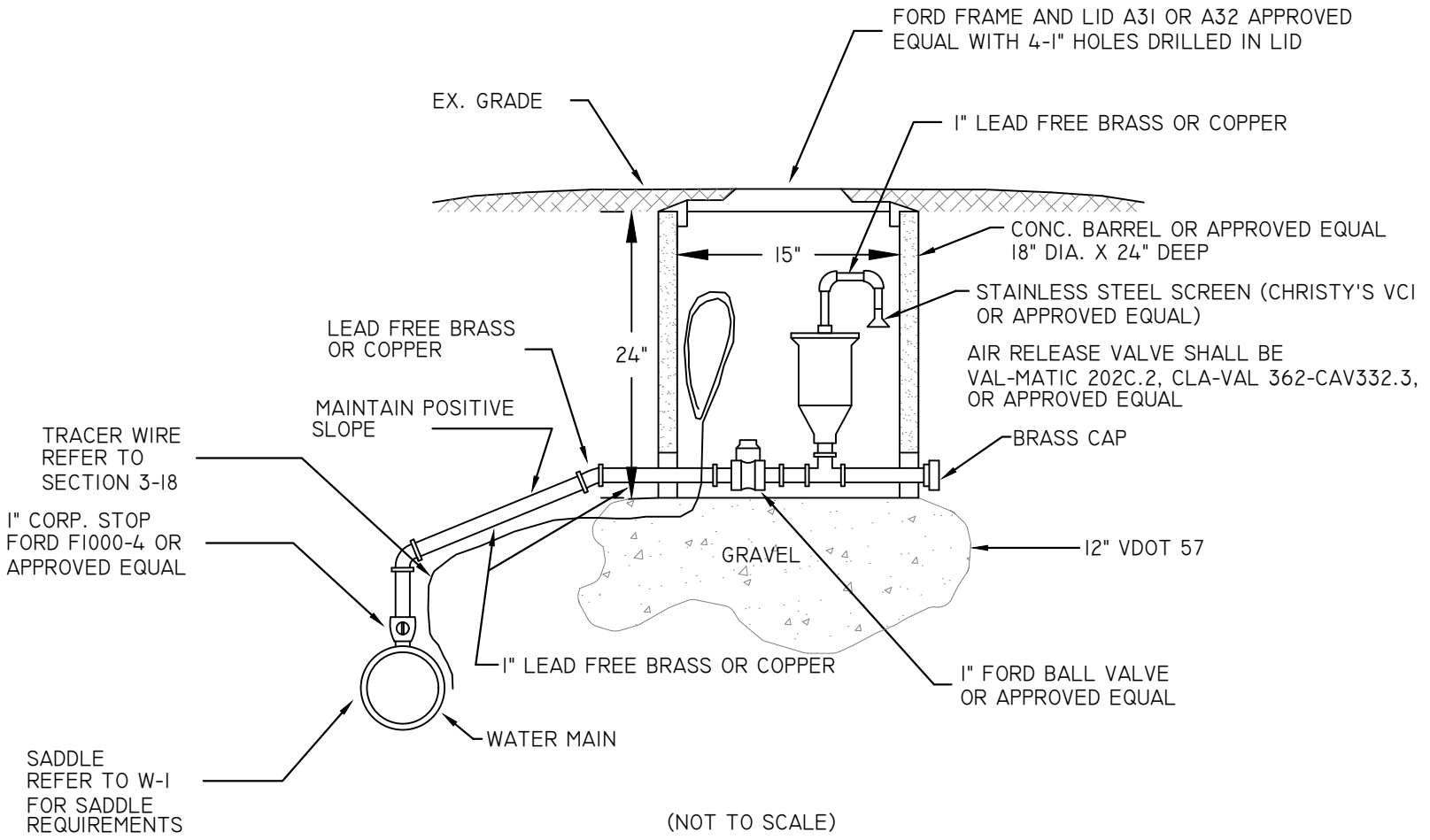
NOTE :

APPROVED M.J. RESTRAINTS (I.E. MEGALUGS, GRIP RINGS OR UNI-FLANGE) MAY BE SUBSTITUTED FOR CONCRETE THRUST BLOCKS, REFER TO DRAWING W-8.

CONCRETE THRUST BLOCKS REQUIRED WHEN WORKING PRESSURE IS GREATER THAN 200 PSI.

REFER TO SECTIONS 2-01, 2-02, 2-03 & 2-05.

Henry County Public Service Authority	Blow-Off & Sample Tap Assemblies	Date: October 2019	W-11

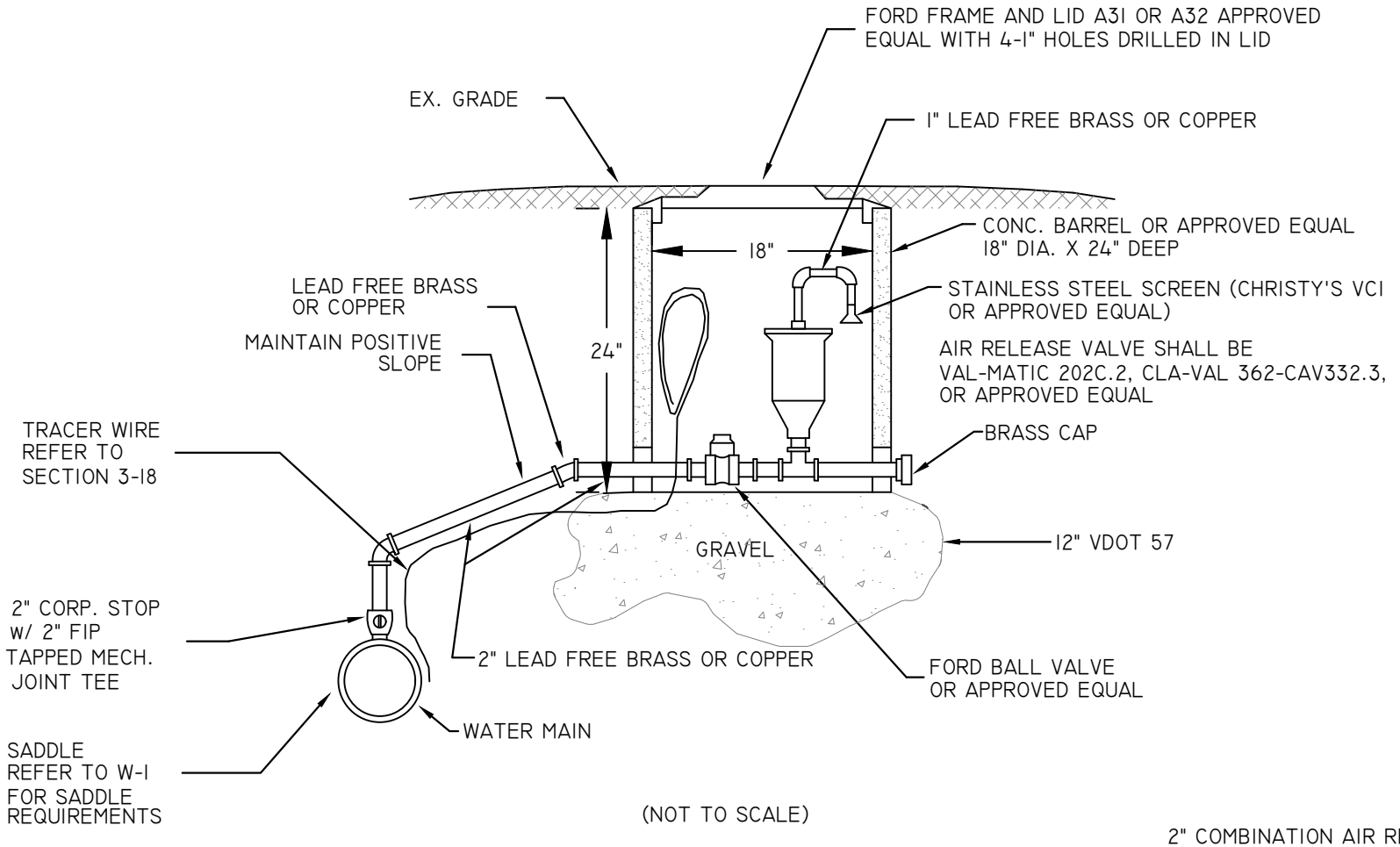


(NOT TO SCALE)

1" COMBINATION AIR RELEASE ASSEMBLY SHALL BE USED ON WATER LINES UP TO 4" IN DIAMETER.

REFER TO SECTIONS 2-01, 2-05 & 2-07

Henry County Public Service Authority	1" Combination Air Release Assembly	Date: October 2019	W-12

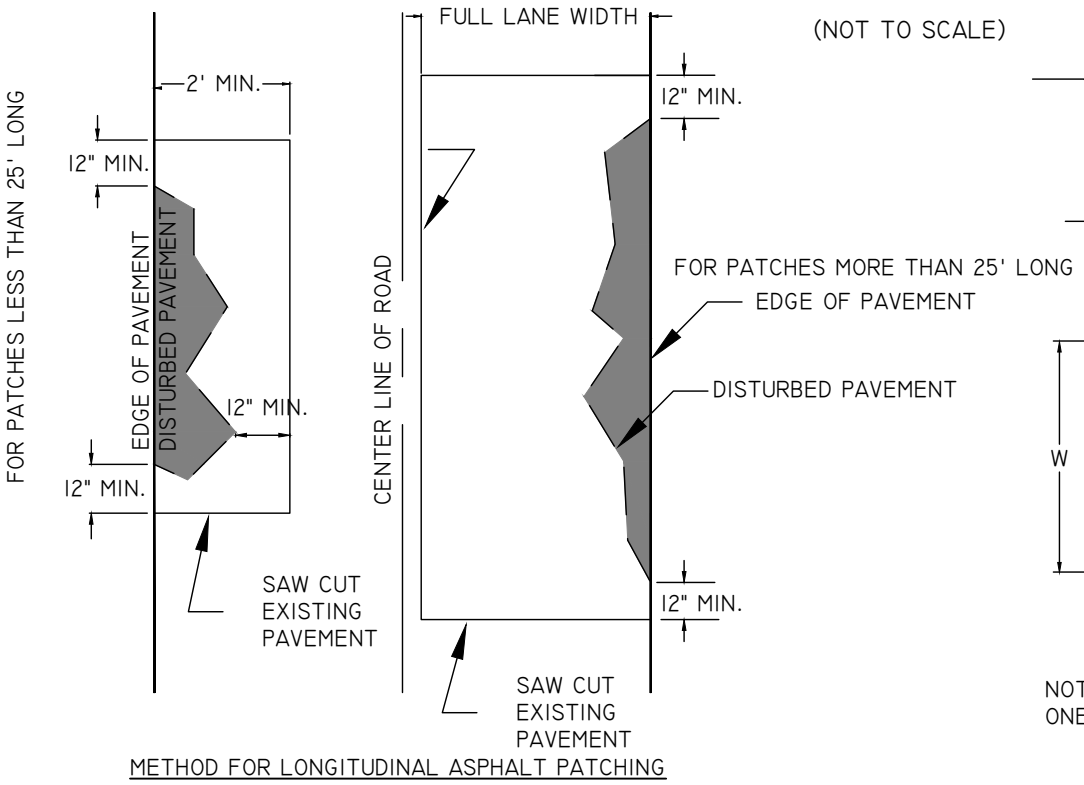


(NOT TO SCALE)

2" COMBINATION AIR RELEASE ASSEMBLY SHALL BE USED ON WATER LINES UP TO 6" IN DIAMETER. FOR WATER LINES GREATER THAN 6", ENGINEER SHALL APPROVE SIX OF COMBINATION AIR RELEASE.

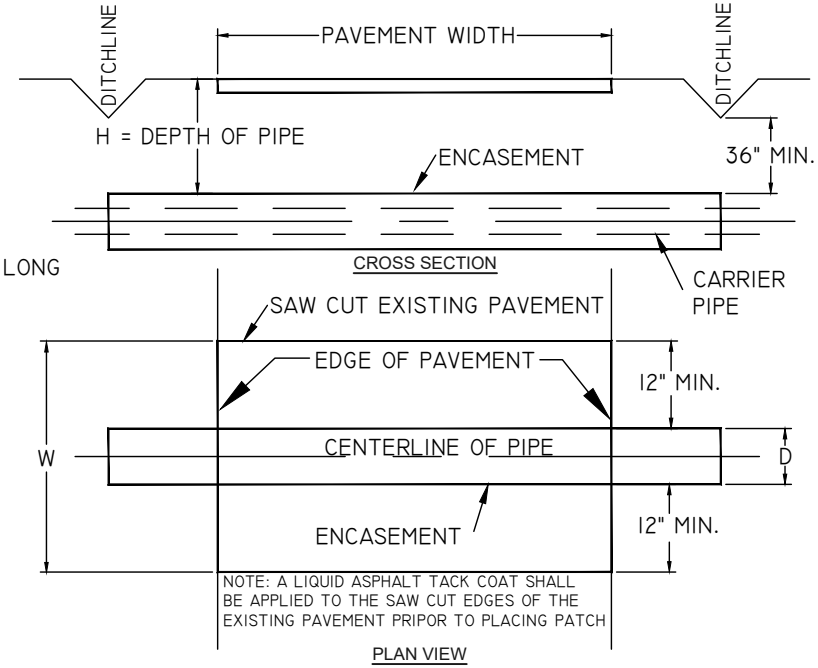
REFER TO SECTIONS 2-01, 2-05 & 2-07

Henry County Public Service Authority	2" Combination Air Release Assembly	Date: October 2019	W-13

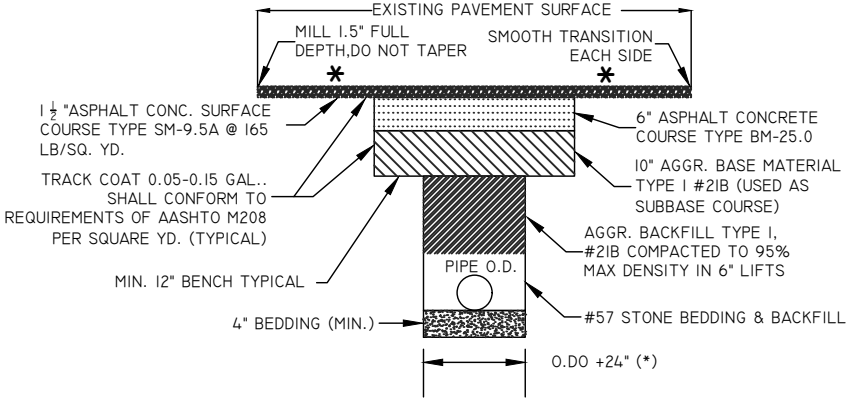


(NOT TO SCALE)

METHOD FOR LONGITUDINAL ASPHALT PATCHING



NOTE: W = WIDTH OF OPEN CUT AND D = THE DIAMETER OF THE ENCASEMENT PLUS ONE FOOT MINIMUM ON EACH SIDE OF THE ENCASEMENT FOR BACKFILL MATERIAL



* FOR PIPE LESS THAN 12" THE TRENCH WIDTH MAY BE 36" MAXIMUM. SEE UB-1 (ROAD AND BRIDGE STANDARDS VOLUME II)
NOTES: ALL PAVEMENT MARKINGS DAMAGED OR DESTROYED BY TRENCH EXCAVATION ACTIVITY SHALL BE REPLACED BY THE PERMITEE PER VDOT SPECIFICATIONS.
THIS DETAIL IS FOR HIGHWAYS WITH EXISTING ASPHALT CONC. PAVEMENT SECTIONS.
THE EXTENT OF PAVEMENT RESTORATION FOR ALL OTHER PAVEMENT CUTS SHALL BE DETERMINED BY THE DISTRICT ADMINISTRATOR'S DESIGNEE.

* WIDTH OF TRAVEL LANE MIN. FULL PAVEMENT WIDTH FOR OPEN CUT TRENCHING ALONG ROAD CENTERLINE OF OR 25' (MIN.) FOR PERPENDICULAR CROSSINGS.

METHOD FOR PATCHING OPEN-CUT ROAD CROSSINGS

NOTES:

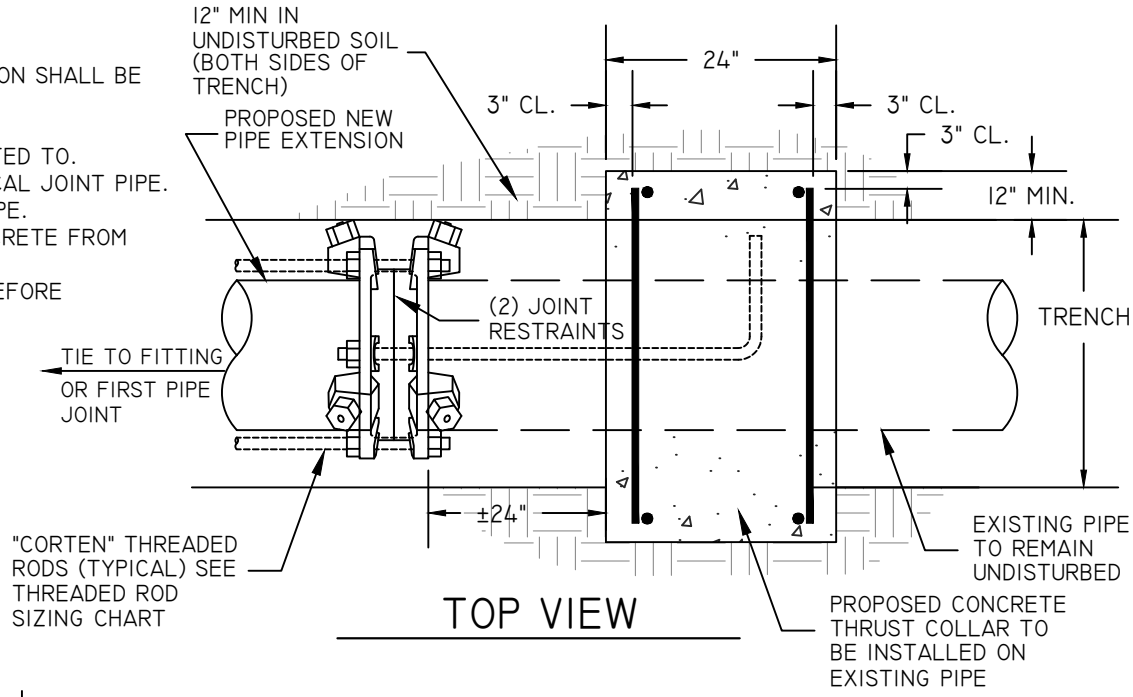
1. ROCK DUST OR OTHER ACCEPTABLE MEANS SHALL BE USED TO PROTECT PAVEMENT AGAINST DAMAGE BY TRACKED VEHICLES. NO ALLOWANCES FOR DAMAGE TO PAVEMENT HAS BEEN PROVIDED IN THE BID PROCESS. ALL DAMAGES TO PAVEMENT SHALL BE CORRECTED BY THE CONTRACTOR WHOM SHALL BEAR ALL COSTS. BID PRICES SHALL INCLUDE COSTS OF ALL RESTORATION.
2. A LIQUID ASPHALT TACK COAT SHALL BE APPLIED TO SAW CUT EDGES OF EXISTING PAVEMENT PRIOR TO PLACING PATCH.
3. DISTURBED AREAS OVER 25 FEET IN LENGTH SHALL REQUIRE A FULL LANE OVERLAY FOR THE FULL LENGTH OF THE DISTURBED AREA PLUS 12 INCHES MINIMUM ON EACH END OF THE DISTURBED AREA.
4. THICKNESS OF ASPHALT PATCH SHALL BE 1.5 TIMES THE THICKNESS OF THE EXISTING ASPHALT, BUT IN NO CASE SHALL IT BE LESS THAN 3". ASPHALT SHALL BE TYPE SM-9.5A OR EQUIVALENT.
5. DENSITY REQUIREMENTS FOR BACKFILL MATERIAL AND ASPHALT SHALL CONFORM WITH THE CURRENT VIRGINIA ROAD & BRIDGE SPECIFICATIONS.
6. PERMANENT PATCHING SHALL BE PLACED WITHIN ONE WEEK OF THE COMPLETION OF THE INSTALLATION PER SECTION OF DISTURBED PAVEMENT
7. REFER TO SECTIONS 3-02 & 3-13

Henry County Public Service Authority	Pavement Restoration	Date: October 2019	W-14

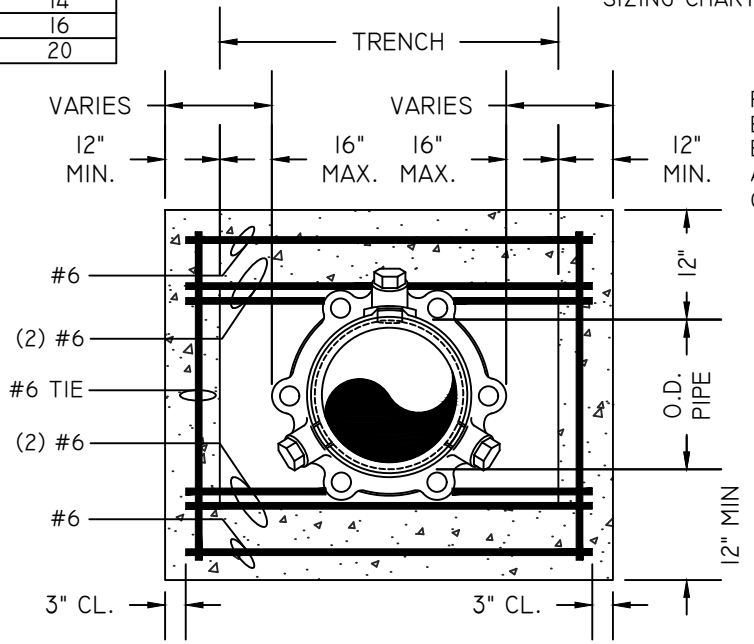
1. CONCRETE SHALL BE 3000 P.S.I. READY MIX CONCRETE.
2. REINFORCING BARS SHALL BE DEFORMED, AND TIED TOGETHER.
3. TRENCH BOTTOM WIDTH IN VICINITY OF THRUST COLLAR INSTALLATION SHALL BE THE MINIMUM WIDTH.
4. BACKFILL AND COMPACT IN 6" LAYERS.
5. PLACE THRUST COLLAR NEAR END OF EXISTING PIPE BEING CONNECTED TO.
6. FIRST JOINT OF NEW PIPE BEYOND THRUST COLLAR TO BE MECHANICAL JOINT PIPE.
7. PLACE RESTRAINED JOINT THRUST RING 4' FROM FITTING END OF PIPE.
8. FORMS SHALL BE USED WHEN PLACING CONCRETE TO PREVENT CONCRETE FROM INFILTRATING JOINTS.
9. ALLOW MINIMUM OF 3 DAYS FOR CONCRETE TO OBTAIN STRENGTH BEFORE WATERLINE BECOMES ACTIVE.
10. REFER TO SECTIONS 2-02, 3-09 & 7.

THREADED ROD SIZING CHART

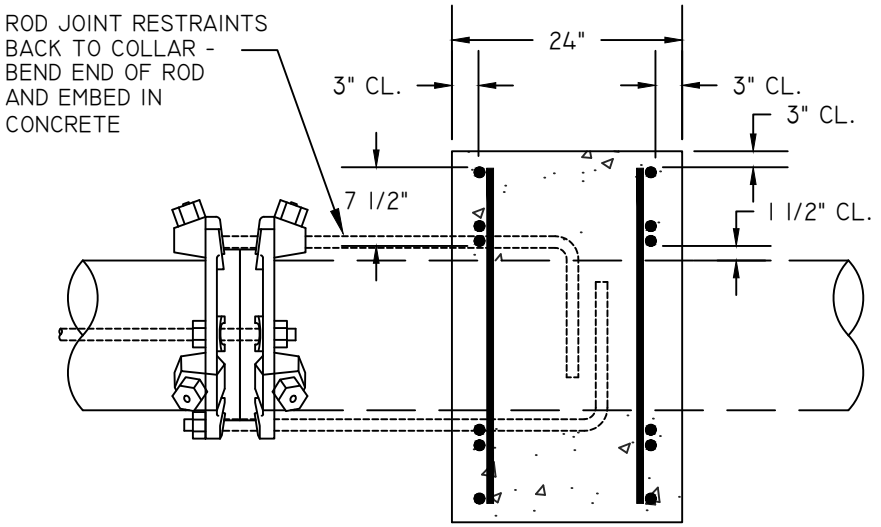
PIPE SIZE (INCHES)	ROD DIAMETER (INCHES)	NUMBER OF RODS REQUIRED
6	3/4	4
8	3/4	4
10	3/4	4
12	3/4	6
16	3/4	12
20	3/4	14
24	1	16
30	1	20



TOP VIEW

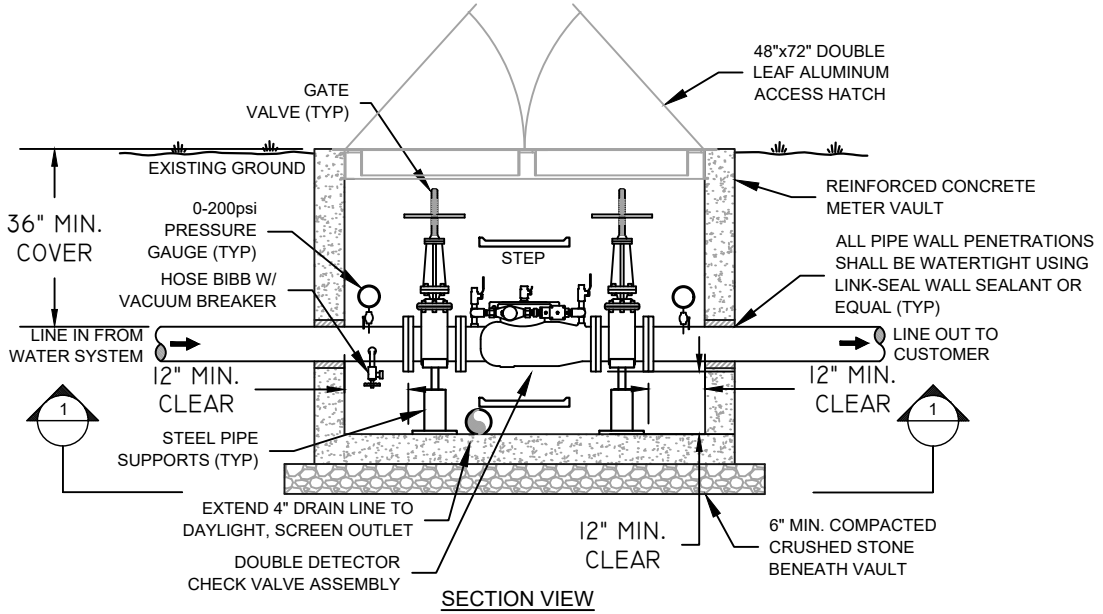


ELEVATION VIEW

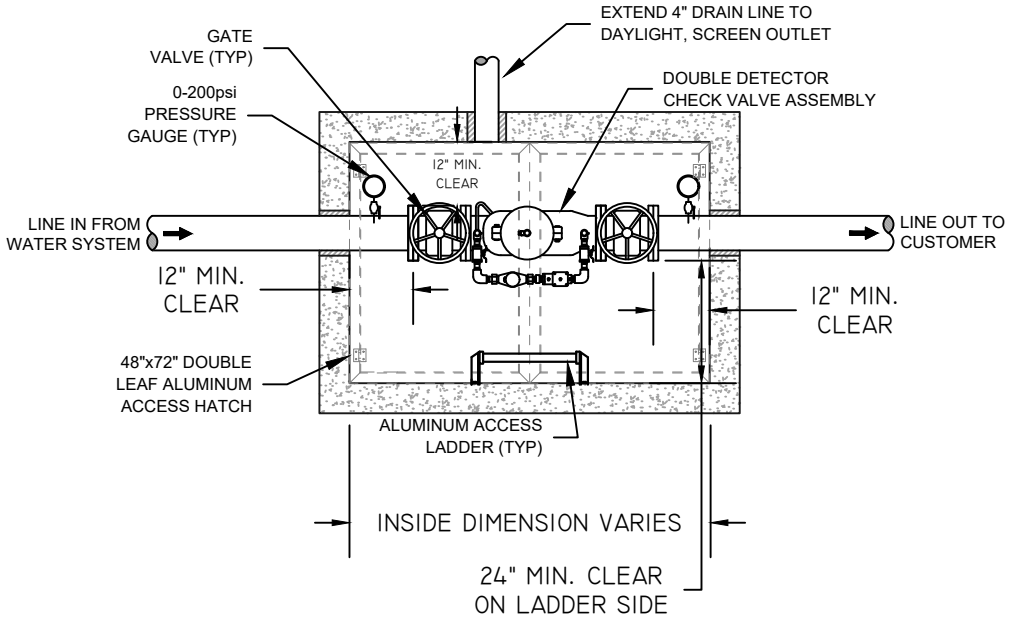


SIDE VIEW

Henry County Public Service Authority	Thrust Collar Detail	Date: October 2019	W-15



SECTION VIEW



PLAN VIEW

DOUBLE DETECTOR CHECK VALVE GENERAL CONSTRUCTION NOTES:

1. VAULT SHALL BE INSTALLED IN THE ROAD SHOULDER OR ON CUSTOMER PROPERTY, IN A LOCATION OUT OF DRAINAGEWAYS AND NOT DIRECTLY SUBJECT TO TRAFFIC.

2. VAULT SHALL BE CONSTRUCTED OF REINFORCED CONCRETE WITH DIMENSIONS SUFFICIENTLY LARGE TO ACCOMMODATE ALL PROPOSED VALVES AND PIPING. VAULT SHALL BE CONSTRUCTED USING 4000psi MINIMUM CONCRETE, REINFORCED FOR H-20 LOADING, 6" MINIMUM THICK WALLS AND TOP. VAULT SHALL BE FURNISHED WITH AN INTERIOR ACCESS LADDER. VAULT SHALL BE INSTALLED WITH A 4" DRAIN LINE TO DAYLIGHT.

3. ALL WATER PIPING INSIDE THE VAULT SHALL BE DUCTILE IRON, CLASS 350, WITH FLANGED FITTINGS. PROVIDE PIPE SUPPORTS AND REACTION BLOCKING AS NECESSARY.

4. VAULT ACCESS HATCH SHALL BE HALLIDAY SERIES H2W OR EQUAL HEAVY DUTY ALUMINUM CHANNEL FRAME WITH DOUBLE LEAF DOORS, SPRING ASSIST, AND FURNISHED WITH A LOCKING ASSEMBLY.

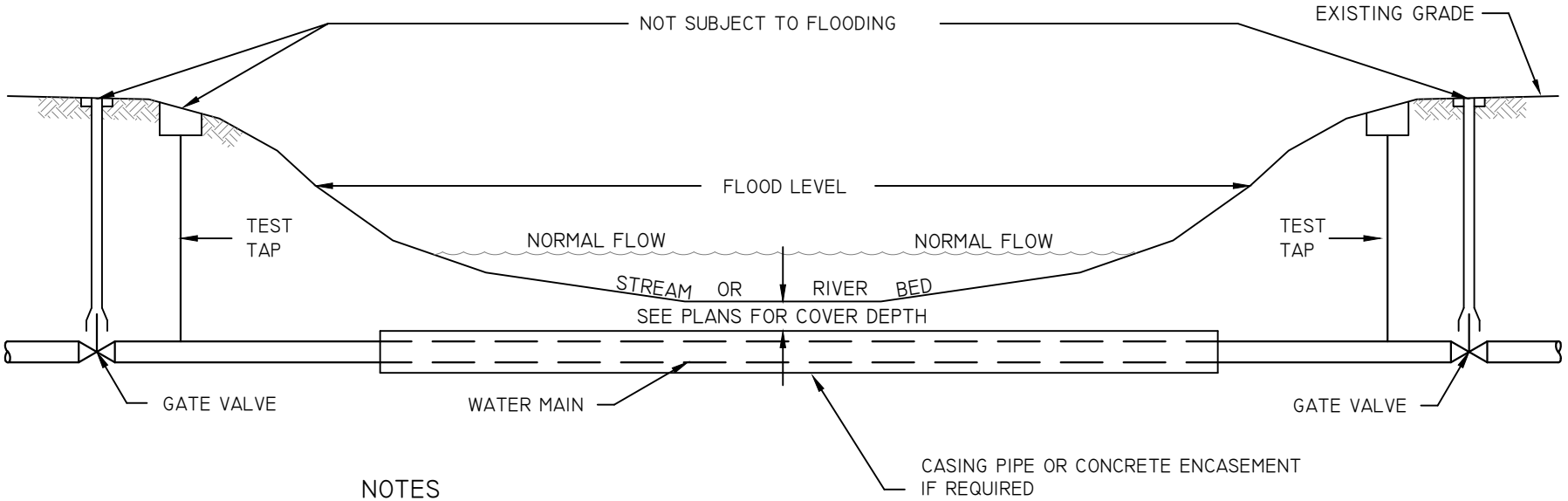
5. PRESSURE GAUGES SHALL BE GLYCERIN FILLED AND FURNISHED WITH A BALL ISOLATION VALVE.

6. DOUBLE DETECTOR CHECK VALVE ASSEMBLY SHALL BE FURNISHED COMPLETE WITH TEST PORTS. VALVE SHALL BE WILKINS MODEL 350ADA DOUBLE DETECTOR CHECK VALVE ASSEMBLY OR APPROVED EQUAL.

7. LOW FLOW BY-PASS METER SHALL BE SENSUS iPerl WITH TOUCH READ PIT LID (TRPL) WITH 6' SIGNAL CORD (5/8" X 3/4" & 1" METERS) AND SENSUS SMARTPOINT 520M RADIO TRANSCEIVER. RADIO TRANSCEIVER BRACKET SHALL BE MOUNTED IN CONCRETE VAULT TOP.

8. REFER TO SECTIONS 1-03, 1-06, 1-10, 2-01, 2-02, 2-03, 2-07 & 7

Henry County Public Service Authority	Double Detector Check Valve Assembly	Date: October 2019	W-16

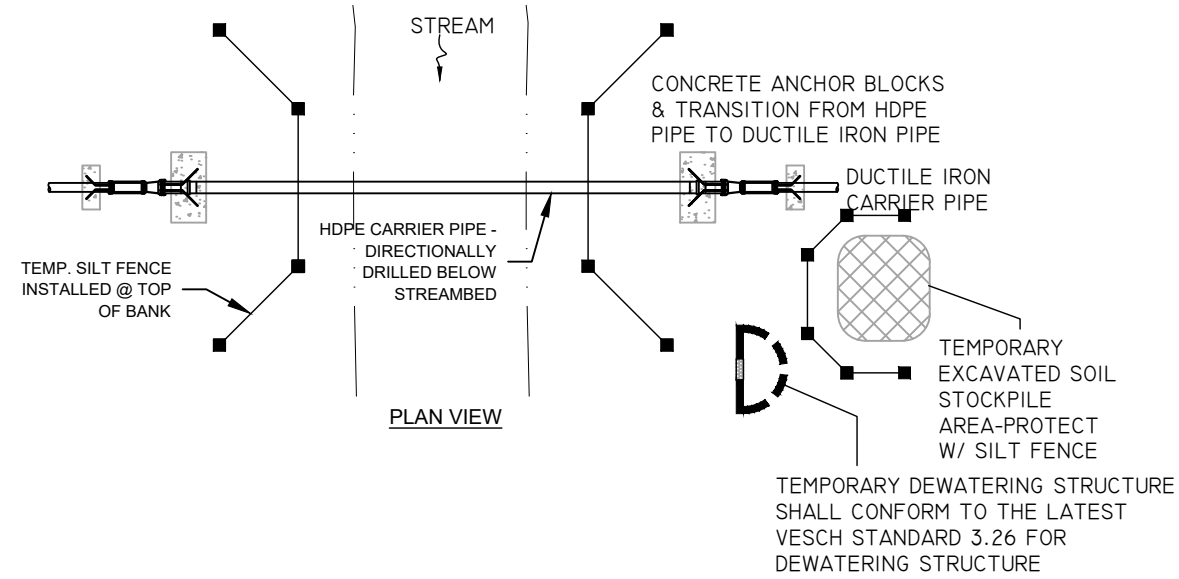


NOTE: SEE DRAWING W-11 FOR SAMPLE TAP DETAIL AND DRAWING W-6 FOR VALVE DETAIL.

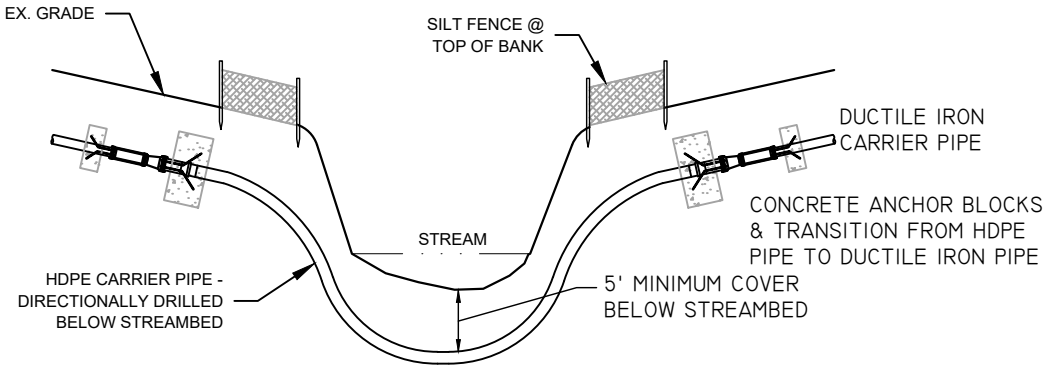
NOTES

1. THE PIPE SHALL BE DUCTILE IRON MECHANICAL JOINT OR OTHERWISE NOTED. PIPE SHALL BE INSTALLED FROM ISOLATION VALVE TO ISOLATION VALVE.
2. VALVES SHALL BE PROVIDED AT BOTH ENDS OF THE WATER CROSSING SO THAT THE SECTION CAN BE ISOLATED FOR TESTS OR REPAIR; THE VALVES SHALL BE PLACED 10' EACH SIDE OF CASING OR OTHERWISE NOTED AND BE EASILY ACCESSIBLE AND NOT SUBJECT TO FLOODING.
3. SAMPLE TAPS SHALL BE AVAILABLE AT EACH END OF THE CROSSING AND AT A REASONABLE DISTANCE FROM EACH SIDE OF THE CROSSING AND NOT SUBJECT TO FLOODING.
4. PERMANENT TAPS SHALL BE MADE FOR TESTING AND LOCATING LEAKS.
5. REFER TO SECTIONS 1-12, 2-01, 2-02, 2-03, & 2-05.

Henry County Public Service Authority	Subsurface Water Crossing	Date: October 2019	W-17



PLAN VIEW



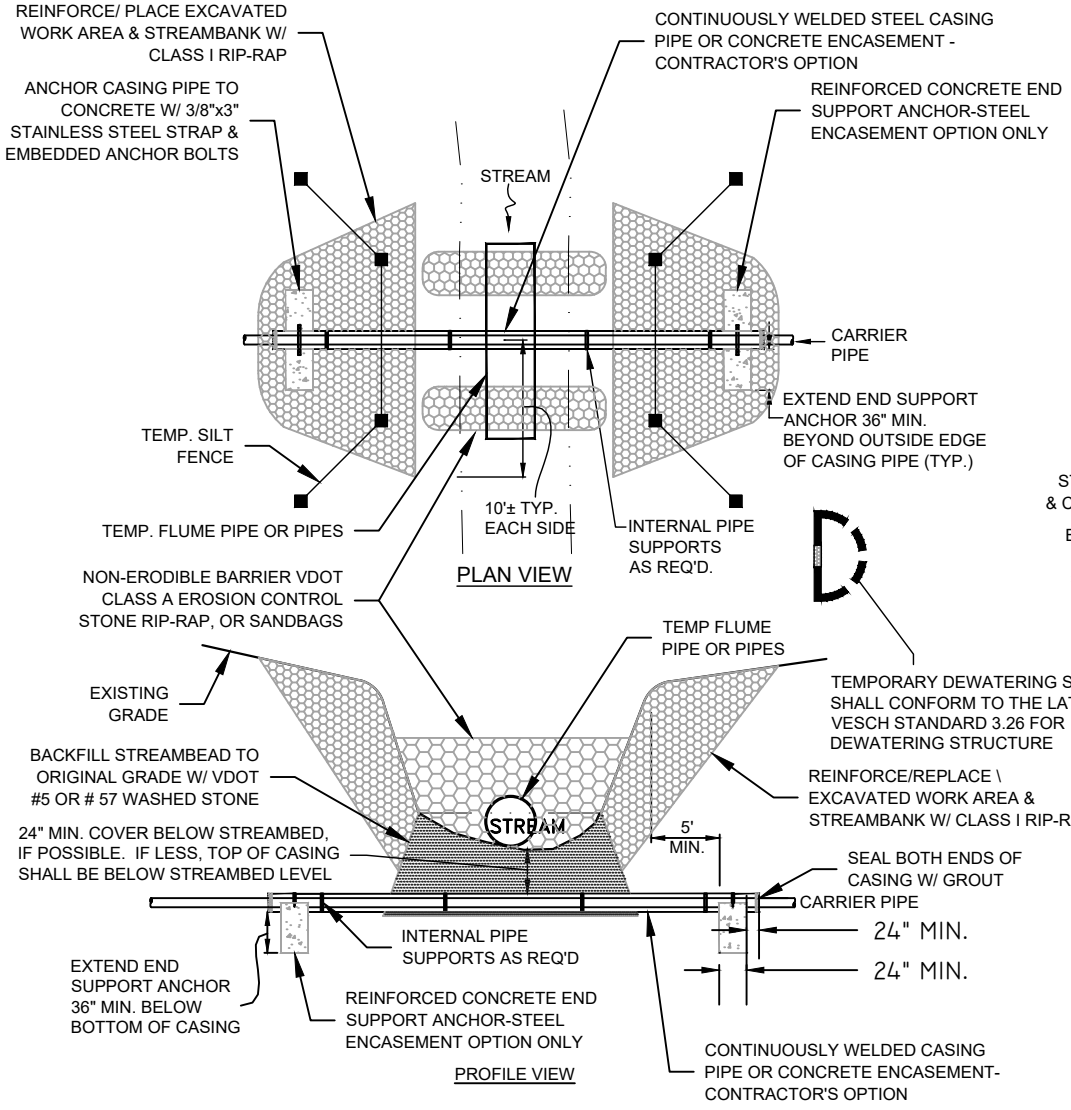
SECTION VIEW

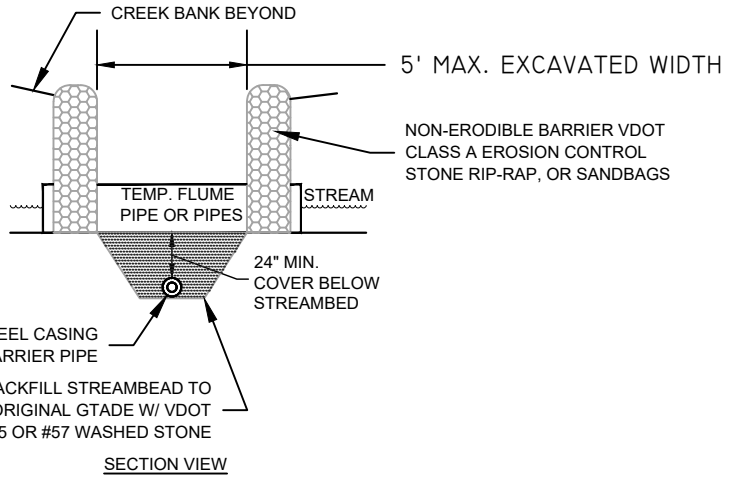
NOTES

1) CONSTRUCTION SHALL BE DONE IN LOW STREAM FLOW PERIODS WITH NO FORECAST PRECIPITATION.
2) NO IN-STREAM WORK WILL BE ALLOWED.
3) INSTALL EROSION CONTROL MEASURES; SILT FENCE AND TEMPORARY SEDIMENT TRAP.
4) EXCAVATE BORE AND RECEIVING PITS ON OPPOSITE SIDES OF STREAM.
5) DIRECTIONALLY DRILL AND INSTALL HDPE CARRIER PIPE BELOW STREAMBED.
6) INSTALL TRANSITION FITTINGS, CONNECTING HDPE PIPE TO DUCTILE IRON PIPE.
7) INSTALL CONCRETE ANCHOR BLOCKS AT PIPE TRANSITION AREAS.
8) EXTEND DUCTILE IRON CARRIER PIPE BEYOND BORE AND RECEIVING PITS.
9) REMOVE DRILLING EQUIPMENT; BACKFILL BORE PIT, RECEIVING PIT, & SEDIMENT TRAP TO GRADE.
10) STABILIZE AND REVEGETATE DISTURBED WORK AREAS WITH SEED, STRAW, AND/ OR MULCH AS REQ'D.
11) REMOVE TEMPORARY SILT FENCE AFTER REVEGETATION IS COMPLETE.
12) REFER TO SECTION 1-12.

NOTE: THIS DETAIL APPLIES TO ALL UTILITY LINE STREAM CROSSINGS SPECIFIED TO BE COMPLETED BY DIRECTIONAL DRILLING. BACKFILLING OF EXCAVATED DRILLING CUTTINGS/ DEWATERING PITS THAT ARE LOCATED ON VDOT RIGHTS-OF-WAY SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF VDOT ROAD & BRIDGE SPECIFICATION, SECTION 303, & THE PROJECT SPECIFICATION. NO DEWATERING OR DRILL CUTTING PITS ON VDOT RIGHTS-OF-WAY SHALL BE BACKFILLED IN WHICH MATERIAL EXISTS THAT CANNOT BE COMPACTED TO A DENSITY EQUAL TO THAT OF PRE-CONSTRUCTION CONDITIONS. NO POTENTIALLY HAZARDOUS DRILLING FLUIDS SHALL BE USED IN THE OPERATION. IF DURING DIRECTIONAL DRILLING, ANY EVIDENCE OF SEEPAGE OR FRAC-OUT OF DRILLING MUD IS DISCOVERED AT THE STREAM, THE DIRECTIONAL DRILLING OPERATION SHALL CEASE AND THE CONTRACTOR SHALL NOTIFY THE ENGINEER FOR DIRECTIONS.

Henry County Public Service Authority	Directionally Drilled Stream Crossing	Date: October 2019	W-18

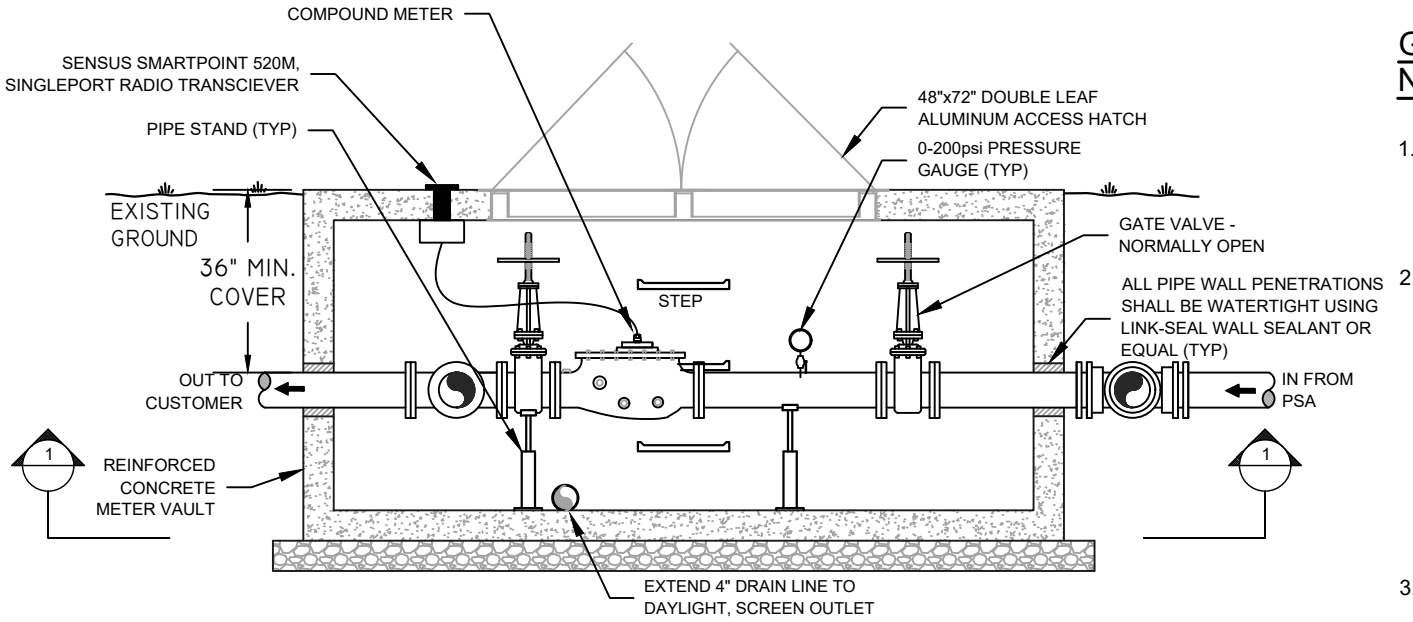




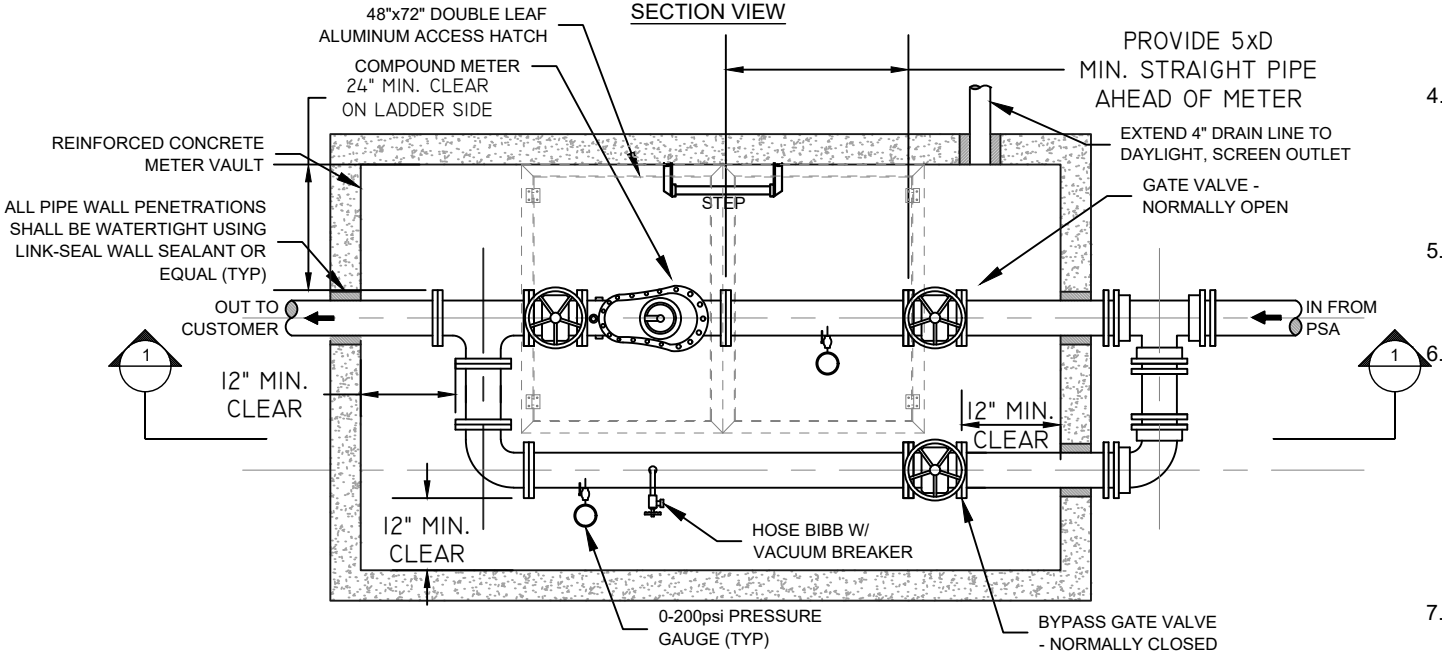
NOTE: THE FLUME PIPE METHOD SHALL ONLY BE AUTHORIZED BY THE ENGINEER AND ONLY AFTER THE HORIZONTAL BORE METHOD HAS BEEN ATTEMPTED AND FAILED. FLUME PIPE CROSSING METHOD TO BE USED WHEN IN-STREAM CONSTRUCTION WILL LAST 48 HOURS OR LESS & STREAM IS LESS THAN 20' WIDE.

STEP 1) CONSTRUCTION SHALL BE DONE IN LOW FLOW PERIODS & WITH FLUME PIPE OPERATIONAL.
STEP 2) CROSSING SHALL BE ACCOMPLISHED IN A MANNER THAT WILL NOT PROHIBIT FLOW OF STREAM.
STEP 3) INSTALL TEMPORARY SILT FENCES TO CONTROL APPROACH AREAS.
STEP 4) INSTALL FLUME PIPE & NON-ERODIBLE BARRIER.
STEP 5) DEWATER W/IN DAMMED OFF AREA INTO SEDIMENT TRAPPING DEVICE.
STEP 6) EXCAVATE TRENCH & INSTALL PIPE.
STEP 7) BACKFILL STREAMBED WITH WASHED STONE TO ORIGINAL PROFILE. STABILIZE BANKS W/ RIP-RAP.
STEP 8) REMOVE BARRIER & FLUME PIPE.
STEP 9) IMMEDIATELY STABILIZE & REVEGETATE STREAM BANKS BY SEED, MULCH & STRAW.

Henry County Public Service Authority	Open Cut Flume Pipe Stream Crossing	Date: October 2019	W-19



SECTION VIEW

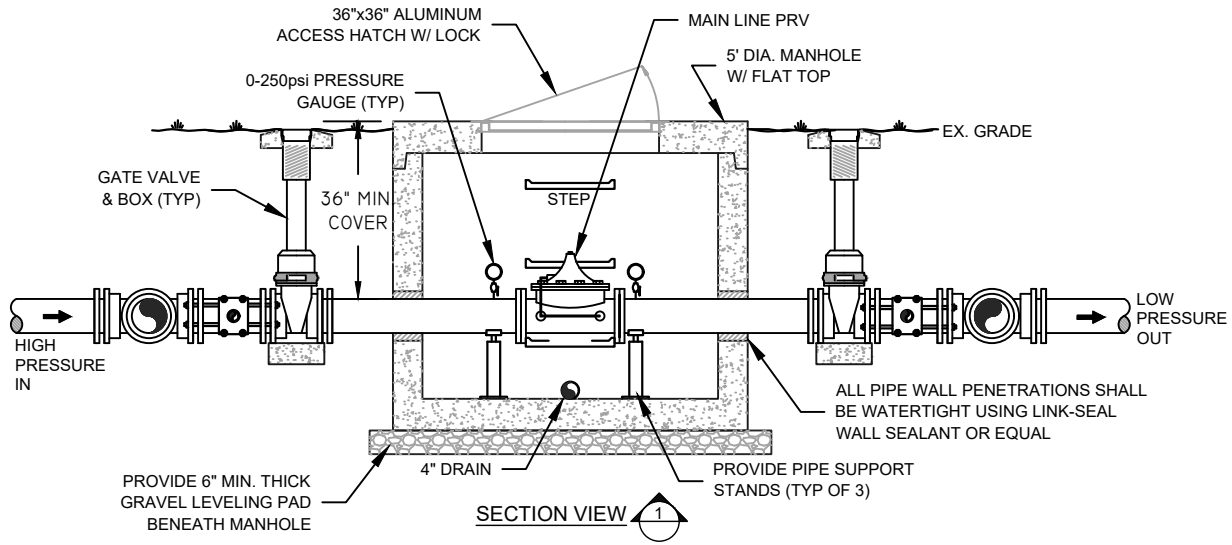


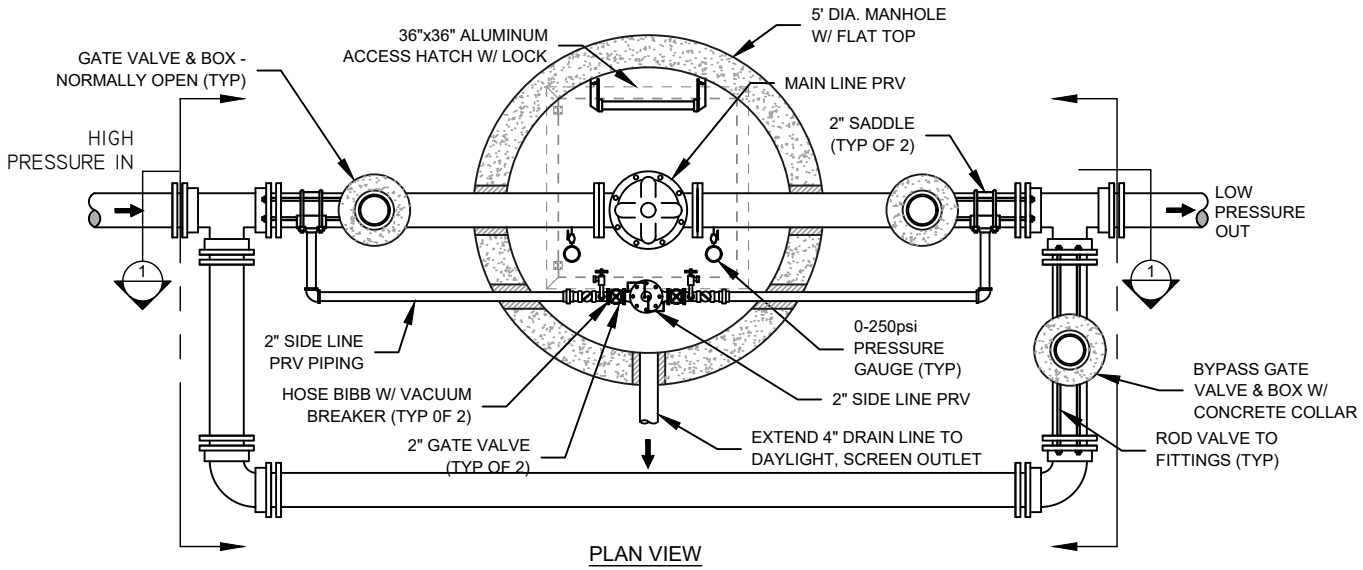
PLAN VIEW

GENERAL CONSTRUCTION NOTES

1. VAULT SHALL BE INSTALLED IN THE ROAD SHOULDER OR ON CUSTOMER PROPERTY, IN A LOCATION OUT OF DRAINAGEWAYS AND NOT DIRECTLY SUBJECT TO TRAFFIC.
2. VAULT SHALL BE CONSTRUCTED OF REINFORCED CONCRETE WITH DIMENSIONS SUFFICIENTLY LARGE TO ACCOMMODATE ALL PROPOSED VALVES AND PIPING. VAULT SHALL BE CONSTRUCTED USING 4000psi MINIMUM CONCRETE, REINFORCED FOR H-20 LOADING, 6" MINIMUM THICK WALLS AND TOP. VAULT SHALL BE FURNISHED WITH AN INTERIOR ACCESS LADDER. VAULT SHALL BE INSTALLED WITH A 4" DRAIN LINE TO DAYLIGHT.
3. ALL WATER PIPING INSIDE THE VAULT SHALL BE DUCTILE IRON, CLASS 350, WITH FLANGED FITTINGS. PROVIDE PIPE SUPPORTS AND REACTION BLOCKING AS NECESSARY.
4. VAULT ACCESS HATCH SHALL BE HALLIDAY SERIES H2W OR EQUAL HEAVY DUTY ALUMINUM CHANNEL FRAME WITH DOUBLE LEAF DOORS, SPRING ASSIST, AND FURNISHED WITH A LOCKING ASSEMBLY.
5. PRESSURE GAUGES SHALL BE GLYCERIN FILLED AND FURNISHED WITH A BALL ISOLATION VALVE.
6. WATER METER SHALL BE SENSUS MODEL OMNI COMPOUND C2 WITH SENSUS SMARTPOINT 520M SINGLE PORT RADIO TRANSCEIVER. RADIO TRANSCEIVER BRACKET SHALL BE MOUNTED IN CONCRETE VAULT TOP. SIZE DETERMINED BASED UPON CUSTOMER FLOW DEMANDS. METER VAULT AND METER SHALL BE APPROVED BY HCPSA ENGINEER.
7. REFER TO SECTIONS 1-03, 1-06, 2-01, 2-02, 2-03, 2-05, 2-07, & 7.

Henry County Public Service Authority	Setting for Meters 3" and Greater	Date: October 2019	W-20





MAIN LINE PRV GENERAL CONSTRUCTION NOTES:

1. PRV VAULT SHALL BE INSTALLED IN THE ROAD SHOULDER OR EASEMENT, IN A LOCATION OUT OF DRAINAGEWAYS AND NOT DIRECTLY SUBJECT TO TRAFFIC.

2. VALVE VAULT SHALL BE CONSTRUCTED OF REINFORCED CONCRETE WITH DIMENSIONS SUFFICIENTLY LARGE TO ACCOMMODATE ALL PROPOSED VALVES AND PIPING. VAULT SHALL BE CONSTRUCTED USING 4000 psi MIN. CONCRETE, REINFORCED FOR H-20 LOADING, 6" MIN. THICK WALLS & TOP. VAULT SHALL BE FURNISHED WITH AN INTERIOR ACCESS LADDER.

3. ALL WATER PIPING INSIDE THE VAULT SHALL BE DUCTILE IRON, CLASS 350, WITH FLANGED FITTINGS OR BRASS W/ THREADED FITTINGS. PROVIDE PIPE SUPPORTS AND REACTION BLOCKING AS NECESSARY.

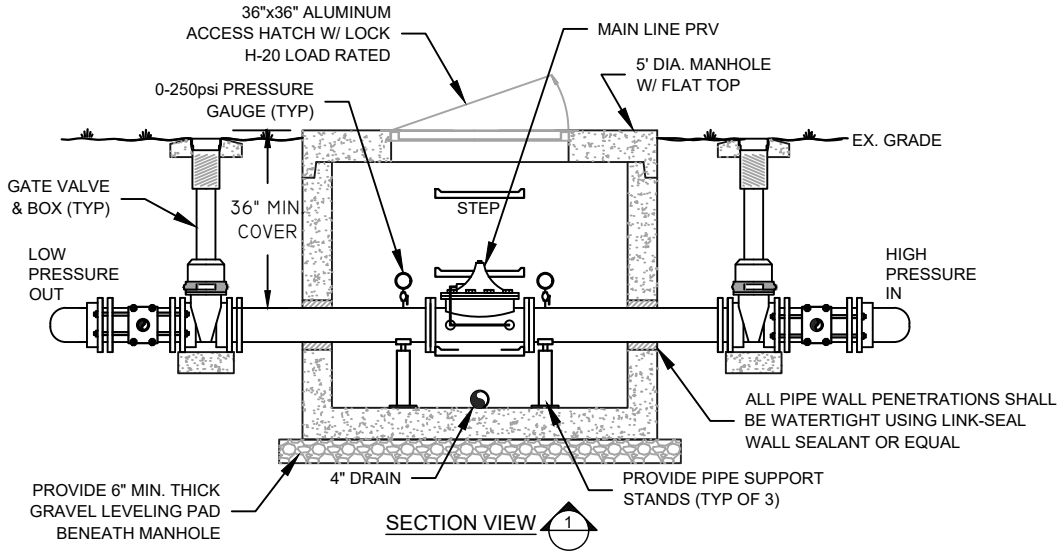
4. VAULT ACCESS HATCH SHALL BE HALLIDAY SERIES H1W OR EQUAL HEAVY DUTY ALUMINUM CHANNEL FRAME WITH SINGLE LEAF DOOR, SPRING ASSIST, AND FURNISHED WITH A LOCKING ASSEMBLY.

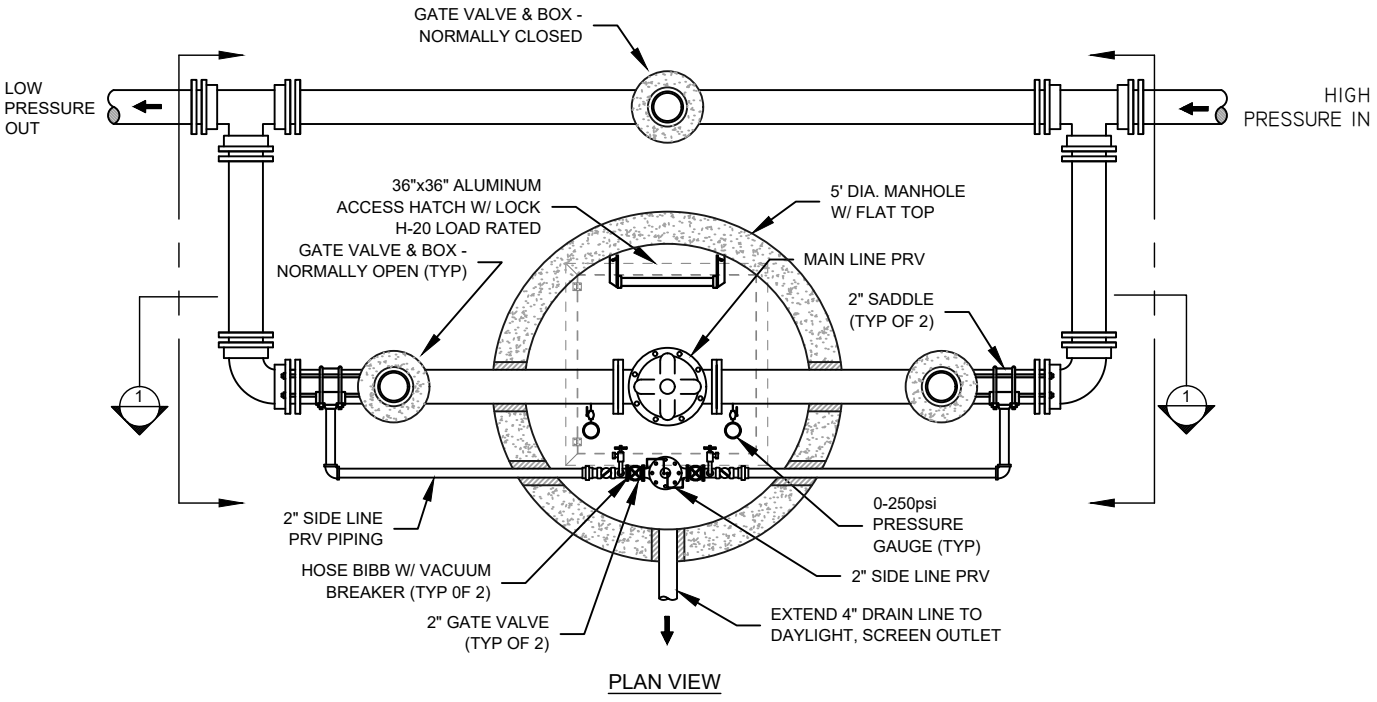
5. PRESSURE REDUCING VALVES SHALL BE FIELD SET/ CALIBRATED BY THE MANUFACTURER'S REPRESENTATIVE.

6. THE PROPOSED MAIN LINE AND 2" SIDE LINE PRESSURE REDUCING VALVES SHALL BE PILOT OPERATED, DESIGNED TO REDUCE A HIGH INCOMING PRESSURE TO A CONSTANT, LOWER DOWNSTREAM PRESSURE OVER A VARIABLE FLOW RANGE. VALVES SHALL BE FURNISHED WITH A POSITION INDICATOR. PRV'S SHALL BE MANUFACTURED BY CLA-VAL, OR APPROVED EQUAL.

7. PRESSURE GAUGES SHALL BE GLYCERIN FILLED AND FURNISHED WITH A BALL ISOLATION VALVE.

8. REFER TO SECTIONS 1-03, 1-06, 2-01, 2-02, & 2-07.





MAIN LINE PRV GENERAL CONSTRUCTION NOTES:

1. PRV VAULT SHALL BE INSTALLED IN THE ROAD SHOULDER OR EASEMENT, IN A LOCATION OUT OF DRAINAGEWAYS AND NOT DIRECTLY SUBJECT TO TRAFFIC.

2. VALVE VAULT SHALL BE CONSTRUCTED OF REINFORCED CONCRETE WITH DIMENSIONS SUFFICIENTLY LARGE TO ACCOMMODATE ALL PROPOSED VALVES AND PIPING. VAULT SHALL BE CONSTRUCTED USING 4000 psi MIN. CONCRETE, REINFORCED FOR H-20 LOADING, 6" MIN. THICK WALLS & TOP. VAULT SHALL BE FURNISHED WITH AN INTERIOR ACCESS LADDER.

3. ALL WATER PIPING INSIDE THE VAULT SHALL BE DUCTILE IRON, CLASS 350, WITH FLANGED FITTINGS OR BRASS W/ THREADED FITTINGS. PROVIDE PIPE SUPPORTS AND REACTION BLOCKING AS NECESSARY.

4. VAULT ACCESS HATCH SHALL BE HALLIDAY SERIES H1W OR EQUAL HEAVY DUTY ALUMINUM CHANNEL FRAME WITH SINGLE LEAF DOOR, SPRING ASSIST, AND FURNISHED WITH A LOCKING ASSEMBLY.

5. PRESSURE REDUCING VALVES SHALL BE FIELD SET/ CALIBRATED BY THE MANUFACTURER'S REPRESENTATIVE.

6. THE PROPOSED MAIN LINE AND 2" SIDE LINE PRESSURE REDUCING VALVES SHALL BE PILOT OPERATED, DESIGNED TO REDUCE A HIGH INCOMING PRESSURE TO A CONSTANT, LOWER DOWNSTREAM PRESSURE OVER A VARIABLE FLOW RANGE. VALVES SHALL BE FURNISHED WITH A POSITION INDICATOR. PRV'S SHALL BE MANUFACTURED BY CLA-VAL, OR APPROVED EQUAL.

7. PRESSURE GAUGES SHALL BE GLYCERIN FILLED AND FURNISHED WITH A BALL ISOLATION VALVE.

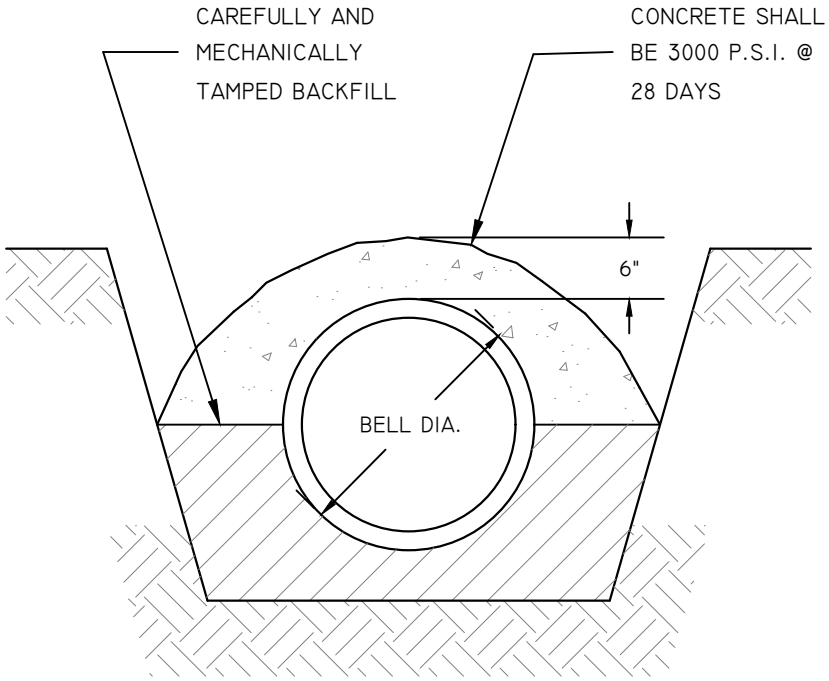
8. REFER TO SECTIONS 1-03, 1-06, 2-01, 2-02, & 2-07.

Henry County Public Service Authority	Main Line Pressure Reducing Valve - Option B	Date: October 2019	W-22

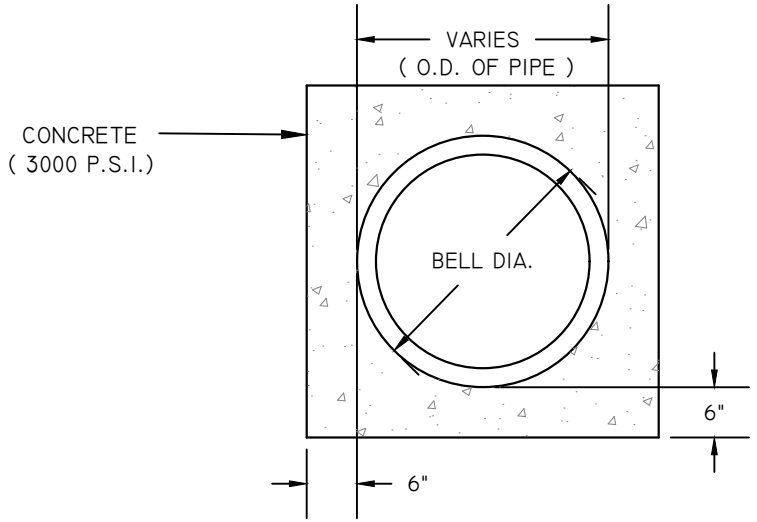
APPENDIX B
SEWER DETAILS

S-1	Sewer Pipe Bedding Concrete Encasement and Cap
S-2	Sewer Service Connection and Clean-out
S-3	Terminal Clean-out and Inspection Box
S-4	Standard Manhole Type A
S-5	Standard Outside Drop Manhole Type B
S-6	Standard Inside Drop Manhole Type C
S-7	Manhole Frames and Covers
S-8	Force Main Saxophone Connection
S-9	Aerial Crossing
S-10	Concrete Anchor – Slopes Greater Than 20%
S-11	Automatic Air/Vacuum Release Assembly

REFER TO DETAIL W-9 FOR
BEDDING REQUIREMENTS



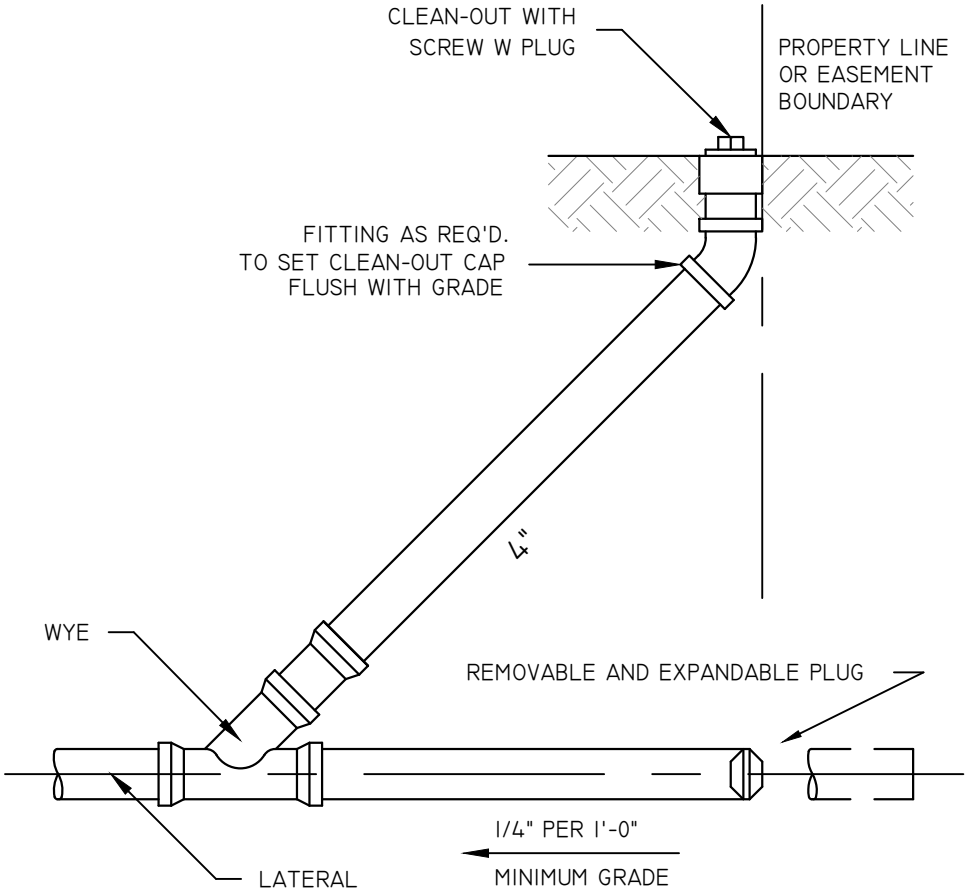
CONCRETE CAP



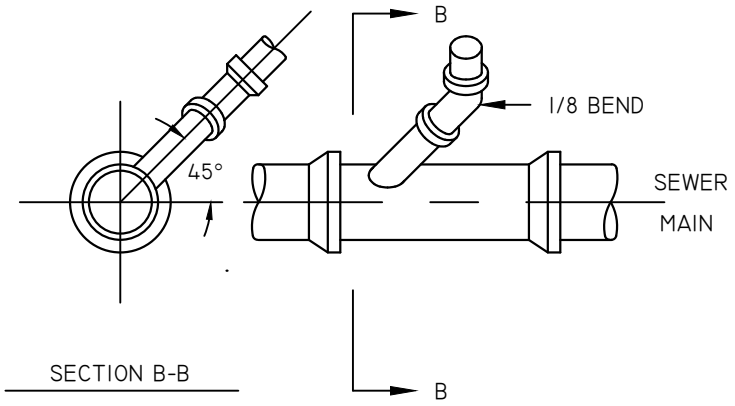
CONCRETE ENCASEMENT

REFER TO SECTION 7.

Henry County Public Service Authority	Sewer Pipe Bedding Concrete Encasement and Cap	Date: October 2019	S-1



HOUSE CONNECTION TO BE INSTALLED
BY PROPERTY OWNER AND SHALL COMPLY
WITH STATE AND LOCAL BUILDING CODES.



SECTION B-B

WYE BRANCH

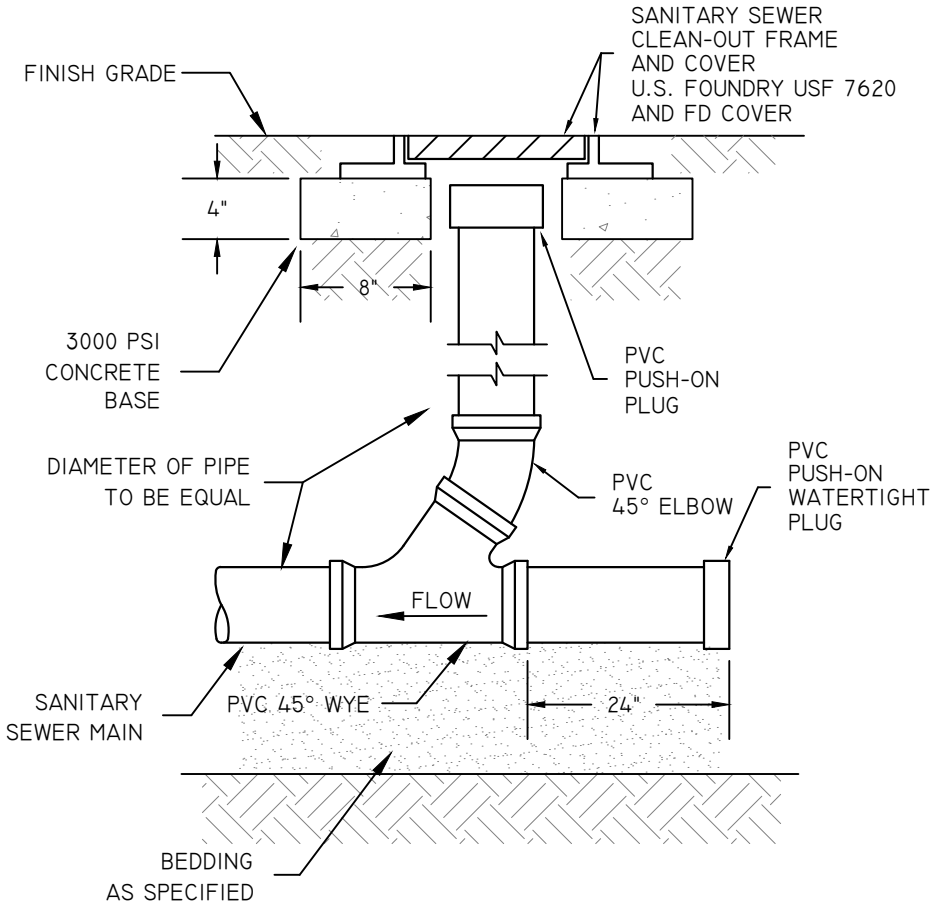
NOTES :

MINIMUM LATERAL SIZE: 4" FOR RESIDENTIAL SERVICE
6" FOR NON-RESIDENTIAL SERVICE

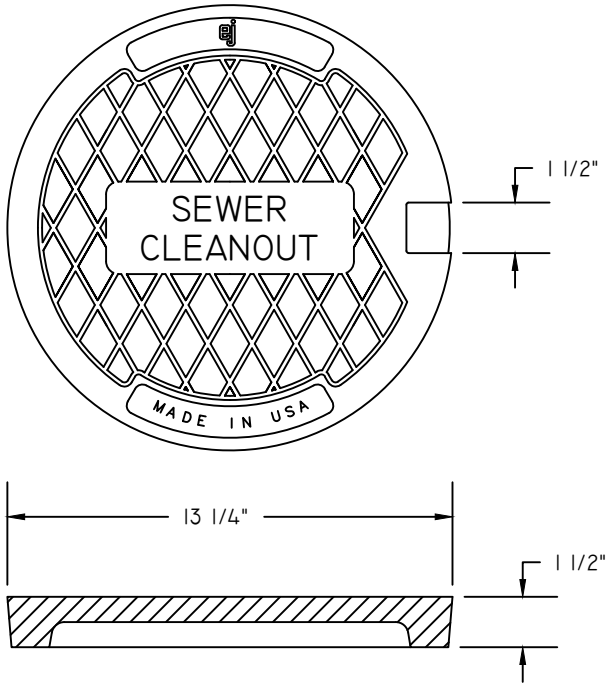
STRAPPED SADDLE WYES MAY BE USED
WHERE APPROVED BY THE AUTHORITY.

REFER TO SECTIONS 5-02 & 6-11.

Henry County Public Service Authority	Sewer Service Connection and Clean-Out	Date: October 2019	S-2

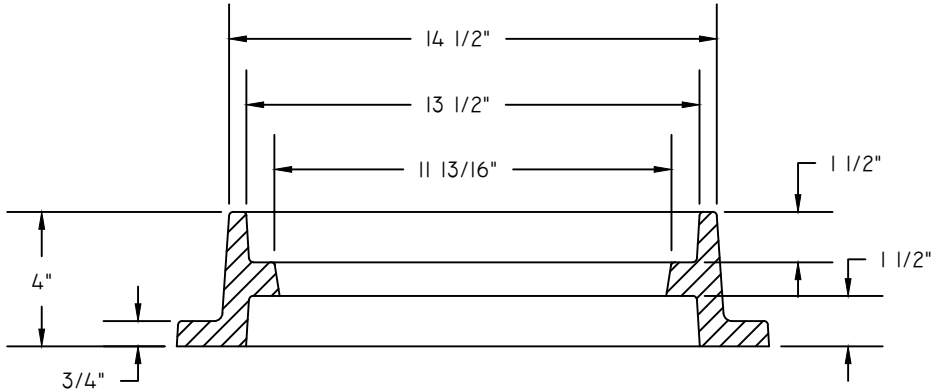


REFER TO SECTIONS 5-02 & 6-11.



CLEANOUT BOX COVER

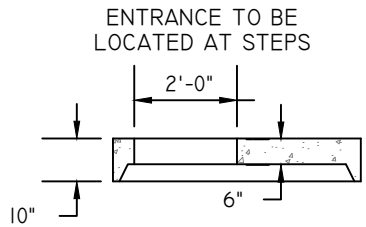
EJ V1610-2 CLEANOUT BOX COVER OR APPROVED EQUAL



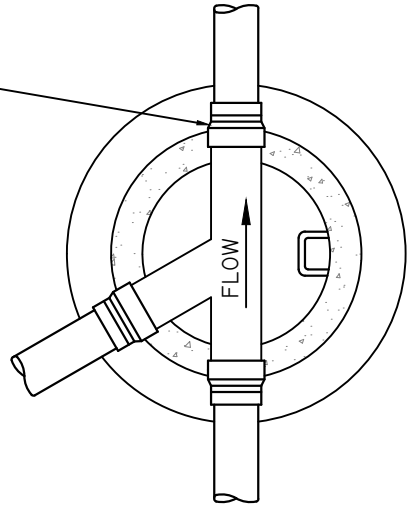
CLEANOUT BOX FRAME

EJ V1610-2 CLEANOUT BOX FRAME OR APPROVED EQUAL

Henry County Public Service Authority	Terminal Clean-Out and Inspection Box	Date: October 2019	S-3



ALTERNATE FLAT TOP
HCPSA APPROVAL REQUIRED



SECTION A-A

NOTES

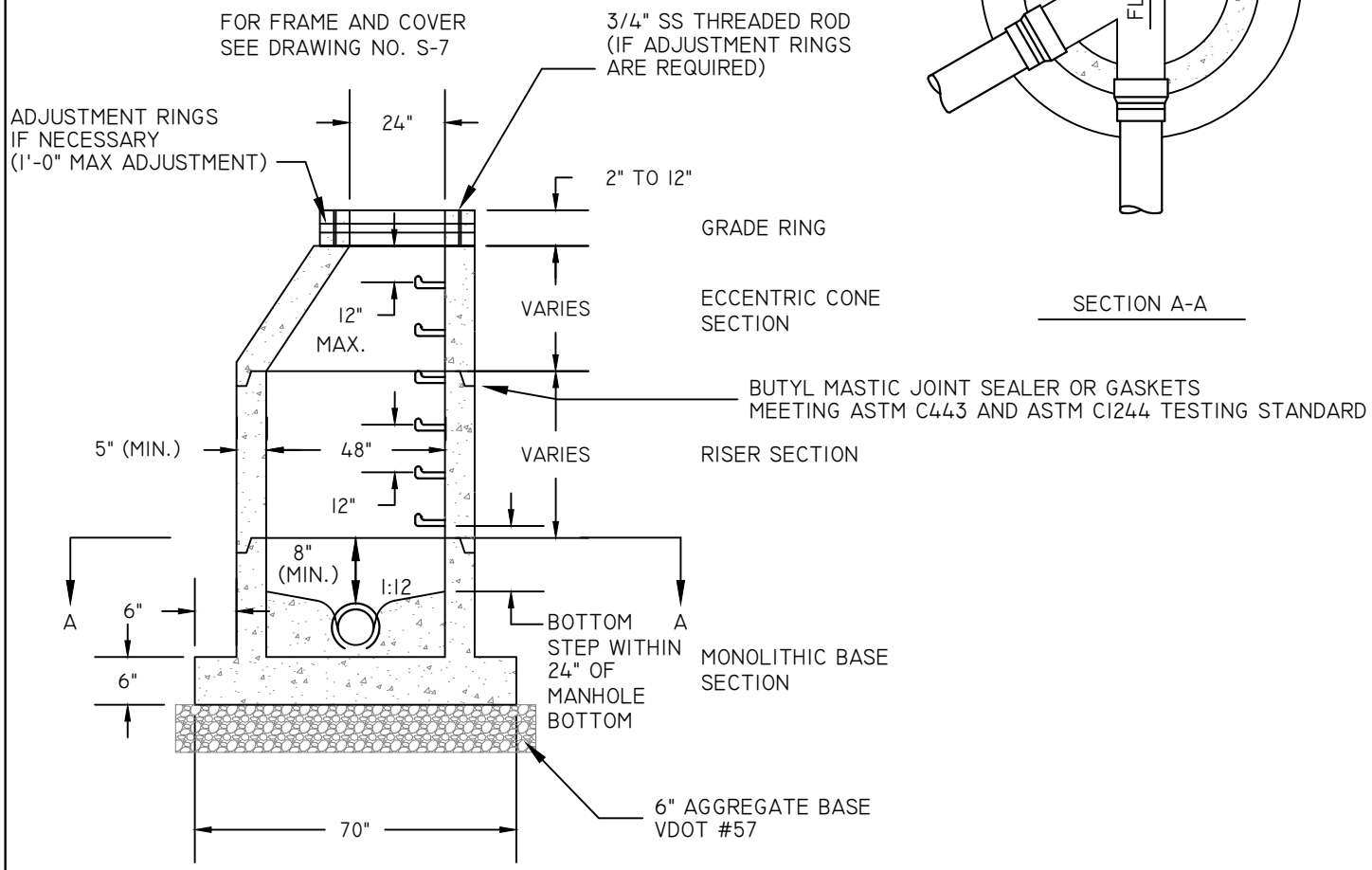
INVERT CHANNELS SHALL BE SMOOTH, SEMI-CIRCULAR AND SHALL PROVIDE A CONTINUOUS INVERT THROUGH THE MANHOLE.

NON PREFORMED INVERT CHANNELS SHALL BE FORMED WITH BRICK SURFACED WITH CEMENT MORTAR.

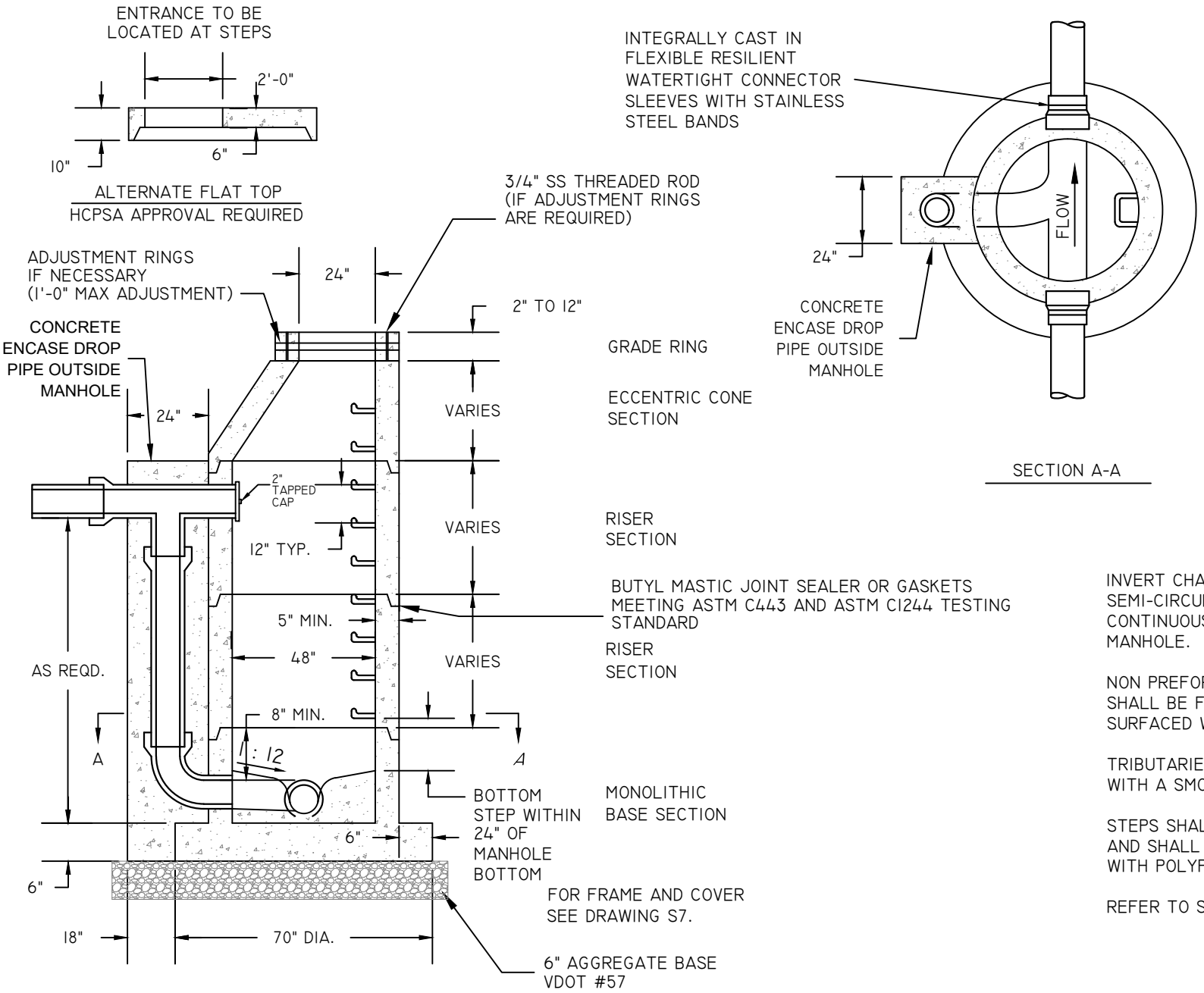
TRIBUTARIES CHANNELS SHALL JOIN WITH A SMOOTH TRANSITION.

STEPS SHALL BE INTEGRALLY CAST IN AND SHALL CONSIST OF NO. 4 REBAR WITH POLYPROPYLENE COATING.

REFER TO SECTIONS 5-03 & 6-10.



Henry County Public Service Authority	Standard Manhole Type A	Date: October 2019	S-4



NOTES

INVERT CHANNELS SHALL BE SMOOTH, SEMI-CIRCULAR AND SHALL PROVIDE A CONTINUOUS INVERT THROUGH THE MANHOLE.

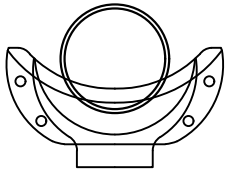
NON PREFORMED INVERT CHANNELS SHALL BE FORMED WITH BRICK SURFACED WITH CEMENT MORTAR.

TRIBUTARIES CHANNELS SHALL JOIN WITH A SMOOTH TRANSITION.

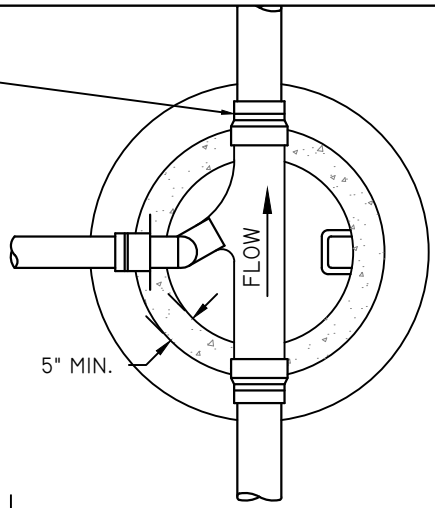
STEPS SHALL BE INTEGRALLY CAST IN AND SHALL CONSIST OF NO. 4 REBAR WITH POLYPROPYLENE COATING.

REFER TO SECTIONS 5-03 & 6-10.

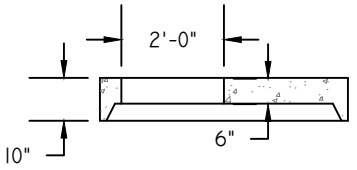
Henry County Public Service Authority	Standard Outside Drop Manhole Type B	Date: October 2019	S-5



DROP BOWL DETAIL

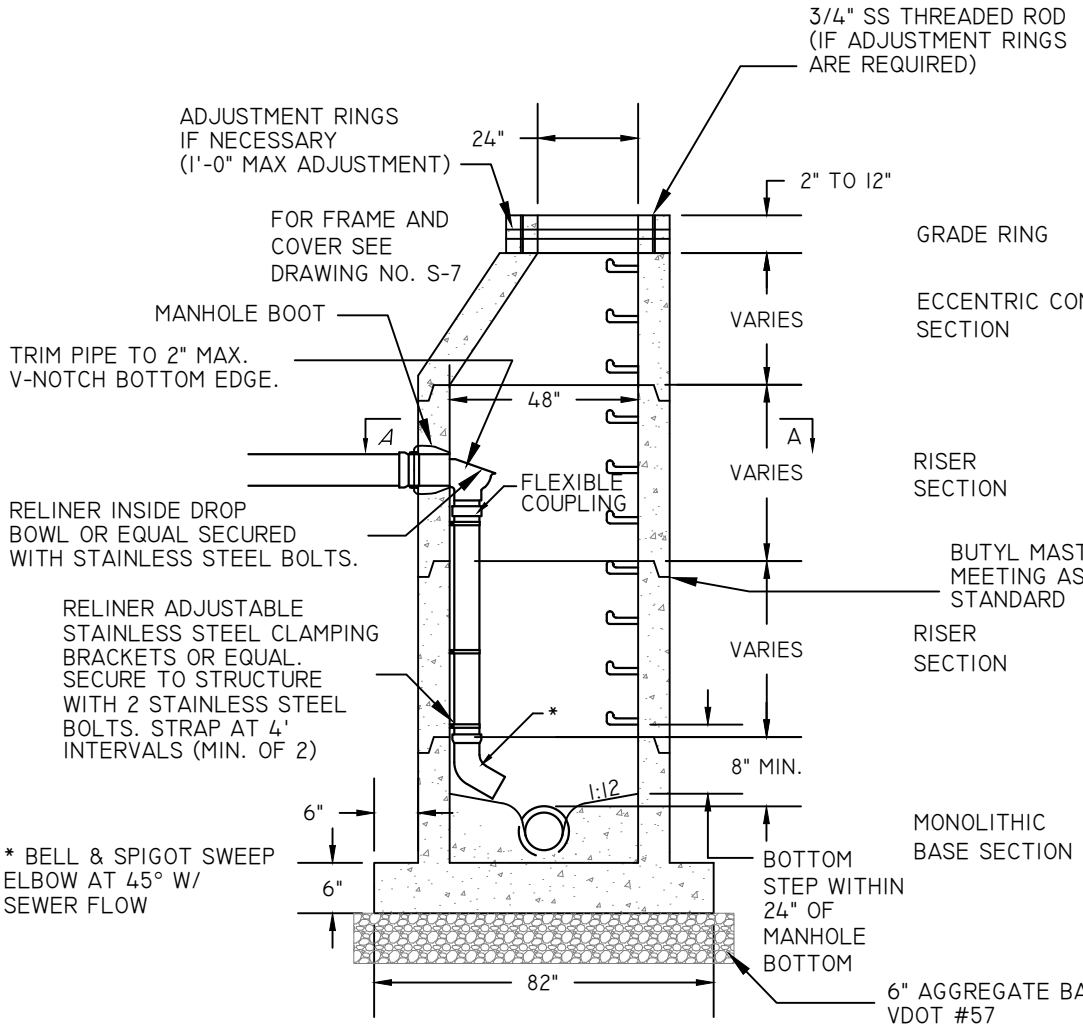


SECTION A-A



ALTERNATE FLAT TOP

ENTRANCE TO BE LOCATED AT STEPS HCPSA APPROVAL REQUIRED



NOTES

INVERT CHANNELS SHALL BE SMOOTH, SEMI-CIRCULAR AND SHALL PROVIDE A CONTINUOUS INVERT THROUGH THE MANHOLE.

NON PREFORMED INVERT CHANNELS SHALL BE FORMED WITH BRICK SURFACED WITH CEMENT MORTAR.

TRIBUTARIES CHANNELS SHALL JOIN WITH A SMOOTH TRANSITION.

STEPS SHALL BE INTEGRALLY CAST IN AND SHALL CONSIST OF NO. 4 REBAR WITH POLYPROPYLENE COATING.

INSIDE DROP CONNECTIONS SHALL ONLY BE USED WHERE APPROVED BY THE AUTHORITY.

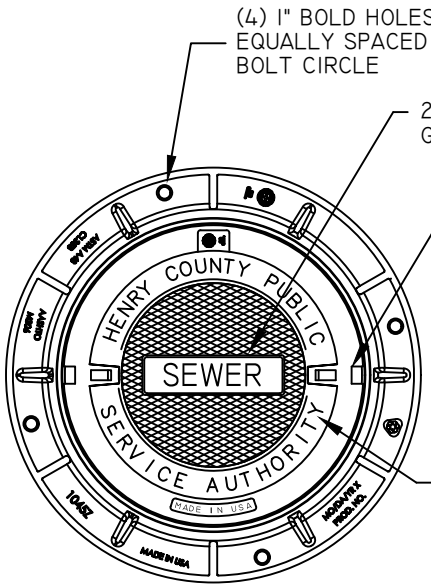
INSIDE DROP PIPE MATERIAL SHALL BE APPROVED BY THE AUTHORITY.

REFER TO SECTIONS 5-03 & 5-10.

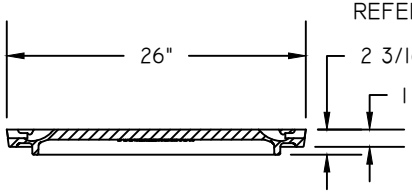
Henry County Public Service Authority	Standard Inside Drop Manhole Type C	Date: October 2019	S-6

COVER

EJ 1040A COVER OR APPROVED EQUAL

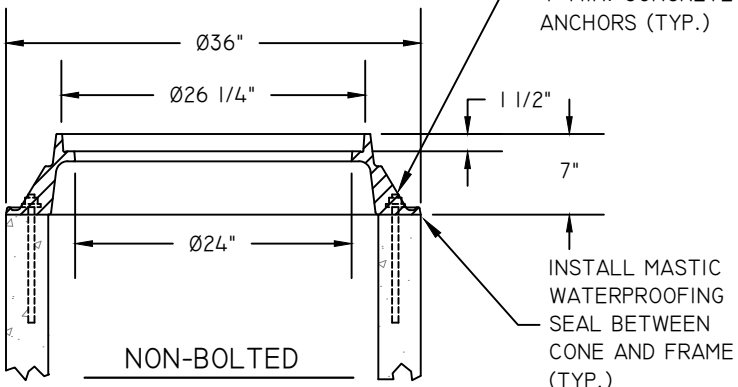


REFER TO SECTION 5-03



FRAME

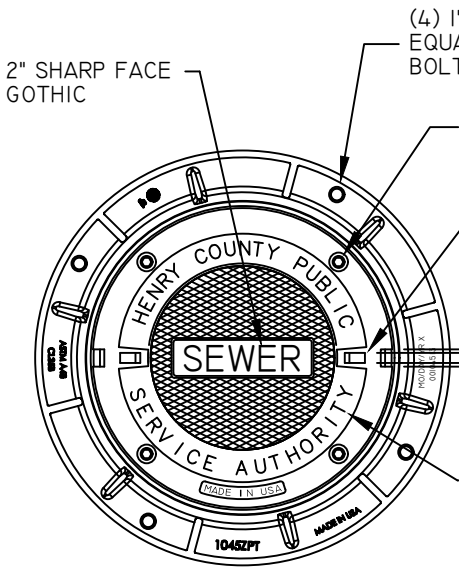
EJ 1045Z FRAME OR APPROVED EQUAL



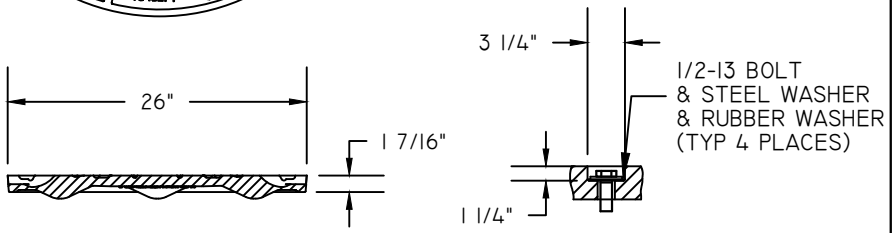
NON-BOLTED

COVER

EJ 1040APT COVER OR APPROVED EQUAL



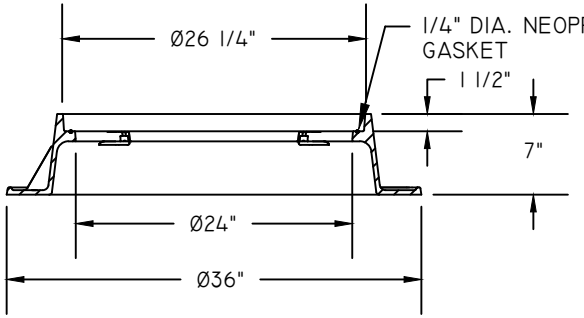
REFER TO SECTION 5-03



FRAME

EJ 1045ZPT FRAME OR APPROVED EQUAL

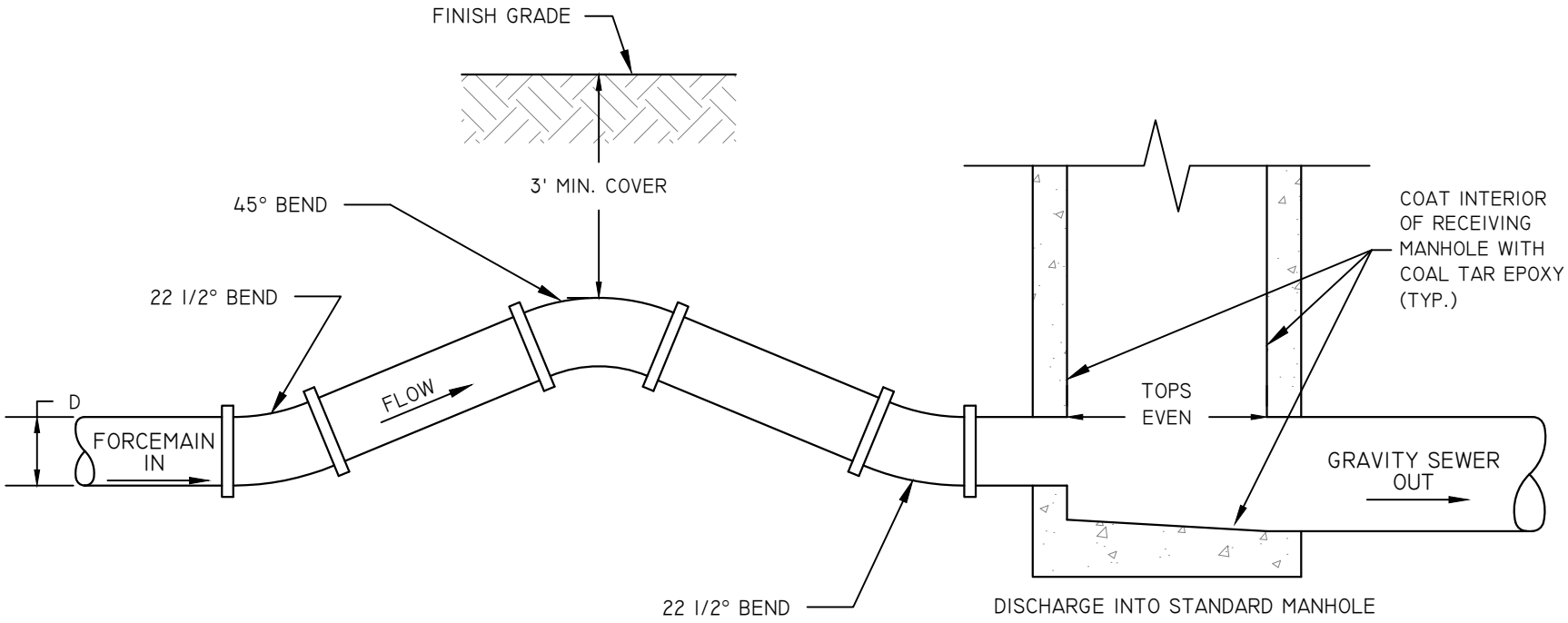
BOLD DETAIL



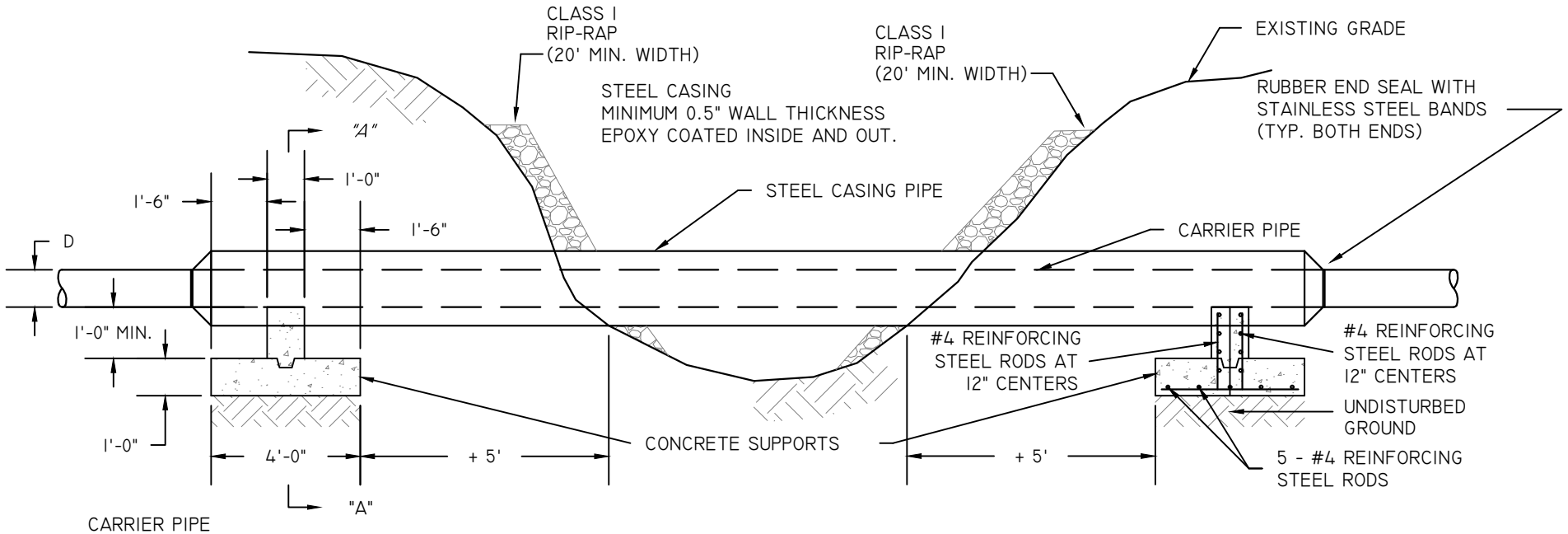
BOLT-DOWN MANHOLE FRAME AND COVER SHALL BE USED WHEN SHOWN ON PLANS AND DIRECTED BY THE HCPSA.

BOLTED

Henry County Public Service Authority	Manhole Frames & Covers	Date: October 2019	S-7



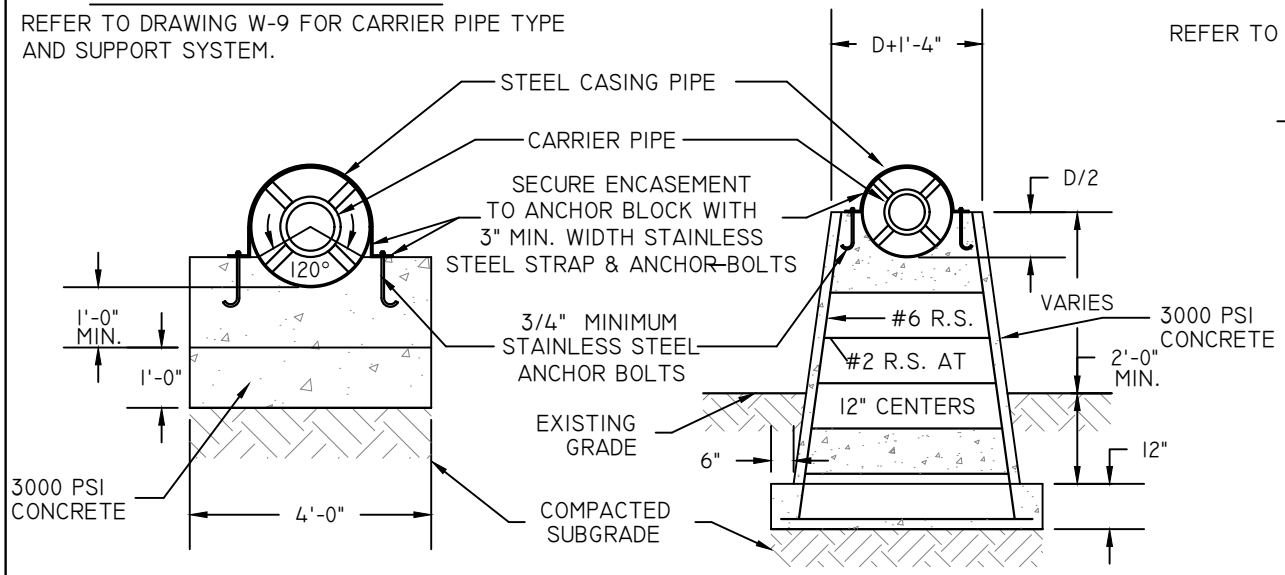
Henry County Public Service Authority	Force Main Saxophone Connection	Date: October 2019	S-8



CARRIER PIPE

REFER TO DRAWING W-9 FOR CARRIER PIPE TYPE AND SUPPORT SYSTEM.

REFER TO SECTIONS 5-02 & 6-14

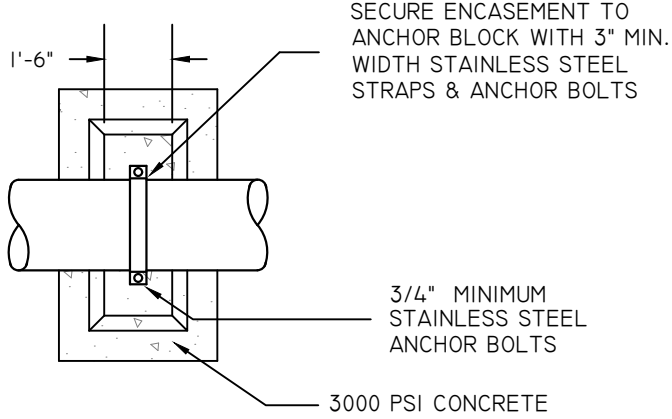


SECTION "A"

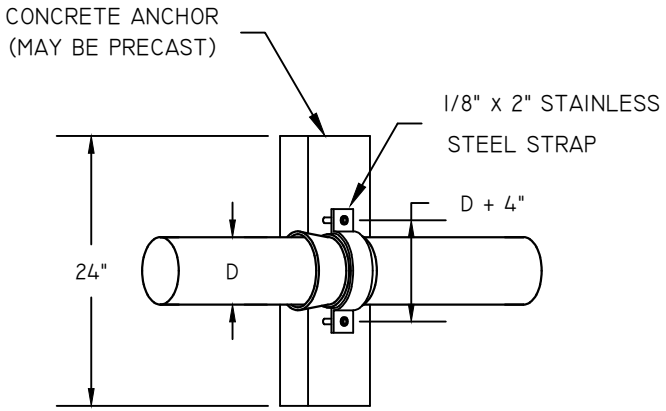
EXPOSED CONCRETE PIER

BURIED CONCRETE PIER

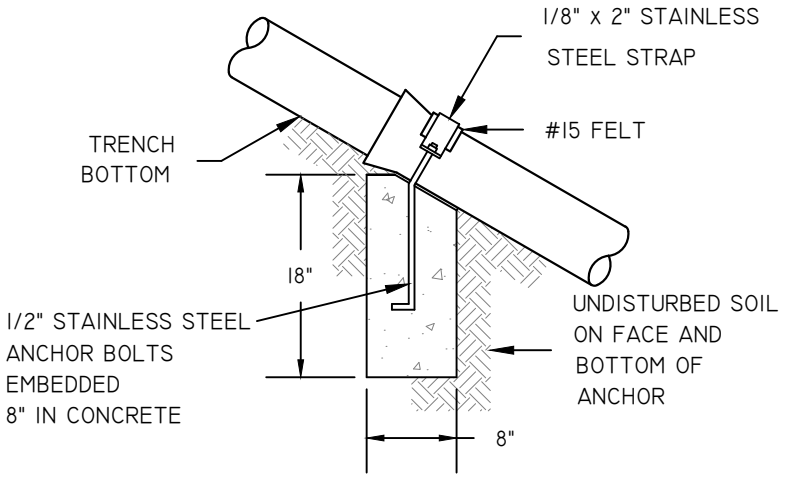
TOP VIEW



Henry County Public Service Authority	Aerial Crossing	Date: October 2019	S-9

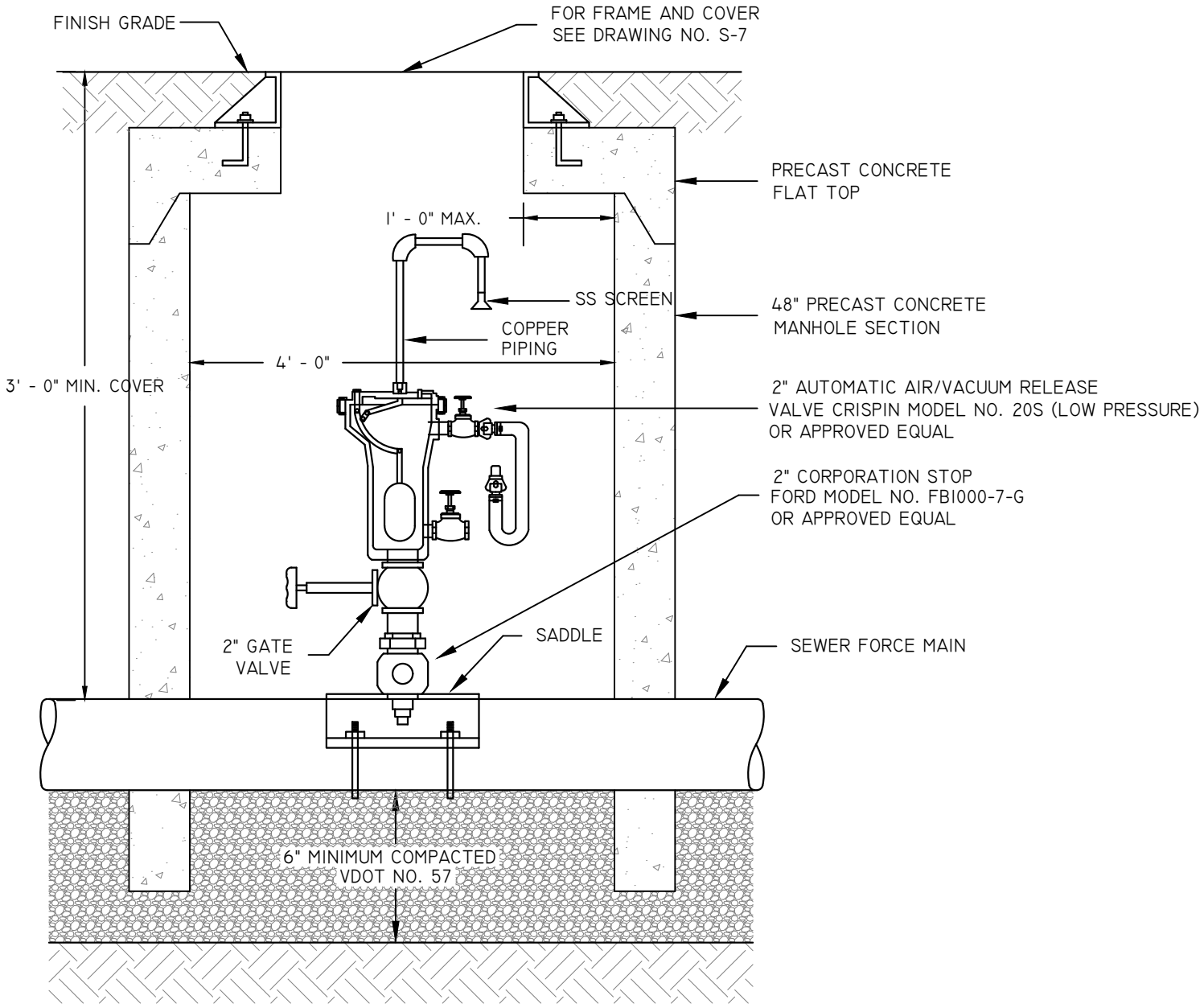


TOP VIEW



SIDE VIEW

SLOPE %	MINIMUM SPACING (FT)
0-19.99	NO SLOPE ANCHOR REQUIRED
20-34.99	35
35-50.99	25
51-MORE	15 OR SPECIAL DESIGN



Henry County Public Service Authority	Automatic Air/Vacuum Release Assembly	Date: October 2019	S-11