

**STANDARD WATER LINE SPECIFICATIONS
& CONSTRUCTION DETAILS**

PREPARED FOR:

**CITY OF GALAX
111 EAST GRAYSON STREET
GALAX, VIRGINIA 24333**

PREPARED BY:

**ADAMS-HEATH ENGINEERING, INC.
119 NORTH MAIN STREET
GALAX, VIRGINIA 24343**

JANUARY 2010

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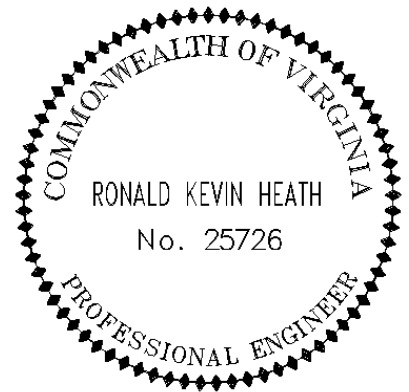
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TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

Excavation & Backfilling for Utilities	2000
Water Line Construction	3000

CONSTRUCTION STANDARD DETAIL DRAWINGS

W1 – Water Line Bedding	
W2 – Typical Gate Valve	
W3 – Typical Fire Hydrant Assembly	
W4 – Typical 5/8", 3/4", & 1" Water Meter	
W5 – Typical 1-1/2" or 2" Water Meter	
W6 – Concrete Thrust Blocks	
W7 – Water Air / Vacuum Release Valve	
W8 – 2" Blowoff Valve	
W9 – Steel Encasement	
W10 – Future Water Line Extension	
W11 – Cut/Sleeve Connection	
W12 – Water & Sewer Crossing	

SECTION 2000

EXCAVATION AND BACKFILLING FOR UTILITIES

PART 1 - GENERAL

- 1.1 SCOPE - This section covers the excavation and backfill for all water, sanitary sewer, and storm sewer pipelines.

PART 2 - MATERIALS

- 2.1 MATERIAL CLASSIFICATION – Selection of pipe trench backfill material is dependant upon the trench bedding requirements for the location of the installation in accordance with the standard construction details. Backfill material is classified based upon the Unified Soil Classification System (USCS). The soil classifications are defined as follows:

USCS Soil Classification System (FHA Bulletin No. 373) as shown on the Plans.

Class I - Angular, crushed (1/4 to 1 inch – i.e. VDOT #26 stone)

Class II - Coarse sands and gravel with maximum particle size of 25 mm (1 inch) including variously graded sands and gravel containing small percentages of fine, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class (i.e. VDOT #78 stone).

Class III - Fine sand and clayey gravel less than 1 inch, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM, and SC are included in this class (i.e. VDOT #10 stone).

- 2.2 INITIAL BACKFILL - Initial Backfill is defined as that material placed from the bottom of the trench excavation to the minimum required depth over the top of the pipe, as shown on the standard detail plan sheets. Initial Backfill shall be consolidated using a hand operated vibratory compactor. Initial Backfill for all pipe shall be required to be Class I (angular crushed stone, VDOT No. 78)
- 2.3 FINAL BACKFILL - Final Backfill is that material placed from the top of the Initial Backfill to the top of the trench. In general, material excavated from the trench may be used as Final Backfill with the following exceptions:
1. Unsuitable soils shall not be used for Final Backfill. Unsuitable soils include mud, muck, organic matter, construction debris, and frozen materials. Further, unsuitable soils shall be defined as inorganic and organic, silt and clay soils meeting the definition of the USCS System (ASTM D-2487) soil group symbols OL, MH, CH, OH, and Pt.
 2. Rock over 5" in size shall not be used for Final Backfill.
 3. In paved areas which are to be repaved following pipeline construction, trench backfill shall be Class I, full depth.

PART 3 - EXECUTION

3.1 EXCAVATION

- 3.1.1 General - All excavation shall be open-cut unless designated otherwise on the plans. All excavation shall be unclassified, regardless of the nature of material encountered. The cost for excavation shall be included in the contractor's bid for pipeline as no separate payment will be made for excavation. It is the Contractor's responsibility to determine what protective measures (shoring, sheet piling, trench box, etc.) are required to execute the work and provide safety to the workers and the general public.

- 3.1.2 Trench Excavation - Trenches for pipeline utilities are to be excavated by the Contractor using equipment/procedures necessary to complete the work. Trench width shall be as required to meet the minimum pipe bedding requirements shown on the plan sheets and to comply with OSHA safety requirements. Trenches are to be excavated to the design grade depth and width. Minimum trench width for all pipelines 4 inches and larger shall be no less than the outside diameter of the pipe plus 8 inches on both sides (pipe O.D. plus 16" min). Small diameter (2 inches and smaller) water service lines may be installed using a narrower trench width. It is the Contractor's responsibility to excavate trenches at the design depth. Overexcavation shall be replaced with suitable compacted fill material at the Contractor's expense. In no case shall pipe bear upon bedrock in the trench. When the utility trench lies in bedrock, the trench shall be overexcavated a minimum of 6" below the design grade and backfilled to the design grade with crushed stone. In locations where the excavated trench is unsuitable to support the pipe due to wet or unstable material, the unsuitable material shall be removed and replaced with suitable material. The cost for all excavation and replacement of unsuitable materials shall be included in the Contractor's bid for pipeline installation as no separate payment will be made.
- 3.1.3 Pipe Bedding - Bedding requirements for pipelines are dependant upon the type of pipe material utilized. Refer to the Standard Detail plan sheets for the type of bedding and backfill material required (Class I, II, or III as described in Part 2) and for the type of trench preparation (Class A, B, or C) as described herein. Bedding requirements shall be as follows:
- A. PVC Pipeline Material - Bedding for all material lines (gravity or pressure) shall be a minimum of Class B as described in ASCE Manual No. 37 and as shown on the standard detail plan sheets - unless otherwise specified.
 - B. Metal Pipeline Material (Ductile Iron, steel, copper) - Bedding for all metal material lines (gravity or pressure) shall be a minimum of Class C as described in ASCE Manual No. 37 and as shown on the standard detail plan sheets - unless otherwise specified.
 - C. Reinforced Concrete Pipeline Material - Bedding for all reinforced concrete material lines (gravity or pressure) shall be a minimum of Class C as described in ASCE Manual No. 37 and as shown on the standard detail plan sheets - unless otherwise specified.
 - D. Exceptions - The bedding requirements and bedding details as specified herein and as shown on the standard detail plan sheets have been developed to cover most situations. There may be instances when more or less stringent bedding requirements are warranted. In these special cases, the Engineer and Contractor shall work together to resolve a mutually agreeable solution.
- 3.2 BACKFILLING - Trenches shall be backfilled as the work progresses. No more than 500 linear feet of trench shall be open at any time. All trenches shall be backfilled at the end of the work day as exposed trenches shall not be left unattended. Initial backfill material shall be Class I, II, or III material as defined in Section 2.1 and as shown on the standard detail plan sheets. Final backfill material shall generally consist of that material excavated from the trench except that unsuitable materials shall not be used. Unsuitable final backfill material would include mud, stumps, organic matter, trash, frozen material, or rock larger than 5". All backfill materials shall contain a moisture content that will facilitate compaction. The initial backfill shall be brought up in layers not exceeding 6 inches in compacted depth for the full length of pipe. Each layer shall be thoroughly compacted using equipment and methods approved by the City's Engineering Department. The remainder of the trench shall be backfilled. Final backfill shall be brought up and compacted in layers not exceeding 8 inches. Backfill in open areas shall be compacted to a density equal to that of the existing ground. Backfill under roadways or other areas subjected to vehicular traffic shall be compacted to a minimum density of 95 percent of maximum density. It is the Contractor's responsibility to dispose of excess trench excavation material in a lawful acceptable manner. It is the Contractor's responsibility to repair any backfill settlement which occurs during the term of the construction contract and warranty period.
- 3.3 FILL - Fill material shall be provided where required to raise the subgrade to the elevations shown on the plan sheets or to replace unsuitable materials. Fill material placed below the design subgrade elevation

shall comply with the requirements for initial backfill material. Fill material placed above the design subgrade elevation shall comply with the requirements for final backfill material. Fill material shall be free of trash, roots, organic matter or frozen materials. No fill shall be placed on muddy or frozen ground. Fill material shall be placed in successive 6" vertical lifts and compacted until the desired grade is achieved.

- 3.4 BORROW - When satisfactory material is not available from required trench excavations, the Contractor shall obtain suitable borrow material. It is the Contractor's responsibility to locate suitable borrow site(s) and to restore the property to the satisfaction of the property owner when complete. No separate payment will be made for furnishing and placing borrow material as the cost for borrow material is to be included in the Contractor's bid for pipe installation.
- 3.5 CONCRETE ENCASEMENT - Where called for on the plan sheets, pipe shall be concrete encased. Concrete used for concrete encasement shall have a minimum 28-day compressive strength of 2500 psi. Concrete used for crossings designated as "river crossing" shall include reinforcing steel. The dimensions of the encasement shall conform to the dimensions shown on the plans. No concrete shall be placed directly in water. The Contractor shall not backfill over concrete encasement until 24 hours after pouring, unless directed otherwise by the Engineer. Concrete encasement will be paid for using a linear foot unit price.
- 3.6 BLASTING - The Contractor may use blasting to assist in trench excavation when conventional excavating equipment alone will not perform the job. Blasting operations shall be in strict accordance with all applicable existing ordinances, OSHA, and state regulations. It is the responsibility of the Contractor to protect all persons and property from damage. Blasts will be secured in a manner to prevent the escape of flying material. The Contractor is strongly encouraged to conduct pre-blast investigations of adjacent properties for his protection. In the event that blast damage occurs, it shall be repaired by the Contractor at his expense. No blasting operations shall be performed without prior written permission from those authorities having jurisdiction.
- 3.7 AGGREGATE AND PAVING - All open cuts through pavement shall be backfilled with crushed stone. Paved public roadways shall be repaved using asphalt base course (greater of 3" or 1.5x existing thickness) and asphalt surface (greater of 2" or existing thickness). Disturbed gravel roads, driveways and shoulders shall be replaced with aggregate stone a minimum depth of six inches or equal to the original thickness, whichever is greater. Existing paved driveways that are disturbed shall be repaved to original thickness using local plant mix asphalt.

SECTION 3000

WATER LINE CONSTRUCTION

PART 1 - GENERAL

- 1.1 DESCRIPTION - This section of the specifications covers materials of construction, installation procedures, and testing of all proposed potable water lines within the City of Galax water system. These specifications apply to both projects constructed by the City of Galax and to projects constructed by others with the improvements to be conveyed to the City.
- 1.2 RELATED SPECIFICATIONS - The following specification sections include other information relevant to water line construction:
- Section 2000 - Excavation and Backfilling for Utilities.
 - Standard Detail Construction Drawings
- 1.3 QUALITY ASSURANCE - All construction materials and installation procedures shall comply with all applicable AWWA requirements and the Virginia Department of Health's Waterworks Regulations. All piping utilized shall be stamped with the "NSF-PW" seal, designating that the material is approved for use in potable water systems.
- Prior to final acceptance, all water lines installed in this project shall be subjected to and pass pressure and bacteriological test procedures detailed herein.
- 1.4 SUBMITTALS - The following items shall be provided to the City for all water line related projects within the City's water system:
- 1.4.1 Construction Drawings – Plans for all water line improvements shall be submitted to the City for review and approved prior to construction. Plans shall be drawn to scale and clearly show all work to be completed.
- 1.4.2 Construction Material Specifications – All construction materials shall comply with the City's Standard Specifications unless the City grants a waiver in writing. Contractors requesting a waiver shall submit to the City for review a complete list of all requested deviations, along with sufficient product information for the City to consider.
- 1.4.3 Permits – All necessary permits shall be secured and copies provided to the City prior to start of construction; including as applicable, the Virginia Department of Health, Stream Permit (VMRC, USACE, and/ or DEQ), Erosion Control, and others.
- 1.4.4 Test Reports – Copies of all required water line pressure test and bacteriological test results for new water lines shall be provided to the City before the lines will accepted.
- 1.4.5 Record Drawings – Following construction, the Contractor shall provide to the City a complete set of record drawings showing all improvements. Drawings shall be to scale and shall be provided both in hard copy (paper) and electronic (compatible with City software) format.
- 1.5 CONSTRUCTION LAYOUT - Construction quantities shown on the plans and designated in the bid schedule are estimated based upon field surveying.

The Contractor is responsible for construction stakeout required to build the project.

During design of the project, the Engineer has performed field surveys to determine the location of existing utilities which could conflict with the proposed construction. The plans depict the Engineer's best representation of existing conditions. The exact location of all existing utilities may not be known

and is not guaranteed to be shown on the plans. It is the Contractor's responsibility to field locate all existing utilities prior to start of construction. The Contractor shall be responsible for repair of any utilities damaged by construction.

The plans indicate those portions of the work which are located on private property. Easements for the proposed construction have been obtained by the Owner. It is the Contractor's responsibility to construct the work as shown on the plans and to limit his encroachment on private property to within the easements' boundaries. It is the Contractor's responsibility to replace any property corners damaged by construction using a licensed surveyor.

All valve boxes, fire hydrants, blow-off valves, air release valves, meters, sample hydrants, and other appurtenances on City street right-of-way shall be located as required by the City inspector.

The Contractor is responsible for identifying paved, concrete, unpaved roads and parking lots prior to bidding the project. The cost of surface restoration shall be included in the Contractor's unit price bid for pipeline. All property disturbed by construction shall be restored to as near as practical to its original condition.

PART 2 - PRODUCTS

- 2.1 PIPE - Unless specifically called for on the plans or specified herein, it shall be the Contractor's option to select the type of pipe material for each application from those acceptable materials shown in the Pipe Schedule. Pipe sizes shall be as shown on the plans for City projects or shall be submitted to the City for review and approval for all other projects.
- 2.1.1 Ductile Iron Water Pipe - All ductile iron pipe shall be manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Push-on joints and mechanical joints shall be in accordance with ANSI/AWWA C111/A21.11. Pipe thickness shall be in accordance with ANSI/AWWA C150/A21.50 based on laying conditions and internal pressure as specified on the project plans. Ductile iron pipe shall have an interior cement mortar lining and exterior asphaltic seal coating in accordance with ANSI/AWWA C104/A21.4.
- 2.1.2 Polyvinyl Chloride Water Pipe - PVC pipe 4" and larger, shall meet the requirements of AWWA C900, be U.L. approved, and shall have dimensions as described in AWWA C900 Table 2, "Outside Diameters of Cast Iron Pipe". Pipe joints shall be rubber gasketed and be of either push on or mechanical type in accordance with ANSI/AWWA Specification C111/A21.11. All PVC pipe shall be stamped with the NSF-PW certification. PVC in sizes 3" diameter and smaller shall meet the requirements of ASTM D-2241 and be SDR 21.
- 2.1.3 Galvanized Steel Water Pipe - Pipe shall conform to the requirements of ASTM A120-63T. All galvanized steel water pipe shall be NSF-PW certified and shall be stamped as such.
- 2.1.4 Copper Service Lines - All 3/4" and 1" water service lines shall be copper material, ASTM D-2239, Type K. All copper service lines shall meet AWWA C-800 and NSF Standard No. 61 and shall be stamped with the NSF-PW certification.
- 2.2 PIPE FITTINGS
- 2.2.1 Ductile Iron Fittings - All fittings for ductile iron and PVC pipe shall be compatible with the pipe specified herein and comply with ANSI/AWWA Specification C110/A21.10. Unless shown or specified otherwise, ductile iron fittings for direct-burial pipelines may be either push-on or mechanical joint type (Contractor's option). All push-on fittings shall conform with ANSI/AWWA C153/A21.53 or ANSI/AWWA C110/A21.10 and all mechanical joint fittings shall conform to ANSI/AWWA C111/A21.11. Ductile iron pipe inside buildings and vaults shall be flange fitted unless shown otherwise.

- 2.2.2 Galvanized Pipe Fittings - All galvanized steel fittings shall be standard weight malleable, threaded, and with a pressure rating equal to or greater than the pipe pressure requirements.

<u>SIZE</u>	<u>PIPE SCHEDULE</u>	
	<u>WORKING PRESSURE (PSI)</u>	<u>ACCEPTABLE MATERIAL</u>
3/4" to 1"	150, 200	Copper Type K
1-1/2" to 3"	150, 200	PVC(SDR 21), Galvanized Steel Schedule 40
4"	150, 200, 250, 300, 350	Ductile Iron Class 51
4"	150	PVC-C900 150 (SDR 18)
4"	200	PVC-C900 200 (SDR 14)
6" and larger	150, 200, 250, 300, 350	Ductile Iron Class 350 WP
6" and larger	150	PVC-C900 150 (SDR 18)
6" and larger	200	PVC-C900 200 (SDR 14)

2.3 GATE VALVES AND ACCESSORIES

- 2.3.1 Gate Valves - Gate valves 2" and larger shall conform to AWWA Specifications C-509. Valves shall be ductile iron body, bronze-mounted, Nitrile encapsulated disc, non-rising stem, and capable of withstanding the working pressure to which they are subjected. All valves shown to be located in valve boxes shall have 2" square operating nuts. Valves not buried shall be equipped with handwheels. Valves shall not leak when subjected to the appropriate line test pressure on one side and zero pressure on the other side. Gate valves shall be Mueller (Series 2360) or approved equal.
- 2.3.2 Valve Boxes - All buried gate valves shall be equipped with a valve box. Valve boxes shall be Tyler 6850 Series or an approved equal. The valve box shall be of two piece cast iron construction with the cover marked "WATER". Valve boxes shall be threaded to allow the height to be adjusted. All valve boxes shall be installed flush with grade. Valve boxes in areas not paved shall be installed with a concrete collar.
- 2.4 FIRE HYDRANTS - Fire hydrants shall be cast iron body, bronze mounted, suitable for a working pressure indicated on the drawings, and shall be in accordance with UL246, FM1510, and ANSI/AWWA specification C502. Hydrants shall be constructed so as to allow withdrawal of internal working parts without disturbing the barrel. Hydrants shall be traffic type, that will not geyser, should the upper barrel and stem section be broken off. The main valve opening shall be 5-1/4" in diameter. The main valve shall be made of natural rubber ASTM D2000. Hydrants shall open left (counter clockwise). Hydrants shall have two 2-1/2" threaded hose nozzles and one 4-1/2" threaded pumper nozzle. Hose and pumper nozzles shall be field replaceable. Nozzle caps shall be securely chained to the barrel. Operating and cap nuts shall be 1-1/2" pentagon, unless otherwise specified. Hydrants shall have 6" mechanical joint inlet connections and a 6" gate valve installed between the hydrant and the distribution system. Hydrants installed on all lines shall be suitable for a maximum working pressure of 250 psi and shall be Mueller Super Centurian (Series 250 Model A-423) or approved equal.
- 2.4.1 Hydrant Painting - Following installation, all hydrants shall be painted with one coat of zinc chromate primer and two finish coats of Red Industrial Enamel. Paint shall not foul or obstruct nozzle threads, cap chains, or any lubrication fittings. Hydrant tops shall be color code painted to indicate flow capacity. Hydrant caps shall be color code painted to indicate pressure rating. Color coding of hydrants to be in accordance with the following:

Hydrant Top - Flow Capacity

Red: <500 Gallons/Minute

Orange: 500 - 999 Gallons/Minute

Green: 1,000 - 1,499 Gallons/Minute

Blue: >1,500 Gallons/Minute

Hydrant Caps - Static Pressure

Red: <50 psi

Orange: 50-120 psi

Green: >120 psi

- 2.5 AIR/ VACUUM RELEASE VALVES - All air release valves shall be combination air/vacuum release valves and shall meet AWWA C-512. Combination air/vacuum release valves shall allow air to escape from the distribution system during pipeline filling and normal operation and also open to allow air to enter the system during vacuum conditions such as during a line break. The valve shall have an internal float assembly to prevent leakage. Combination air/vacuum release valves shall be Val-Matic Series 200C or approved equal.

- 2.6 SERVICE CONNECTION - Service connections generally include individual water service meters and all related items required to make a complete functioning assembly as shown on the standard detail plan sheets. All water services and related service connection plumbing shall be constructed in accordance with the Uniform Statewide Building Code as noted in 12VAC-5-590-1190 of the Waterworks Regulations.

- 2.6.1 Water Service Meters - Unless shown or specified otherwise, all water service meters shall be 3/4" x 5/8". All service meters shall comply with AWWA C700 and shall be positive displacement, magnetically driven. All meters shall be new and shall be manufactured by Sensus Technologies, to match the Owner's existing equipment inventory. All 3/4" x 5/8" meters shall be Sensus Model SR11. All 1-1/2" and 2" meters shall be Sensus Model SR.

Register - The register must be of the straight reading type and shall read in gallons and be capable of direct visual reading at the meter. All reduction gearing shall be contained in a permanently hermetically sealed, tamper-proof enclosure made of a corrosion resistant material. The register is to be secured to the upper maincase by means of a tamper-resistant locking device so that the register cannot be removed by the utility customer. The register shall be warranted for ten (10) years from date of shipment against defects in material and workmanship.

Main case shall be of bronze construction consisting of an outer case so that measuring chamber can be removed without disconnecting the meter from the coppersetter and shall withstand 250 psi operating pressures.

Measuring chamber shall be made from molded thermoplastic.

Strainer - Each meter shall be provided with a nonferrous strainer.

- 2.6.2 All components of the meter system (water meter, touch read, meter reading device, etc.) shall be manufactured by Sensus Technologies and shall be current production equipment. All components shall have been in production for a minimum of two (2) years.

Guarantees - All meters shall be guaranteed against defects in material and workmanship for one year from date of shipment. 5/8" meters will conform to AWWA M6 manual, new meter standards, for five (5) years/500,000 gallons, whichever occurs first, and AWWA M6 Manual, repaired meters standards 10 years/1,000,000 gallons following the new meter warranty. An equivalent program must be offered for 3/4" and 1" meters.

- 2.6.3 Related Service Connection Items - Service connections shall include the water meter and all related items shown or specified on the standard detail plan sheets; including the following items:

- a. 3/4" corporation stop - All service connections shall have a corporation stop installed at the point of connection to the distribution system main. A tapping saddle is required on all water service

connections, regardless of the type of pipe. Tapping saddles/corporation stops shall be connected to the distribution main at a 45 degree angle to the horizontal plane. Corporation stops shall be Mueller Model H-15008 ground key corporation valves only to match the Owner's existing equipment inventory.

- b. Meter Box - In areas not subject to vehicular traffic, meter boxes may be either reinforced concrete or fabricated from polyethylene. Meter boxes subject to traffic are required to be reinforced concrete. Meter settings which do not require a PRV require a meter box that shall have an 18" minimum diameter with a depth of 30 inches. If the service connection requires a PRV, the meter box shall be 24" minimum diameter with a depth of 30". Meter box lids shall be a Ford Meter box cover Type X, or approved equal. For a PRV meter box, the appropriate extension ring shall be provided.
- c. Meter Setter – meter setters in sizes $\frac{5}{8}$ " through 1" shall be a Mueller B-2404-2A with a lock wing Mueller 300 angle ball valve and angle dual check valve. Provide horizontal inlet and outlet with multipurpose straight coupling Mueller H-14227 using pipe sizes and materials to match requirements of the installation. Alternate meter setters manufactured by others may be accepted with prior approval of the Public Works and Engineering Departments. Meter setters shall be installed complete with stabilizing rods and in accordance with the manufacturer's application and installation instructions.

Meter Setters in sizes 1- $\frac{1}{2}$ " and 2" shall be a Mueller B-2423-2 with a lock wing Mueller 300 angle ball meter valve and angle dual check valve with meter flange. Provide lock-wing ball valve and dual check valve in meter bypass line. Alternate meter setters manufactured by others may be accepted for installation complete with stabilizing rods and in accordance with the manufacturer's application and installation instructions.
- d. 3/4" Service Pigtail - Each service connection shall be provided with a 3/4" service line to the property line and an end connection at the property line. The end connection shall be a Mueller H-14227 Multi-purpose connection or approved equal.

2.7 PRECAST MANHOLES and VAULTS - Unless indicated otherwise, all manholes and valve vaults shall be precast reinforced concrete. Shop drawings showing dimensions, reinforcing, and material specifications shall be submitted to the Engineer for approval. All submittals shall be stamped by a Virginia Registered Professional Engineer. Manholes shall be manufactured in accordance with the latest edition of ACI Standard 318. Manhole or vault joints shall be made watertight using flexible butyl mastic sealant. All manholes and vaults shown to have a concrete bottom shall be provided with a floor drain to daylight. All lift rings shall be removed and all lift holes sealed following installation of the structure.

2.8 MANHOLE FRAMES AND COVERS - Manholes and vaults shall be provided with covers of the type shown on the plans. Iron castings shall conform to the standard specifications for Grey Iron Castings ASTM Specification A-48-41, Class 20. The manhole frame and cover shall be a true 24" minimum opening diameter. One approved model is Dewey No. 3000.

Hinged lids shall be equal to Bilco Type J-AL or Type JD-AL, Halliday, aluminum construction, sized as shown on the drawings. Provide H-20 loading where required. Aluminum hatches shall be coated with a bituminous sealant on all surfaces in direct contact with concrete. Alternate metal cover designs will be considered on a case-by-case basis and may be acceptable if approved by both the Engineering and Public Works Departments.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION - All pipe shall be installed using sound construction techniques in compliance with the pipe manufacturer's recommendations, AWWA standards, Virginia Department of Health's

Waterworks Regulations, and the Engineer's requirements. A general overview of installation requirements is included herein:

1. All pipe shall be bedded in accordance with the pipe bedding details shown on the plan sheets and/or as specified in Section 2000, Excavation and Backfilling for Utilities. All water lines shall be installed with 36" minimum depth of pipe cover with the only exception being that 24" minimum cover will be acceptable for service lines at the meter box only.

The trench bottom shall be constructed to provide a firm, stable and uniform support for the full length of the pipe. Bell holes shall be provided at the proper location for each pipe joint to permit proper joint assembly and pipe support. When an unstable subgrade condition is encountered which will provide inadequate pipe support, the trench shall be overexcavated a minimum of 6" or as required and refilled with suitable foundation material. Unstable subgrade conditions include mud, organic matter, bedrock, or other conditions which would result in unsatisfactory pipe support. In all cases, trench excavation shall be sufficient to provide pipe bedding as shown and/or specified. Trenches shall be excavated as the work progresses and are to be backfilled as the pipe is installed. Trenches shall be fully backfilled at the end of each day and open trenches shall not be left unattended. It is the Contractor's full responsibility to excavate and protect utility trenches in a manner that is safe both to his workers and the general public.

2. Trenches for pipelines shall be excavated using suitable equipment/means for each particular installation. Pipeline trenches are to be excavated to the required width and grade in a manner to minimize the disturbance to adjacent areas. Excavated trench bottoms are to be firm and stable prior to the installation of the required pipe and bedding. Trenches shall be reasonably dry prior to pipe installation. In locations where water occurs in the trench, the trench shall be dewatered prior to pipe installation. Dewatering may include pumping, diversion, or installation of underdrains.
3. The Contractor shall provide all new materials for construction and shall store and install the materials in a manner which does not result in damage to the material. All materials shall be stored in a manner which will prevent the entry of dirt, mud, animals, or other foreign materials. All PVC pipe shall be stored under a roof or cover to prevent damage from sunlight. Damaged materials will be rejected and the Contractor required to provide materials free of defects at no additional charge. Any dirt, mud, or other foreign matter shall be cleaned from all materials prior to installation.
4. All water lines and related appurtenances shall be laid in compliance with the manufacturer's recommendations, Virginia Department of Health's Waterworks Regulations, the plans and specifications and all applicable AWWA requirements. All blisters, excess pipe coatings, or foreign matter shall be removed from the ends of each fitting and piece of pipe. Particular care shall be taken to properly clean and lubricate the pipe interior and exterior at joints to ensure proper connection. Joint gaskets shall be inspected to ensure proper positioning and alignment. In locations where pipe must be cut to install fittings, valves, or to join other lines, the pipe shall be carefully cut using a pipe saw. Cutting of pipe with a torch shall not be allowed. Following pipe cutting, the cut surface shall be filed or sanded to remove any burrs.
5. Pipe lines shall generally be installed in a continuous manner corresponding to plan line numbers as designated on the plans. The Contractor shall not install lines in a manner to purposefully skip sections which would require later completion. Pipe shall be strung daily in amounts equal to the amount anticipated to be installed on that day. Pipe shall not be allowed to be left lying along the proposed line route overnight. Trench excavation and pipe installation shall be in compliance with the City inspector's recommendations or requirements. The Contractor shall fully comply with City's requirements and any shutdowns or delays caused by the Contractor's noncompliance shall be at the Contractor's expense.
6. All fittings in water mains shall be provided with reaction backing. Reaction backing will be accomplished by installing either concrete thrust blocks or mechanical joint restraints. Concrete

thrust blocks shall conform to the dimensions given on the plan sheets. When concrete thrust blocks are used, the water line shall not be pressurized until after the concrete has cured for at least seven days. Fittings anchored by tie rods shall have at least two 3/4" steel rods fastened with clamps around the fitting and around the main.

7. Pipe shall be installed with straight horizontal and vertical alignment at the proper design grade. In locations where bends in the pipe are necessary, the bends shall be accomplished using either fittings or the manufacturer's permissible joint deflection. In no case shall the pipe be bent to achieve alignment changes.
8. The Contractor shall take necessary measures to prevent foreign material from entering the pipe while it is being installed. Pipe trenches shall be dewatered during pipe installation. Special protection shall be provided at open pipe ends to prevent entry of any foreign material. At all times when the pipe is left unattended, the pipe ends shall be plugged using an approved mechanical device to prevent entry of material.
9. As the pipe is installed, the trench shall be backfilled and bedded in accordance with the standard detail plan sheets and the specifications. Pipe bedding and trench backfill material shall be installed in layers and fully compacted. Excess excavated and unsuitable backfill material shall be disposed of by the Contractor at location(s) determined by the Contractor, and using disposal methods in full compliance with all applicable laws. The Contractor shall take measures to clean up/repair damage as the work progresses. The Engineer reserves the right to shut down the Contractor's pipe laying until sufficient progress is made toward cleanup/repair. Any loss of time due to shutdown as a result of improper cleanup/repair shall not be considered for time extension.
10. Following main line installation, the water line shall be thoroughly flushed, pressure tested, disinfected, and bacteriologically tested. The water line shall not be placed in service until all required tests have been passed and the Engineer authorizes placing the line in service. It is the Contractor's option whether to make taps for proposed service connection before or after pressure testing the main.
11. All water lines (mains and service lines) shall have a detectable underground marking tape installed above the pipe. The marking tape shall be installed at a depth of approximately 4"-12" below the finished ground surface. The marking tape shall be continuously lettered with the caption "CAUTION: BURIED WATER LINE BELOW", detectable by a metal locator, and equal to Lineguard, Inc., detectable marking tape Type III.
12. Prior to project closeout, the Contractor shall clean up all construction debris and restore all surfaces disturbed by construction to as near to their "before construction" condition as possible. All paved areas damaged by construction shall be resurfaced. The Contractor shall restore all areas within City street right-of-ways to the satisfaction of the City Inspector. All grassed areas shall be reseeded with a seed mixture to match the existing surface. Prior to seeding, all disturbed surfaces shall be raked to remove all large rocks, clods, or other debris which could interfere with grass growth. In lawns and other areas subject to mowing, the final surface shall be free of stones and smooth enough to allow mowing. The Contractor shall take all measures necessary to restore grass; including but not limited to reseeding, topsoiling, fertilizing, mulching, or watering - at no additional cost to the Owner. Because final cleanup and restoration is often difficult to achieve to the satisfaction of all parties, the Contractor is highly advised to document the before construction conditions with either photograph or videotape.

- 3.2 SEPARATION OF WATER LINES AND SANITARY SEWERS - Water lines shall be separated from sanitary sewer lines in accordance with the Virginia Department of Health's Waterworks Regulations. Water lines shall be laid at least ten feet horizontally from sewer lines and sewer manholes whenever possible, the distance shall be measured edge-to-edge.

In locations where water/sewer line crossings are required, the water line 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. In locations where the 10 foot horizontal or 18" vertical separation cannot be achieved, the City Engineer shall be notified and work shall cease until the City Engineer resolves the situation. The water line will either be re-routed to provide the required separation or special measures may be authorized, including the following: When local conditions prevent a horizontal separation of ten feet, the water line may be laid closer to a sewer main or sewer manhole provided that: (1) the bottom of the water line is at least 18 inches above the top of the sewer; (2) where this vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint water pipe, pressure-tested in place for two hours at 50 psi without leakage prior to backfilling; and (3) the sewer manhole shall be of watertight construction and tested in place with zero leakage.

When local conditions prevent the desired 18" minimum vertical separation, the following construction shall be used: (1) sewers passing over or under water lines shall be constructed of mechanical joint water pipe, pressure tested in place for two hours at 50 psi without leakage prior to backfilling; (2) water lines passing under sewers shall, in addition, be protected by providing:

- a. a vertical separation of at least 18 inches between the bottom of the sewer line and the top of the water line,
- b. concrete encasement of the water line up to the sewer line to prevent pipe deflection,
- c. the water line be centered at the point of the crossing so that water line joints shall be equidistant from the sewer.
- d. Sewer Manholes: If a water line passes within 10 feet of a sewer manhole, the sewer manhole shall be tested with zero leakage provided with a waterproof frame and cover.
- e. Sewers or Sewer Manholes - No water pipes shall pass through or come in contact with any part of a sewer manhole or any sewer line.

In no case shall the Contractor construct water lines without the minimum required 10-foot horizontal or 18-inch vertical water/ sewer separation unless approved by the City Engineer.

- 3.3 BORINGS FOR UTILITIES (UNDER ROADS) - Unless specifically noted otherwise on the plans, all utility lines crossing paved City streets shall be accomplished by open cutting the pavement. Steel encasement of the carrier pipe is only required in those locations specifically designated. All road crossings shall be accomplished in accordance with the City inspector's requirements. In those locations where boring is specified, the Contractor shall first conduct at least three (3) bore attempts before special permission to open cut is requested. During boring or open cut installation, the Contractor shall maintain traffic flow on the roadway.

All carrier pipes installed inside encasement shall be metal (ductile iron or copper as applicable). The Contractor shall exercise extreme care to ensure that the road crossings are installed to the design depth and slope. Carrier pipes shall be supported by fabricated spiders strapped to the pipe or adjustable mechanical spacers. The pipe supports shall prevent any part of the carrier pipe from coming in contact with the casing. The casing pipe shall be ASTM A53 Grade B & shall conform to Section 232.02(c)5 of the 2007 VDOT Road & Bridge Specifications. The minimum required wall thickness for the steel casing pipe shall be the lesser of ASTM A53 Standard Weight Class for the casing size or 0.5 inches. The casing pipe shall be fabricated to the required length prior to installing the casing in the bore hole. The minimum size diameter casing pipe used for road and railroad crossings shall generally be a minimum of six inches larger than the largest outside diameter of the carrier pipe. A table of the required casing pipe sizes is shown on the standard detail plan sheets.

At open cut road crossings, the existing pavement shall be saw cut on either edge of the pipeline trench to minimize damage to the adjacent pavement. Following pipe installation the crossing shall be backfilled

full depth with compacted crushed stone. Pavement overlay of the crossing shall be conducted in accordance with the standard detail plan sheets.

- 3.4 AGGREGATE AND PAVING - Following pipeline installation, disturbed roadways and shoulders shall be repaired. Repair disturbed gravel roadways, driveways, and shoulders. Repair disturbed paved driveways with local material plant mix bituminous concrete. Repair disturbed public roadway pavement in accordance with the standard detail plan sheets and the VDOT Highway Permit.
- 3.5 INSPECTION AND TESTS - Following installation but prior to placing into service, all water mains shall be subjected to and pass pressure tests, be disinfected, and pass bacteriological testing.
- 3.5.1 Pressure Testing - After installation, all piping shall be thoroughly flushed by opening hydrants or blowoffs as appropriate. All pressure pipe lines shall then be subjected to a hydrostatic test of 150% of the actual working pressure of the line being tested for not less than 2 hours during which time the leakage loss shall not exceed the number of gallons per hour for each section tested, as determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{148,000}$$

L = maximum allowable Leakage, in gallons per hour

S = Length of line under test, in feet

D = Nominal diameter of the pipe, in inches

P = Average test pressure, in psi

Each valved section of water line shall be individually tested between gate valves so that each side of each gate valve is pressurized with the required test psi on one side and zero psi on the other side. Pressure testing shall be conducted as near the high point in the line segment as possible.

The Contractor shall provide all equipment required for the pressure testing and shall be solely responsible for conducting the test. All testing equipment shall be in good working order, to the satisfaction of the Engineer. Pressure testing shall only be conducted under the direct supervision of the Engineer. In the event that any section under test shows leakage in excess of the allowable amount, the Contractor shall make such repairs to the line as are required to bring the loss within the required limits. Any visible leaks shall be repaired, regardless of the test results. The test pressure shall be maintained within +/- 5 psi of the required test pressure at all times during test.

- 3.5.2 Disinfection - All water lines shall be disinfected prior to being placed in operation. Prior to disinfection all water lines shall be flushed and pressure tested. All valves and hydrants shall be operated during line flushing. Flushing velocities shall not be less than 2.5 ft/sec.

The contractor shall be responsible for all costs associated with testing. The Owner shall provide the Contractor with enough water to fill, flush, and test the lines one time at no charge. The Owner reserves the right to bill the Contractor for water required for additional flushing. Lines shall be disinfected by chlorination using the following method:

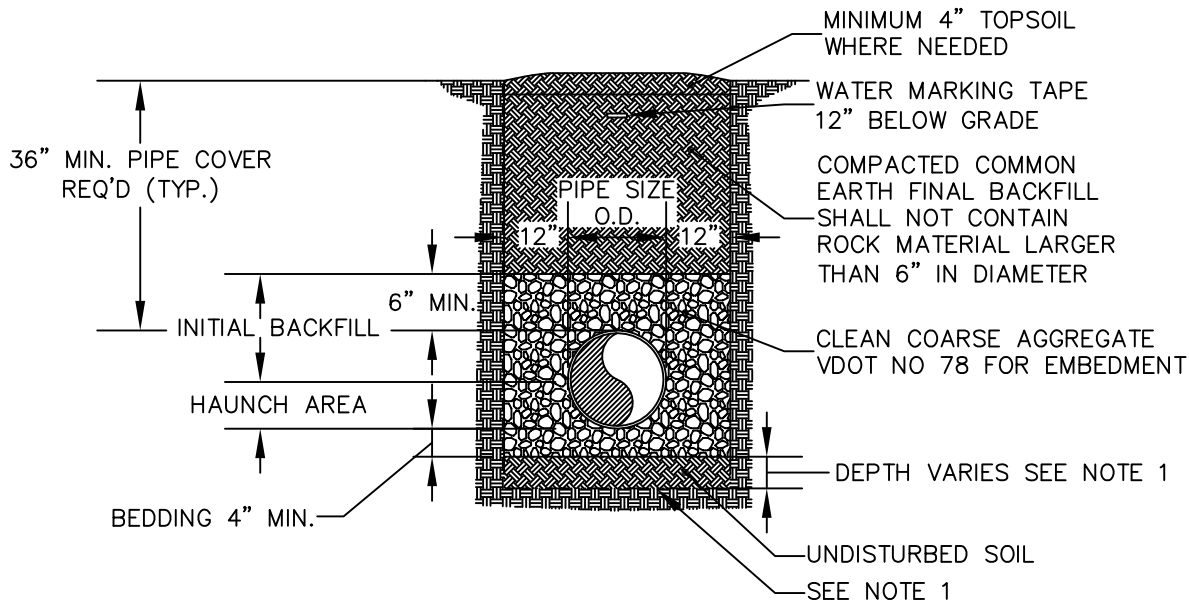
Continuous Feed Method - Potable water shall be introduced into the pipe main at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/l. The chlorinated water shall remain in the pipe line at least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

After disinfection using the previously discussed method, the heavily chlorinated water shall be flushed from the mains using potable water. The chlorinated water shall not be directly discharged to any creek or stream. After flushing, the mains shall be tested for bacteriological contamination. Two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a Virginia licensed laboratory. The results of these samples must indicate no coliform contamination before the

pipe, tanks or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedure and subsequent testing must be repeated.

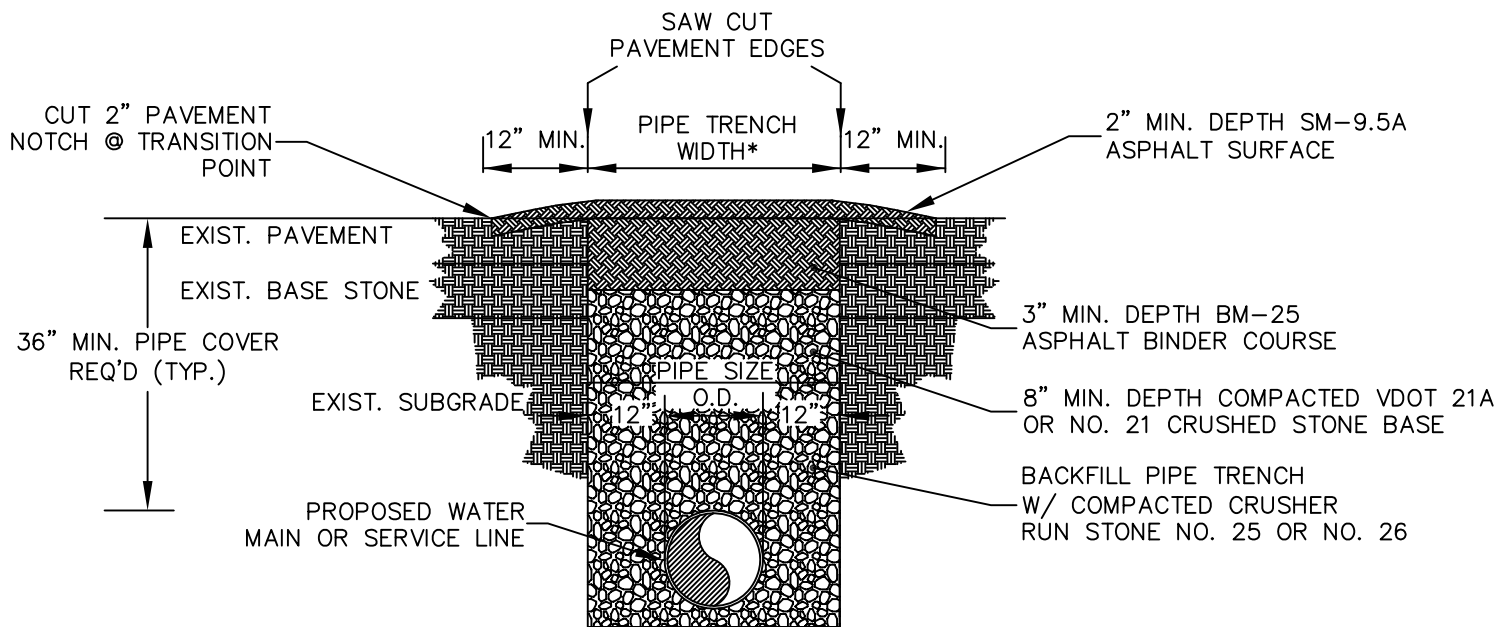
Samples shall be collected at regular intervals, not exceeding 1,200 feet throughout the length of pipe line installed. Additionally, sample sites shall be located at the end of all main lines and at least one sample site on each branch line.

**STANDARD DETAIL
CONSTRUCTION DRAWINGS**



TRENCH DETAIL - UNPAVED AREAS

1. VDOT #1 OR #2 FOUNDATION STONE SHALL BE REQUIRED WHEN SOIL BEARING CONDITIONS ARE UNSTABLE
2. AN ADDITIONAL 1-INCH OF BEDDING MATERIAL WILL BE REQUIRED FOR EACH ADDITIONAL 2-FOOT OF TRENCH DEPTH IN EXCESS OF 16-FOET UP TO A MAXIMUM OF 12-INCHES
3. THIS DETAIL APPLIES TO INSTALLATION OF WATER LINES IN ALL UNPAVED AREAS.



TRENCH DETAIL - PAVED AREAS

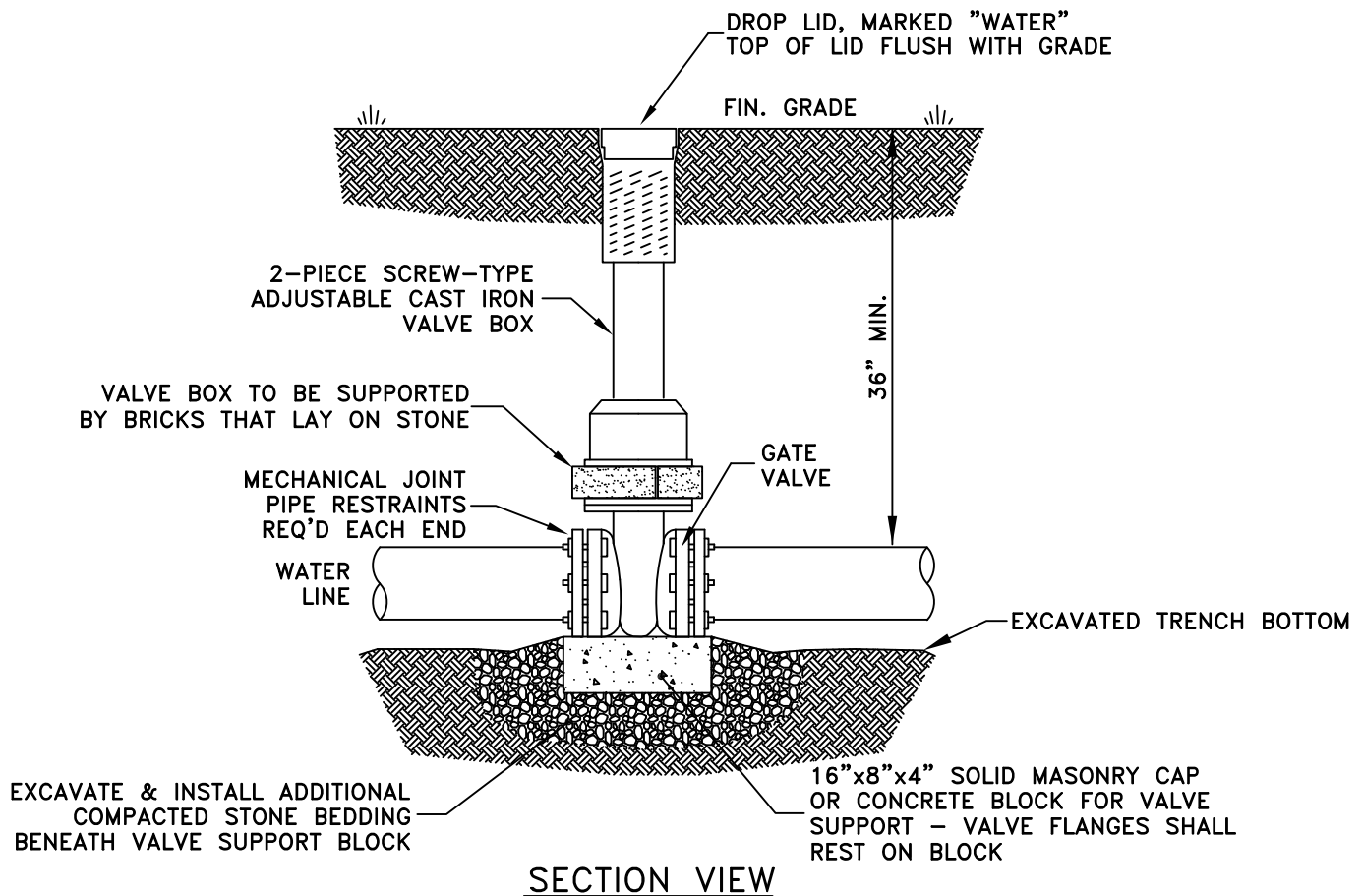
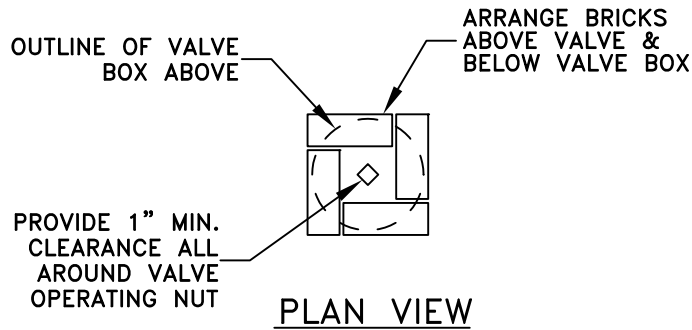
1. THIS DETAIL APPLIES TO INSTALLATION OF WATER LINES IN PAVED AREAS.
2. PIPE TRENCH THROUGH PAVED AREAS SHALL BE SAW CUT.
3. PIPE TRENCH SHALL BE BACKFILLED FULL DEPTH W/ CRUSHED STONE THROUGH PAVED AREAS.
4. REQUIRED PIPE TRENCH WIDTH SHALL BE 24" FOR WATER SERVICE LINES AND 36" FOR WATER MAINS.
5. CONTRACTOR SHALL STAGE CONSTRUCTION AND IMPLEMENT TRAFFIC CONTROL AS REQUIRED TO MAINTAIN TRAFFIC FLOW DURING CONSTRUCTION.

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**WATER LINE BEDDING
MASTER DETAIL**

**FIGURE
W1**



TYPICAL GATE VALVE

1. ALL BURIED VALVES SHALL HAVE MECHANICAL JOINT END CONNECTIONS.
2. VALVE SHALL BE RESTRAINED TO ADJACENT PIPE AND/OR FITTINGS USING EITHER MECHANICAL JOINT PIPE RESTRAINTS (PREFERRED) OR THREAD RODS.
3. VALVE BOX LID TO BE SET FLUSH WITH GRADE.
4. VALVE SHALL NOT BEAR ANY LOADS FROM VALVE BOX.

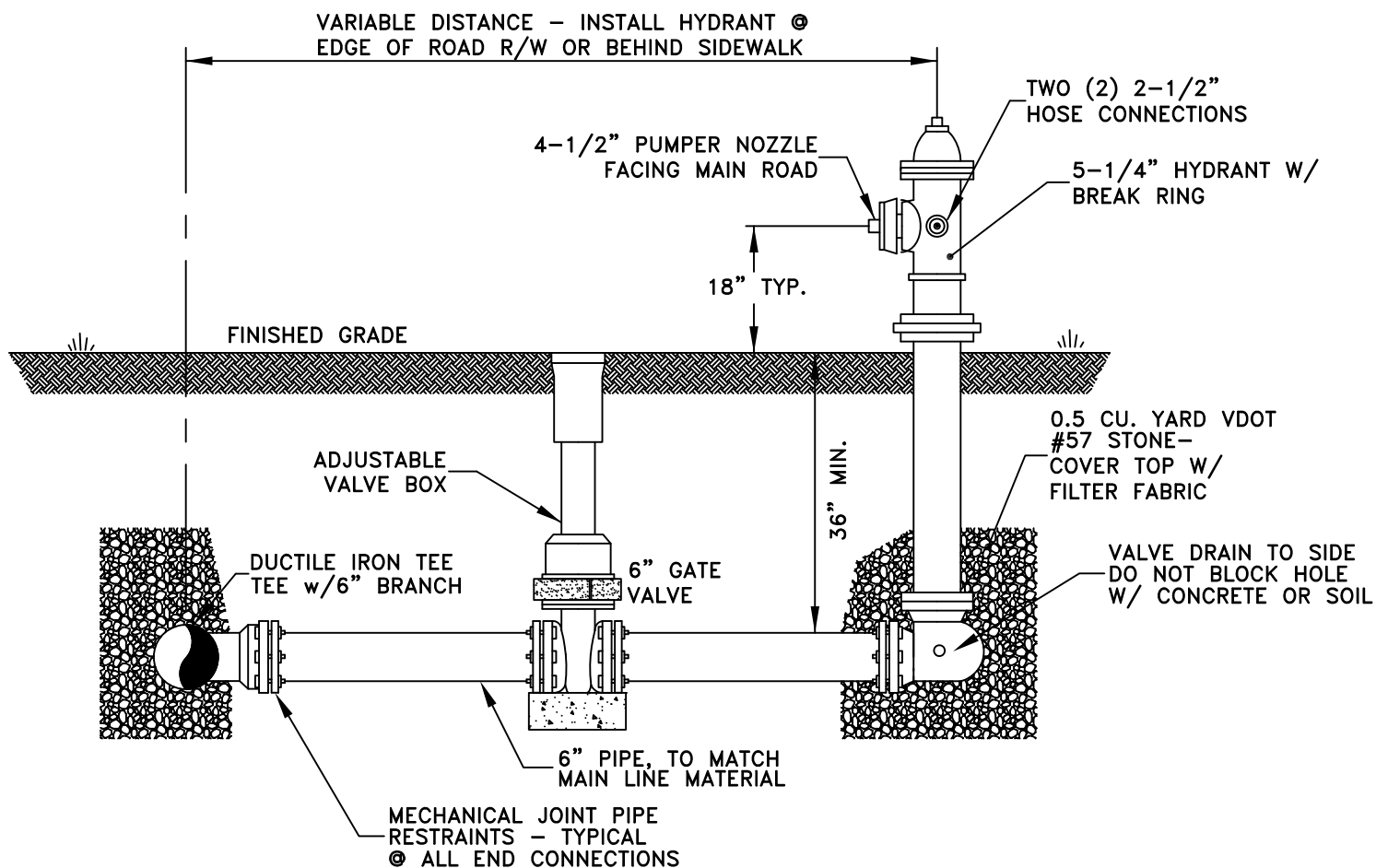
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**TYPICAL GATE VALVE
MASTER DETAIL**

**FIGURE
W2**



FIRE HYDRANT ASSEMBLY DETAIL

GENERAL NOTES:

1. ALL ITEMS SHOWN ON THIS DETAIL ARE TO BE INCLUDED IN THE UNIT PRICE BID FOR A COMPLETE FIRE HYDRANT ASSEMBLY.
2. THE ENGINEERING DEPARTMENT SHALL BE NOTIFIED AND APPROVE OF METHODS TO PROTECT THE FIRE HYDRANT'S WEEP HOLE IF THE HYDRANT IS INSTALLED IN A LOCATION WITH SATURATED SOILS, SUBJECT TO FLOODING, OR LESS THAN 10' FROM A SANITARY SEWER.
3. FIRE HYDRANTS TO BE PAINTED WITH COLOR CODING AS PER SPECIFICATIONS.

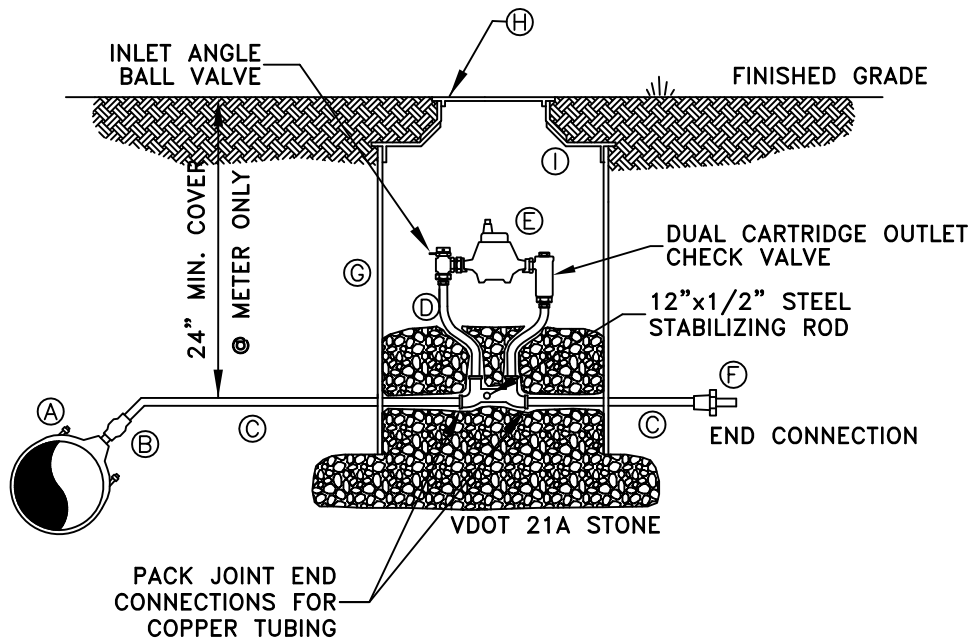
FILENAME: firehydrantmasterdetail.dwg

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**FIRE HYDRANT ASSEMBLY
MASTER DETAIL**

**FIGURE
W3**



TYPICAL 3/4" WATER METER DETAIL

	MNFR.	SIZE	MODEL NO.	DESCRIPTION
A	MUELLER	AS REQ'D	SS SERIES	SERVICE SADDLE
B	MUELLER	5/8", 3/4" OR 1"	H-15008	GROUND KEY CORP. VALVE
C		5/8", 3/4" OR 1"	TYPE K	COPPER SERVICE LINE
D	MUELLER	5/8", 3/4" OR 1"	B-2404-2A	METER SETTER
E	SENSUS	5/8", 3/4" OR 1"	SR-II	WATER METER
F	MUELLER	5/8", 3/4" OR 1"	H-14227	SERVICE END CONNECTION
G	MIDSTATE	18"x30"	POLYETHYLENE	METER BOX
H	FORD	18"	TYPE X	METER BOX LID

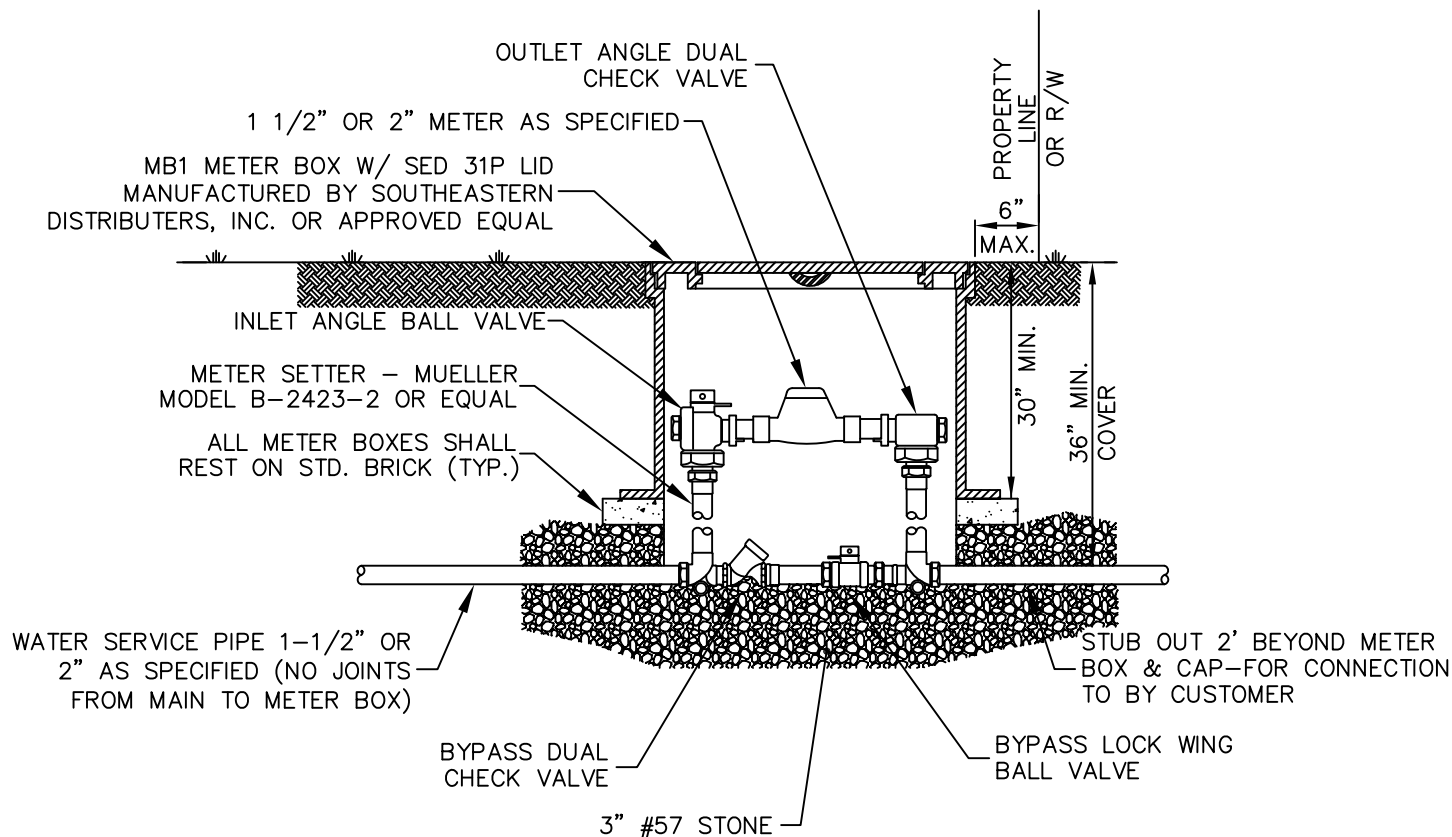
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**TYPICAL 5/8", 3/4" & 1" WATER
METER MASTER DETAIL**

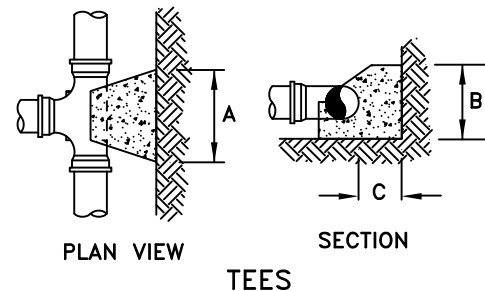
**FIGURE
W4**



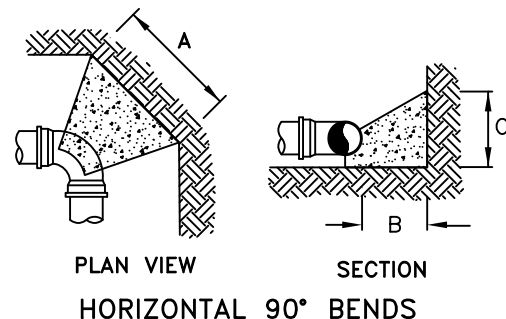
TYPICAL 1-1/2" OR 2" WATER METER DETAIL

PIPELINE THRUST BLOCK DATA

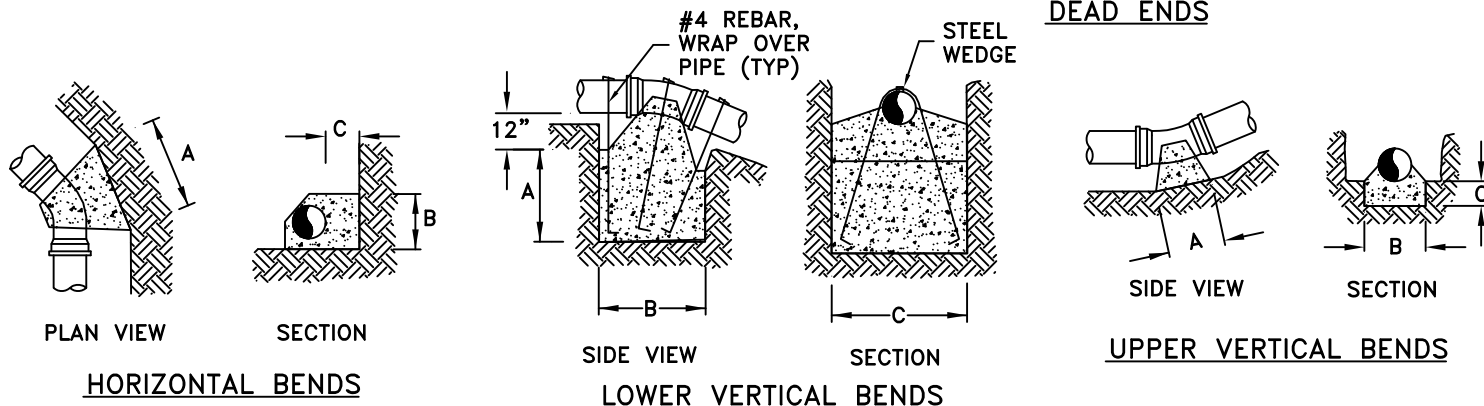
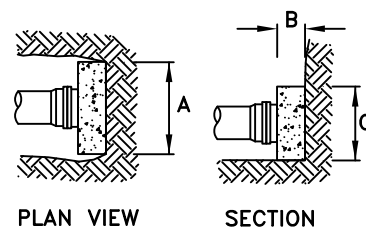
PIPE SIZE	TEES			90° BEND, HORIZONTAL			45° BEND, HORIZONTAL			22 1/2° BEND, HORIZONTAL		
	A	B	C	A	B	C	A	B	C	A	B	C
4"-6"	1.5'	1.33'	1.10'	2.33'	1.67'	1.2'	1.25'	1.2'	0.75'	0.75'	1.2'	0.75'
8"	2.0'	1.67'	1.10'	3.20'	1.75'	1.5'	2.0'	1.33'	0.75'	1.0'	1.33'	0.75'
10"	2.5'	2.0'	1.20'	3.34'	1.75'	2.1'	2.5'	1.5'	1.0'	1.5'	1.5'	0.85'
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'



PIPE SIZE	11 1/4° BEND, HORIZONTAL			45° BEND, UPPER VERTICAL			22 1/2° BEND, UPPER VERTICAL			11 1/4° BEND, UPPER VERTICAL		
	A	B	C	A	B	C	A	B	C	A	B	C
4"-6"	0.5'	1.2'	0.75'	1.25'	1.2'	0.6'	0.75'	1.2'	0.6'	0.5'	1.2'	0.6'
8"	0.67'	1.33'	0.75'	2.1'	1.5'	0.85'	1.0'	1.33'	0.67'	0.67'	1.33'	0.6'
10"	0.85'	1.5'	0.75'	2.1'	1.67'	0.85'	1.5'	1.67'	0.67'	0.85'	1.5'	0.67'
12"	1.0'	1.67'	0.75'	2.5'	1.85'	1.0'	1.75'	1.67'	0.67'	1.0'	1.67'	0.67'



PIPE SIZE	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
4"-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"	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"	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"	3.67'	5.0'	4.5'	2.5'	4.0'	4.0'	2.0'	3.0'	3.0'	3.25'	0.85'	2.33'



CONCRETE THRUST BLOCK CONSTRUCTION NOTES

1. THE PREFERRED METHOD OF JOINT RESTRAINT SHALL BE MECHANICAL JOINT RESTRAINTS. MECHANICAL JOINT RESTRAINTS SHALL BE SERIES 1100 MEGALUG FOR DUCTILE IRON PIPE AND SERIES 2000 MEGALUG RESTRAINTS. ALTERNATE MECHANICAL JOINT RESTRAINTS MANUFACTURED BY OTHERS MAY BE ACCEPTED WITH PRIOR APPROVAL OF THE PUBLIC WORKS AND ENGINEERING DEPARTMENTS. MECHANICAL JOINT RESTRAINTS SHALL BE INSTALLED COMPLETE AND IN ACCORDANCE WITH THE MANUFACTURER'S APPLICATION AND INSTALLATION INSTRUCTIONS.
2. ALL CONCRETE USED FOR THRUST BLOCKS SHALL BE 2500 PSI STRENGTH, POURED AGAINST STABLE, COMPACTED GROUND.
3. PIPES SHALL NOT BE PRESSURIZED UNTIL AT LEAST 7 DAYS AFTER THE THRUST BLOCKS HAVE BEEN POURED.
4. THRUST BLOCKS AT REDUCING FITTINGS SHALL BE SIZED BASED UPON THE LARGER PIPE SIZE.
5. IN LOCATIONS WITH WET OR OTHERWISE UNSTABLE GROUND, THE CONTRACTOR SHALL USE MECHANICAL JOINT PIPE AND RESTRAINTS WITH TIE RODS INSTEAD OF CONCRETE THRUST 3 BLOCKS.

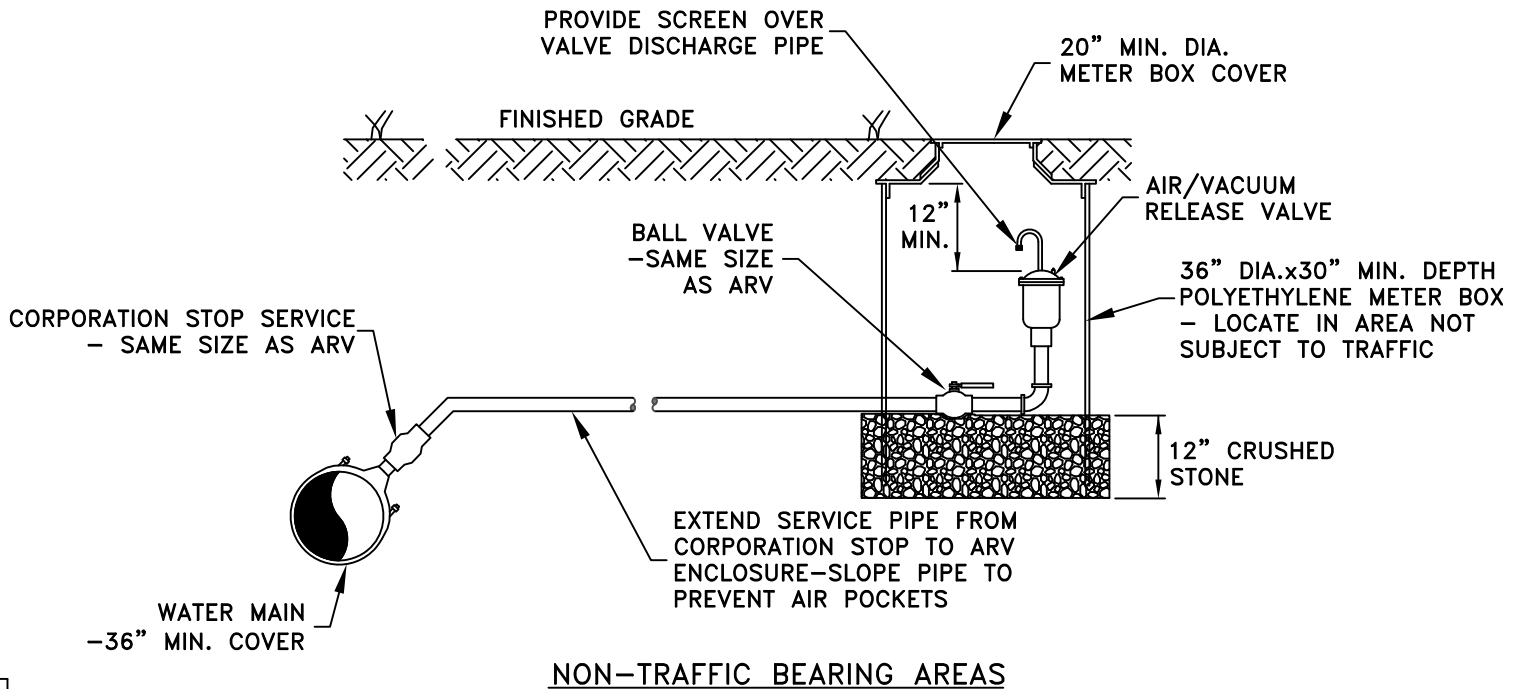
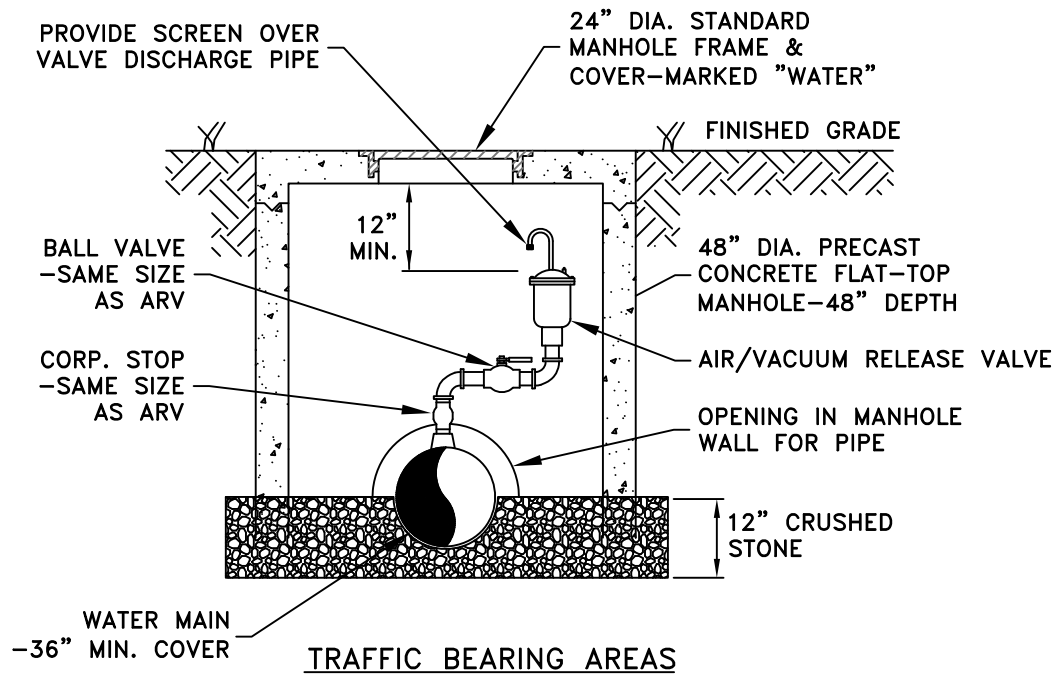
CONCRETE THRUST BLOCK INFORMATION

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**CONCRETE THRUST BLOCK
MASTER DETAIL**

**FIGURE
W6**



WATER AIR/VACUUM RELEASE VALVE

NOTES:

1. DETERMINATION OF TRAFFIC BEARING OR NON TRAFFIC BEARING TO BE BASED UPON FIELD CONDITIONS.
2. REFER TO PLAN SHEETS FOR REQUIRED AIR/VACUUM VALVE SIZE.

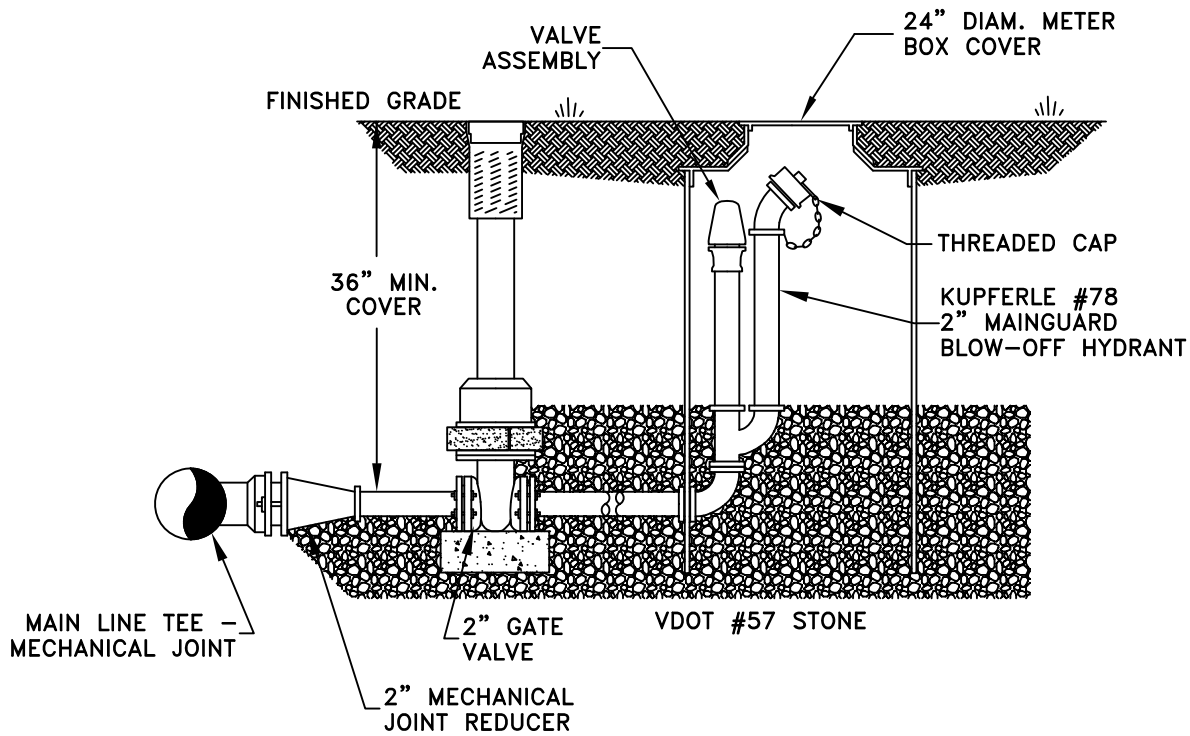
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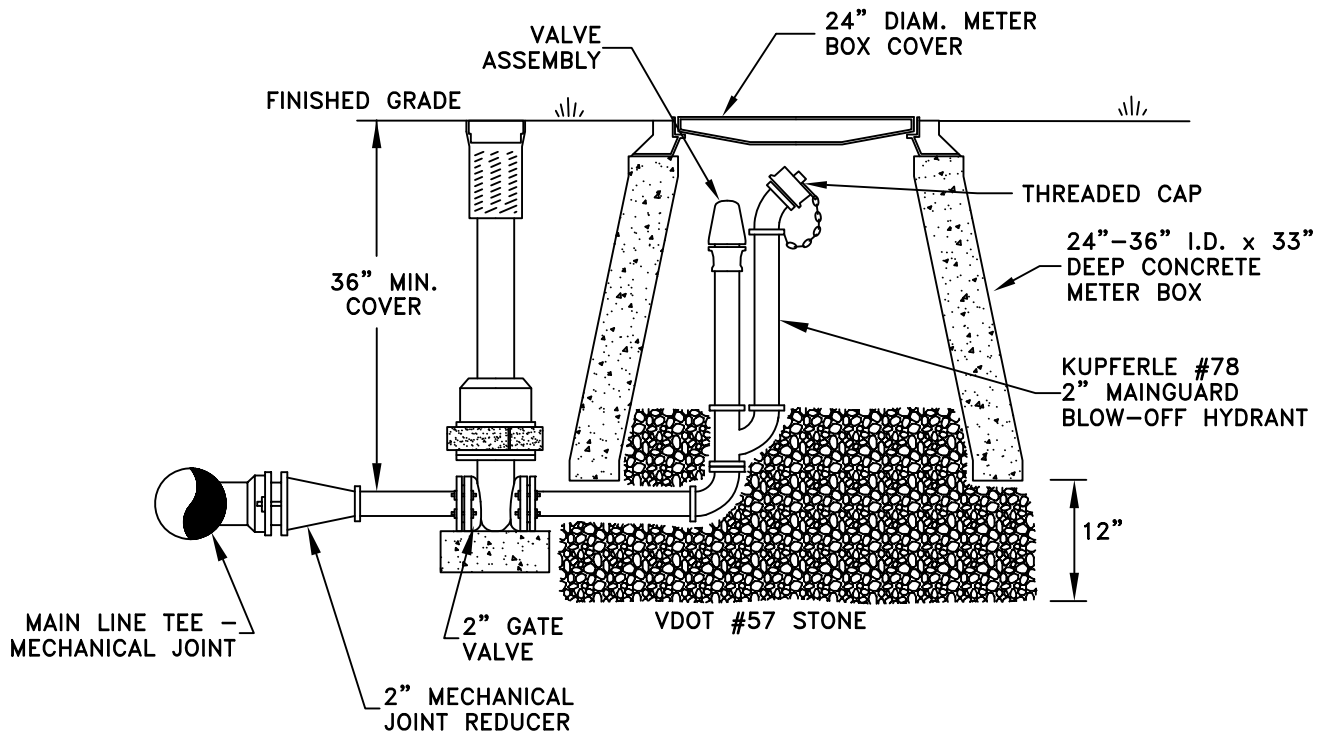
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**WATER AIR/VACUUM RELEASE
VALVE MASTER DETAIL**

**FIGURE
W7**



2" BLOWOFF VALVE - NON-TRAFFIC BEARING AREAS



2" BLOWOFF VALVE - TRAFFIC BEARING AREAS

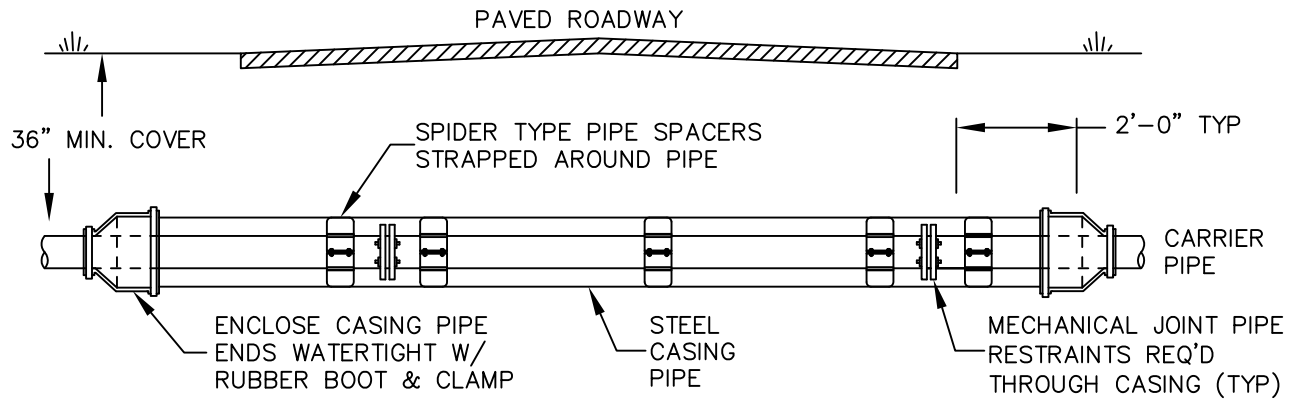
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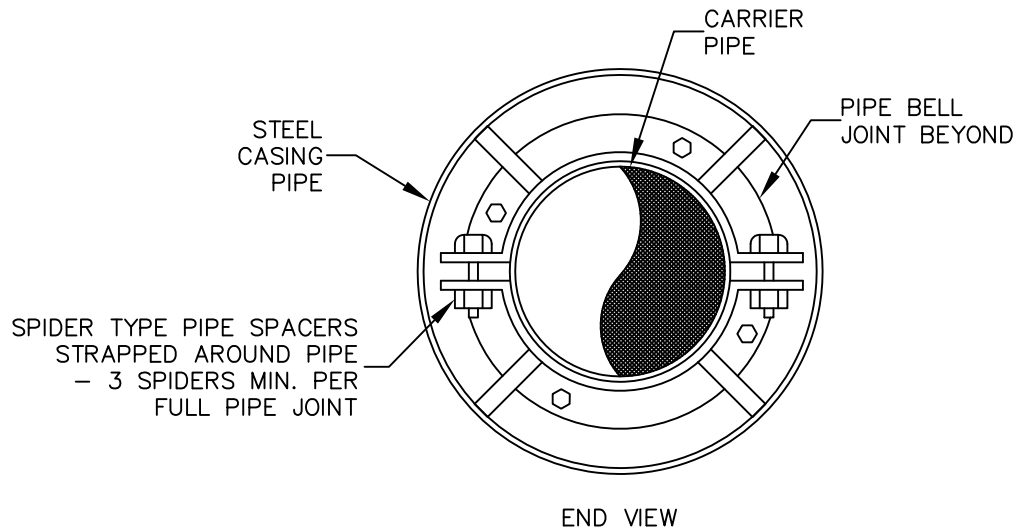
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**2" BLOWOFF VALVE
MASTER DETAIL**

**FIGURE
W8**



ENCASEMENT TABLE	
CARRIER PIPE DIAM.	MINIMUM CASING PIPE DIAM.
3"	12"
4"	12"
6"	14"
8"	16"
10"	18"
12"	24"



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 2001 VDOT ROAD AND BRIDGE STANDARDS.

STEEL ENCASEMENT DETAIL

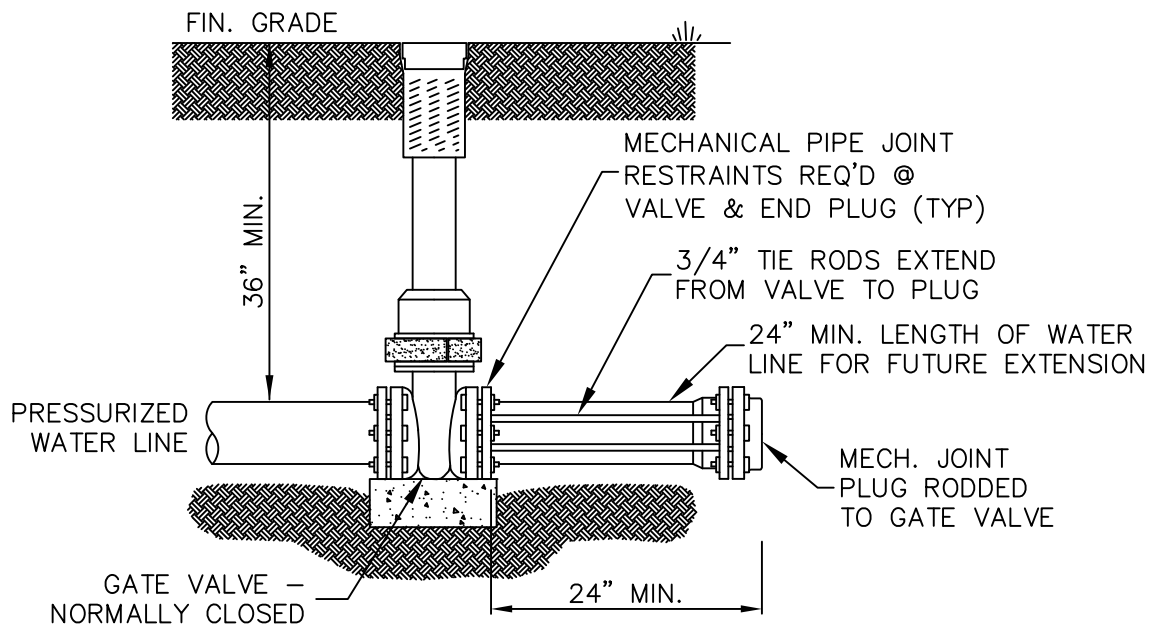
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**STEEL ENCASEMENT
MASTER DETAIL**

**FIGURE
W9**



FUTURE WATER LINE EXTENSION DETAIL

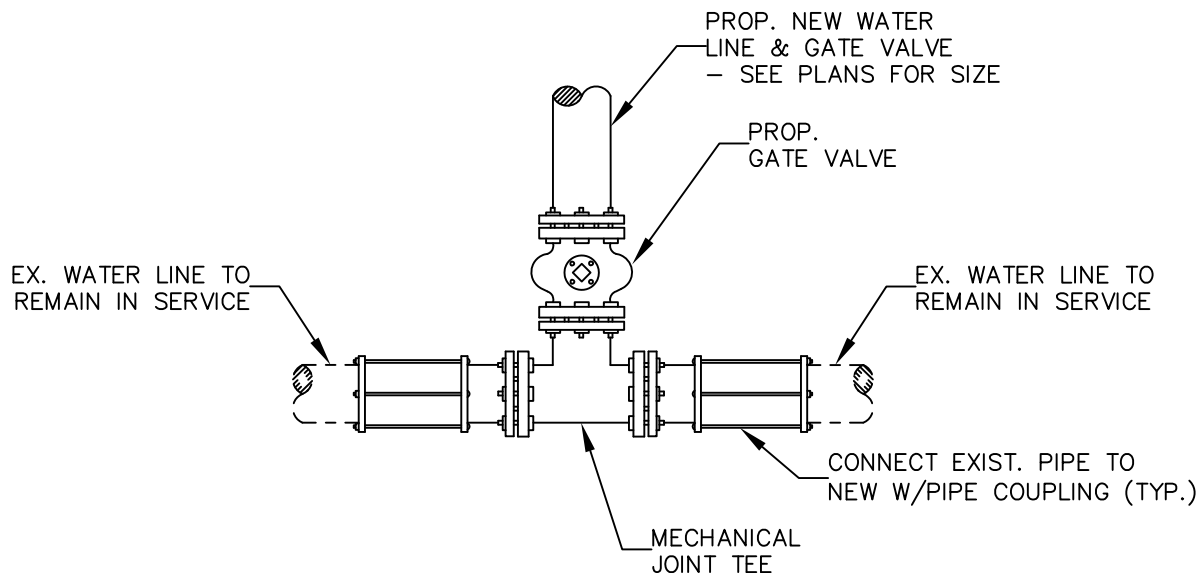
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CITY OF GALAX

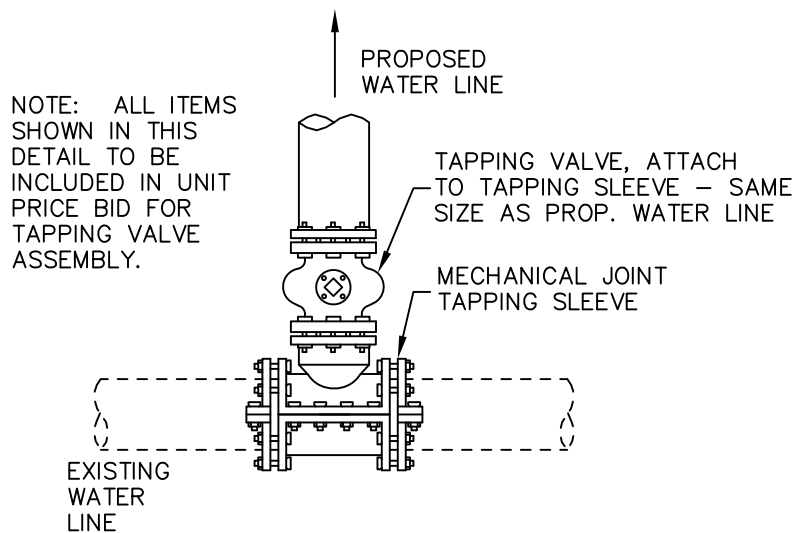
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**FUTURE WATER LINE
EXTENSION MASTER DETAIL**

**FIGURE
W10**



CUT/SLEEVE TEE CONNECTION DETAIL



TAPPING VALVE ASSEMBLY DETAIL

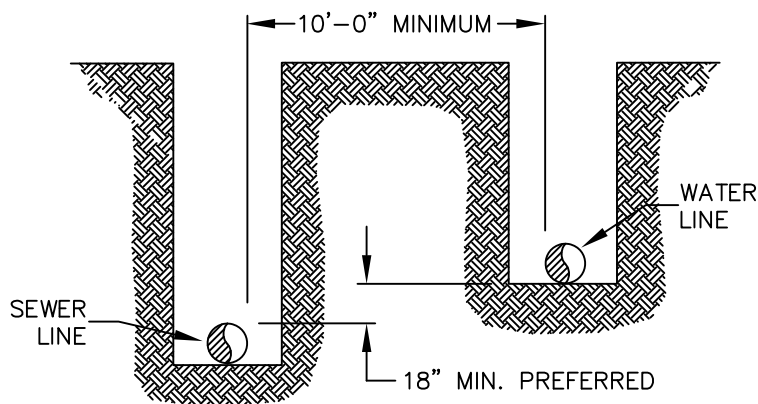
1. NO CUT/SLEEVE CONNECTIONS TO BE MADE TO CITY LINES WITHOUT AUTHORIZATION.
2. PRE-ASSEMBLE FITTINGS TO MINIMIZE THE AMOUNT OF TIME REQUIRED FOR THE EXISTING WATER TO BE SHUT OFF.

CITY OF GALAX

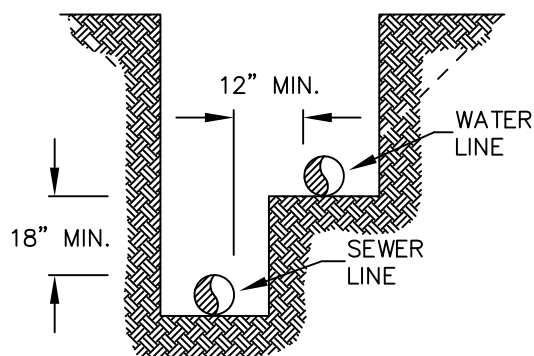
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**CUT/SLEEVE & TAPPING
VALVE MASTER DETAIL**

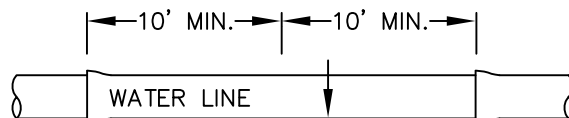
**FIGURE
W11**




HORIZONTAL SEPARATION

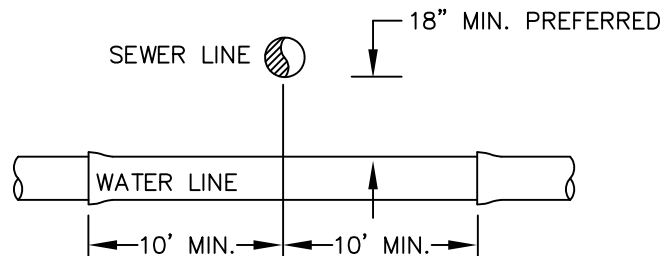


VERTICAL SEPARATION

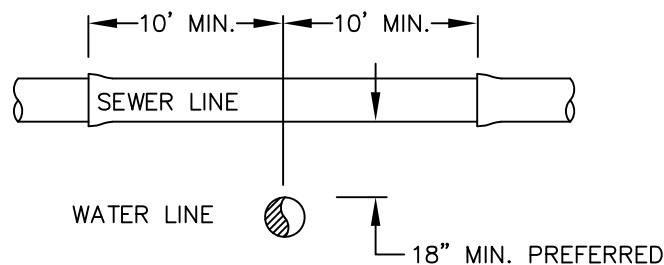


SEWER LINE  18" MINIMUM

PREFERRED CROSSING METHOD



ALTERNATE CROSSING METHOD



ALTERNATE CROSSING METHOD

WATER & SEWER CROSSING DETAILS

NOTE:

IN LOCATIONS WHERE WATER LINES CANNOT BE INSTALLED A MINIMUM OF 18" ABOVE A SEWER LINE, THE SEWER LINE SHALL BE CONSTRUCTED OF D.I. CL50 WATER LINE AND PRESSURE TESTED PRIOR TO BEING PLACED IN SERVICE, WATER LINE JOINTS ARE TO BE LOCATED EQUIDISTANT FROM THE SEWER LINE, AND A CONCRETE CRADLE IS TO BE POURED BETWEEN THE WATER AND SEWER LINES.

FILENAME: linecrossingmasterdetail.dwg

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**WATER & SEWER CROSSING
MASTER DETAIL**

**FIGURE
W12**