# Town of Blacksburg

# Standards & Specifications

# Water Distribution System

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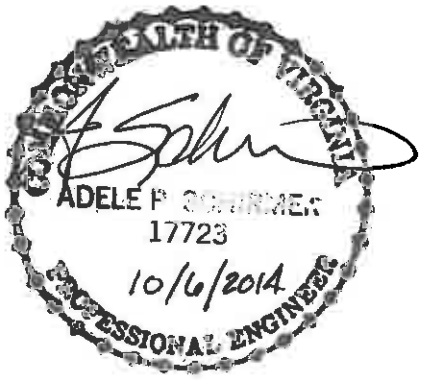

**TOWN OF BLACKSBURG**

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WATER DISTRIBUTION SYSTEMS

## 1.10 GENERAL

The following "SPECIFICATIONS AND STANDARDS FOR WATER DISTRIBUTION SYSTEMS" shall be followed for construction of all water distribution systems unless otherwise authorized by the Director of Engineering and GIS. The Director of Engineering and GIS reserves the right to waive any or all parts of the "SPECIFICATIONS AND STANDARDS" in specific instances as he/she deems appropriate, except where Virginia Department of Health regulations would be violated by such a waiver (the term "Director of Engineering and GIS" refers to the Director or the authorized representative of the Engineering and GIS Department).

These specifications are intended to supplement the Blacksburg Town Code.

Plans for water distribution facilities shall be prepared by, or under the supervision of, a registered professional engineer legally qualified to practice in Virginia who shall affix a signed imprint of his/her seal to each plan or plan-profile sheet and to engineer's reports.

In addition, in accordance with Section 54.1-408 and Section 54.1-409 of the Code of Virginia, a licensed land surveyor B or a certified landscape architect may prepare plans for water line extensions as a part of subdivisions, site plans, and plans of development. An imprint of a signed land surveyor B or certified landscape architect seal shall be affixed to the plans and/or plan-profile sheet.

Variances to the provisions in these specifications shall be granted only when all of the following provisions apply:

1. The requested variance is not detrimental to the public health safety and welfare.
2. There is no reasonable design solution to avoid the need for the requested variance, and the variance could not have been anticipated during the preliminary subdivision or preliminary planning phases of a project.
3. The requested variance is beneficial for operation and maintenance of the public utility system.
4. The variance decision shall be applicable to similarly situated properties and conditions.

Any variance to the provisions of these specifications shall be requested in writing and the above listed findings shall be documented and approved by the Director of Public Works (1 and 3) and the Director of Engineering & GIS (1 and 2).

## 1.11 (reserved)

## 1.12 APPROVAL

Four sets of plans and design data shall be submitted to the Director of Engineering and GIS for each water distribution facilities project. These shall be reviewed and one set returned to the Engineer with recommended changes and/or approval. After necessary changes are made, the original drawings and completed water data sheet shall be delivered to the Director of Engineering and GIS who shall sign each sheet with his/her approval. Note: The Virginia Department of Health must review and approve all waterlines greater than 12 inches in diameter.

## 1.13 (reserved)

## 1.14 APPROVED PLANS

No work shall commence on any water system until the contractor has in his possession a copy of the Town general specifications with plan details and any standards (such as AWWA Standards) along with a complete set of approved plans prepared by a registered engineer, whose signed seal shall appear on each plan sheet. Each set of plans shall also be approved and signed by the Director of Engineering and GIS. Any significant change from the original approved plans shall require an additional approval from the Director of Engineering and GIS. Verbal approval from the Town Inspector shall be sufficient for minor changes. The Town Inspector shall decide whether a change is a minor change or a significant change.

## 1.15 (reserved)

## 1.16 BONDING

An acceptable security or performance guarantee will be required to cover the construction of all water lines, valves, fire hydrants, etc., to be constructed by developers. After the plans have been approved the amount of security will be determined by the Director of Engineering and GIS. Upon receiving the security, the plans will be signed.

After acceptance of the constructed water facilities and a complete set of as-built plans have been received by the Town, the project will be accepted by the Engineering and GIS Department. The contractor/developer will be held responsible for a period of one year from the date of acceptance to cover any defects in construction. Date of acceptance is defined as the date that the last item in following list is completed: the punch list items are completed, approved as-built drawings are received by the Town, and securities are released by the Town.

## 1.20 DESCRIPTION

Water distribution systems shall consist of ductile iron or copper pipes of all types, classes, and sizes shown on the plans, together with the required fittings, valves, fire

hydrants, and other appurtenances shown on the plans and profiles, or as authorized by the Engineering and GIS Department. All water distribution systems and appurtenances shall be installed in accordance with these specifications and standards, and shall conform to locations and grades specified in the plans.

## 1.30 SYSTEM DESIGN

1.31 Capacity of Waterworks – The design capacity of the waterworks shall exceed the maximum daily water demand of the system. Waterworks shall normally be designed utilizing daily water consumption rates listed in 12 VAC 5-590-690 of the Waterworks Regulations. If deviations are made, they shall be based on sound engineering knowledge substantiated in the designer's report and approved by the Director of Engineering and GIS. The following flow formulas shall be used in calculating minimum daily water consumption rates.

a. Q avg daily = 400N/1440
b. Q max daily = (400N/1440) x 2
c. Q peak hourly = $11.4(N)^{0.544}$
d. Q design = Q max daily + Q fire flow

Where Q = Total gallons per minute, and N = Total number of residential units.

Water service and plumbing must comply with the requirements of the Uniform Statewide Building Code.

The system shall be designed to maintain a minimum pressure of 20 psi at the water meter in the distribution system at the design flow. Where pressures exceed 80 psi at the service tap, the provisions of the Uniform Statewide Building Code are to apply.

1.32 Connection to Main – Where there is more than one subsystem available for connection, the location of the connection shall be determined by the Director of Engineering and GIS.

1.33 Fire Protection – Flows required for fire protection shall be a minimum of 1,000 gpm and subject to applicable requirements of the National Fire Protection Agency, Insurance Services Office, and State and local agencies. Fire flow less than 1,000 gpm may be used in accordance with ISO fire rating schedule recommendations with the approval of the Director of Engineering and GIS.

Fire hydrant spacing will not exceed the following: (1) a hydrant will be set at all intersections more than 400 feet apart; (2) a hydrant will be set at the end of all cul-de-sacs or dead end streets more than 400 feet in length; (3) in single family residential areas, the maximum distance between any lot and the nearest fire hydrant, as measured along an improved public right-of-way, shall not exceed 400 feet; and (4) in higher density residential areas and commercial sites, the maximum distance from a structure to the nearest hydrant, as measured along an improved travel way which is

accessible to emergency equipment, shall be 200 feet. Closer spacings may be required in special situations as deemed necessary.

Fire hydrants shall be installed on the public water main system. No private fire hydrants shall be permitted.

Fire Sprinkler Lines-All building sprinkler lines shall be installed separately from the domestic service lines unless approved by the Director of Engineering and GIS. An indicating valve, detector meter and appropriate cross connection assembly shall be installed on all sprinkler lines in accordance with Section 1.42, 6 and Section 1.45, 6. The detector assembly shall be installed in a vault per Figure 14 of the Standard Details of these Specifications.

Indicating Valves- Indicating valves shall be installed on all fire sprinkler lines in accordance with the National Fire Protection Agency (NFPA) 13-Chapter 4-Section A-4-6.1.1.1. They can be of the post indicating or wall mounted type. Post indicating valves shall be installed in accordance with Section 1.54, 3, d.

Detector Meter – Detector meters are required at the following locations:

a. Master meters for entire water systems.
b. Fire services or automatic sprinkler systems.

1.34 Minimum Water Main Size and Minimum Service Connection Size – The minimum size water main allowed for use where fire hydrants are to be provided or when included in a loop system is eight inches. Minimum line size for dead end lines is four inches, with approval from the Director of Engineering and GIS. However, such use shall be justified by hydraulic analysis and future water use requirements.

Provisions shall be made for logical future extensions at all proposed or existing street connections. Future extensions shall be provided with a gate valve and two full joints of pipe. This pipe shall be properly plugged, blocked, disinfected and pressure tested along with the rest of the water system. After passing inspection, the gate valve shall be closed.

The minimum size of service connection shall be ¾ inches.

1.35 Dead Ends – All water mains shall be looped where possible. The maximum dead end line length shall be 400 feet unless otherwise approved by the Director of Engineering and GIS. The Director of Engineering and GIS shall determine the necessity and adequacy of looped water lines. Shopping centers, apartments, and other high-density developments shall be required to provide looped water lines. Such looping shall connect to main water lines at points separated by a minimum of 200 feet. Where dead end lines occur, they shall be provided with a fire hydrant (8 inch line or larger), flushing hydrant, or blow-off for flushing purposes. The flushing device shall not be directly connected to any sewer.

1.36 Minimum and Maximum Cover – The minimum depth of cover for water distribution systems shall be 48 inches, measured from the top of the pipe to the established finished grade. This minimum cover may be modified by the Director of Engineering and GIS when rock is encountered in the trench. The maximum cover shall be 8 feet.

1.37 Easements – Permanent easements of 15 feet width, minimum, shall be provided on all private property for water lines. Prior to considering an easement as permanent, all surface conditions must be restored to original or better conditions. The easement shall be stabilized within 30 calendar days of the completion of construction. Easement plats and deeds suitable for recordation, and recordation fees, shall be provided to the Engineering and GIS Department. No building or permanent structures shall be constructed within easements. No trees, shrubs, structures, fences or obstacles shall be placed within an easement which would render the easement inaccessible by equipment.

1.38 As-Built Plans - A complete set of as-built plans (one set of Mylar reproducibles and one set of blue line copies) shall be submitted to the Engineering and GIS Department upon completion of the water system. As-built plans shall show the location of easements, lines, appurtenances, service connections, and other data necessary to operate and maintain the system. As-built plans shall be delivered within 30 days of the final inspection and prior to the Town's acceptance of the installation. One complimentary set of the approved final plans shall be forwarded by the design engineer to the Virginia Department of Health. The developer/owner shall formally dedicate the water distribution system, easements and/or property to the Town of Blacksburg.

1.39 Construction Notes – The following standard notes shall be included on all water main extension plans:

1. Backflow preventers to be provided by owner.
2. All utilities will be visually inspected by the Town's inspector prior to backfilling trenches.
3. The Town will tap existing water lines and provide meters at the owner's expense.
4. Install lateral location staking per Figure 2.3.

1.40 SYSTEM COMPONENTS

Any request for use of an "approved equal" component shall be made in writing to the Engineering and GIS Department during the plan review process. The determination of the approval of the use of the "approved equal" component shall be made by the appropriate Town Departments including Engineering and GIS and Public Works Departments. Criteria used for determination of use shall be if the component meets the appropriate AWWA and/or ANSI Standard, maintenance requirements, and conformance with existing Town operations and equipment and materials.

No water distribution system component listed in this section or their housings shall be connected directly to any storm drain or sanitary sewer. Housings, including chambers and pits shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits located above the seasonal groundwater table elevation. Sump pumps may be used where other means are not practical.

1.41 Pipe and Fittings – All pipe used for potable water must be approved by the National Sanitation Foundation for water distribution piping, and all waterworks components must meet the lead-free requirements of NSF/ANSI 61.

Public water mains 4" in diameter and larger shall be ductile iron pipe. All water service connections 2" in diameter or less shall be copper in accordance with Section 1.41, 2 of these Specifications.

1. Ductile Iron Pipe – Ductile iron pipe shall conform to American National Standard A21.51 (AWWA C 151), latest revision. The pipe shall have a cement mortar lining and be seal coated, in accordance with ANSI A21.4 (AWWA C 104), latest revision. Joints shall be rubber-gasket joints of the mechanical or push-on type in accordance with ANSI A21.11 (AWWA C 111), latest revision. Ductile iron fitting, shall conform to ANSI A21.10 (AWWA C 110), latest revision. Fittings shall have double thickness cement lining and be seal coated, in accordance with ANSI A 21.4 (AWWA C 104), latest revision. The metal thickness for sizes required shall be as follows:

| Pipe Size | Thickness | Class |
|---|---|---|
| 4" | .25" BM | 51 |
| 6" | .26" BM | 50 |
| 8" | .27" BM | 50 |
| 12" | .31" BM | 50 |
| 16" | .34" BM | 50 |

2. Copper – Copper pipes shall be Type K conforming to American Society for Testing and Materials Standard ASTM B 88, latest revision (maximum size = 2 inches).

3. Casing Pipe – Casing pipe for water lines shall be welded and seamless steel with a minimum yield strength of 36,000 psi. (Steel casing pipe which is installed under a railroad shall be coated on the exterior with a bituminous coating).

The following casing sizes and wall thickness are to be used:

| Casing Size | Wall Thickness (Inches) | |
|---|---|---|
| | Highway R/W | Railroad R/W |
| 8" | 0.250 | 0.188 |

| | | |
|---|---|---|
| 10" | 0.250 | 0.188 |
| 12" | 0.250 | 0.188 |
| 14" | 0.250 | 0.219 |
| 16" | 0.250 | 0.219 |
| 18" | 0.250 | 0.250 |
| 20" | 0.250 | 0.250 |
| 24" | 0.250 | 0.281 |

1.42 Valves-

1. Gate valves shall have a minimum working pressure of 250 psig conforming to AWWA Standard C500, latest revision. The valves shall be of the nonrising stem type with an iron body, mechanical joint ends, "O" ring stem seals, resilient wedge gate. The valves shall open left (counter-clockwise) by a 2-inch square-operating nut. Gate valves shall be as manufactured by Mueller or approved equal.

1. Butterfly Valves – Butterfly valves shall have a minimum working pressure of 150 psig conforming to AWWA Standard C504, Class 150B, latest revision. Valves shall be of one piece, positive drive type with mechanical joint ends, rubber valve seats, an iron body, and permanent lubrication. There shall be mounted on each butterfly valve, a side mounted manual operated with total enclosed, permanently lubricated gearing constructed such that a maximum torque of 80 feet/lb. is required on the operator to develop the seating and unseating torques of the valve. The valves shall open left (counter-clockwise) by a 2-inch square-operating nut. All butterfly valve manufacturer brands shall be approved by the Director of Engineering and GIS.

2. Tapping Valves – Tapping valves shall meet the same specifications as gate valves, except they shall have a full, unobstructed opening to receive a full size shell cutter. It shall be standard mechanical joint type on one end and a flanged joint on the other end. Tapping valves shall be as manufactured by Mueller or approved equal. A Ford Meter Box Company valve, or approved equal, shall be used. The valves shall be subjected to a test of 300 psig and be designed for a working pressure of 250 psig.

3. Tapping Sleeves – Tapping sleeves shall be flanged joint, furnished completely with plain rubber gaskets and flanged gaskets and bolts. Connecting flange between sleeve and valve shall conform to Manufacturers Standardization Society of the Valve and Fittings Industry Standard SP60. Tapping sleeves shall be all stainless steel, as manufactured by Mueller or approved equivalent.

4. Swing Check Valves – Swing check valves shall be iron bodied, bronze mounted and full opening. The shaft for attachment of weight and level, or spring and level shall be constructed from a noncorrosive material. The minimum working pressure shall be 150 psig and 300 psig test pressure. The valves shall be of the level-and-weight, or spring-and-lever type. Check valves shall conform to AWWA C-508, latest revision.

5. Air Release Valves and Blow Off Assemblies – Relief valves shall be of the diaphragm type with adjustable relief pressure setting, installed in accordance with the standard details where shown on the plans. Relief valves will generally not be required on distribution mains (air normally released through service lines). Blow-off assemblies (or fire hydrants, where applicable) shall be installed at the ends of dead end lines and shall be as shown on the Standard Details.

6. Backflow Prevention Device – Requirements for and suitability of backflow prevention devices shall be reviewed on a case-by-case basis. All backflow devices shall meet the requirements of A.S.S.E.

7. Pressure Reducing Valves (2 inches and larger) – Pressure reducing valves shall maintain a constant downstream pressure regardless of varying inlet pressure. It shall be hydraulically operated, pilot-controlled, diaphragm-type globe valve. The main valve shall have a single removable seat and a resilient disc. The stem shall be guided at both ends by a bearing in the valve core and an integral bearing in the valve seat. No external packing glands are permitted and there shall be no pistons operating the main valve or any pilot controls. The pilot control shall be a direct-acting, adjustable, spring loaded, normal open, diaphragm valve, designed to permit flow when controlled pressure is less than spring setting. The control system shall include a fixed manufactured in accordance with ANSI B16.1, ASTM A48, B61 and B62, adjustable from 30 to 300 psig. This valve shall be Cla-Val or approved equal. Water extension projects requiring installation of pressure reducing stations must be approved by the Virginia Department of Health prior to construction. Reference Section 1.31 of these Water Specifications. Pressure gages shall be installed on both the inlet and outlet side of the pressure reducing valve.

1.43 Valve Boxes – Valve boxes shall be two-piece, 5 ¼-inch shaft, 8-inch diameter base of cast iron construction with cover which shall be marked "Water". The top section shall be adjustable for elevation and shall be set to allow equal movement above and below finished grade. The base shall be centered over the valve and shall rest on compacted backfill which has been compacted around the valve box for a distance of four feet on all sides of the box. The top of the base section shall be approximately on line with nut at top of valve system and the entire assembly shall be plumb. Valve boxes shall be adjusted flush with the finish grade. Where valve boxes are located in the road shoulder or ditchline, they shall be set a maximum or two inches below finished grade to preclude damage from road maintenance equipment. Valve boxes shall be gray iron valve boxes and manufactured by East Jordan Iron Works, Inc., Product Number 85502737 or equal, meeting ASTM A48 CL35B and AASHTO M306 specifications.

1.44 Fire Hydrants – All fire hydrants shall have full 360 degree revolving heads and be of the safety flange, breakway top type, meeting requirements of AWWA C502, latest revision. Hydrants shall have a barrel diameter no smaller than 5-1/4-inch, a hydrant valve diameter no smaller than 6 inches, and shall be equipped with two 2.5-inch hose nozzles and one 4-1/2-inch pumper outlet. Hose and pumper outlet threads shall be

National Standard Thread. The direction of opening shall be cast on the head of the hydrants and shall be counter-clockwise. Hydrants shall be painted one coat of primer and two finished coats of an approved red paint. Hydrant shall be manufactured by Mueller Company, Kennedy, or approved equal. Tops shall be painted per flow test data in accordance with the National Fire Protection Association Standards. If the flow at a hydrant is greater than or equal to 1000 gpm, the top shall be painted green. If the flow at a hydrant is between 500 to 1000 gpm, the top shall be painted orange. If the flow is less than 500 gpm, the top shall be painted red.

1.45 Meter Settings – Meter settings shall include corporation stops, curb stops, meter yoke, meter box, barrel, and all appurtenances necessary to providing customer water service at the location designated on the plans or as directed by the Director of Engineering and GIS . All lateral installations must be accomplished by direct tapping, no tapping saddles are allowed. Meter barrels and vaults shall be installed plumb, directly over meter setting with fill carefully tamped. The barrel or vault shall be set within the utility strip located along the Town right-of-way.

1. Corporation Stops – Corporation stops shall have flared fittings and conform to AWWA Standard C-800, latest revision and shall be as manufactured by Mueller, Hays, Ford or approved equal.

2. Curb Stops – Curb stops shall have flared fittings on both ends and be Mueller Mark II Oriseal valve or equal.

3. Meter Yokes – Meter yokes shall be of the riser-type complete with key operated shut-off valve on the inlet side of the yoke. The yoke shall be Ford Type Y-502 or equal.

4. Meter Box – Meter boxes shall be cast iron in traffic bearing locations, plastic, or fiberglass and shall be 20 inches long by 10 inches wide by 16 inches in depth. Plastic or fiberglass boxes shall not be used in paved areas. Box lid shall be cast iron and have the words "Water Meter" plainly cast therein. Meter box and lid shall be as manufactured by the Mueller Company, Ford or equal.

5. Meter – Water meters shall be paid for by the developer and installed by the Town of Blacksburg. Residential meters shall be of the positive displacement type, with magnet drive and sealed register, conforming to AWWA specification C-700, latest revision. All meters shall be an outer case with a separate measuring chamber which can be easily removed from the case. Cast iron frost bottoms shall be provided. All meters shall have cast on them, in raised characters, the size and direction of flow through the meter. All meters shall be provided with an internal synthetic polymer strainer which shall be easily removable from the meter. Meters shall be guaranteed to operate under a working pressure of 150 psi without leakage or damage to any part. All meters shall be guaranteed against defects in material and workmanship for a period of one year from the date of installation. All meters shall be manufactured by Sensus Technologies, Inc.

6. Detector Meter-Detector meters shall be manufactured by Sensus Technologies, Inc.

## 1.50 WATER MAIN CONSTRUCTION METHODS

### 1.51 General

The following specifications and standards shall govern all construction and installation of water mains and appurtenances except as altered or waived by the Director of Engineering and GIS, and approved by the Department of Health. It shall be the contractor's responsibility to comply with all local, State, and Federal regulations as well as good construction and management practices.

1. Traffic control – It shall be the responsibility of the contractor to take any measures as may be necessary or as directed by the Virginia Department of Highways and Transportation and/or the Town of Blacksburg. The owner/developer is required to obtain a Road Closure Permit from the Town and pay the required fee. A traffic control plan prepared in accordance with the latest edition of the Virginia Work Area Protection Manual shall be submitted to the Town for approval prior to commencing work. The owner/developer may not begin work until the Road Closure Permit is obtained and the traffic control plan is approved by the Engineering and GIS Department.

2. Erosion and Sediment Control – It shall be the responsibility of the developer or contractor to submit an Erosion and Sediment Control Plan for review and approval by the Engineering and GIS Department per Section 1.57 of these Specifications.

3. Emergency Utilities – Emergency utilities such as fire hydrants and traffic signal control boxes shall not be obstructed at any time.

4. There shall be present and in responsible charge, whenever water line installation is in progress, a superintendent/foreman who, in the opinion of the inspector, is reasonably qualified and familiar with means and methods of water line installation.

1.52 Excavation – The contractor shall perform all excavation to dimensions and depths shown on the approved plans or as directed by the Engineering and GIS Department. Excavations shall be open cut except where approved by the Director of Engineering and GIS. Existing utilities, structures and fencing shall be protected during construction, and if damaged or removed by the contractor, shall be repaired by him/her at no additional costs to the Town.

1. Trench Width – The following table will service as a guide for ordinary trench width (depths not exceeding six feet).

| Nominal Pipe Diameter | Minimum Trench Width |
|---|---|

| | |
|---|---|
| ¾ - 6" | 3 times nominal pipe diameter |
| 8" | 3 times nominal pipe diameter |
| 10" | Pipe diameter plus 2 feet |
| 12" | Pipe diameter plus 2 feet |
| 16" | Pipe diameter plus 2 feet |
| 18" | Pipe diameter plus 2 feet |
| 30" | Pipe diameter plus 2 feet |
| 42" | Pipe diameter plus 2 feet |

2. Rock Excavation – All rock within 6 inches of the finished pipe shall be removed. Rock is generally defined as any material which cannot be excavated by usual hand or machine methods and is more specifically defined as materials which cannot be excavated without drilling, blasting, or boring, or boulders more than one cubic yard in volume. Contractor is responsible for obtaining all necessary permits and insurance for blasting activities

4. Safety – All excavations shall conform to the latest regulations and safety practices specified by the Occupational Safety and Health Administration.

5. Permits – No excavations shall be made until proper permits have been obtained from the Town of Blacksburg.

6. Length of Open Trench – On any day, no trench shall be opened to a length greater than 500 feet and shall be backfilled on that day.

7. Dewatering – Trenches shall be kept free of water during construction. Pumps, dams and/or under drains shall be maintained by the contractor when required by the Director of Engineering and GIS. No excavation, installation, or backfilling shall be permitted as long as water remains in a trench.

8. Trenching – Pipe trenches shall be excavated to a depth that will insure a minimum of 48 inches of cover for water lines or as indicated in Section 1.34, Minimum Cover. Excavation shall be made for bells of all pipes, and shall be of sufficiently depth to permit access to the joint for construction and inspection. In no case will the bells be used to support the body of pipe.

9. Sheeting, Shoring and Bracing – The contractor shall support the sides and ends of all excavations, wherever necessary or as directed, with bracing, sheeting, shores, or stringers of sufficient size and section to withstand the imposed loads. All bracing and sheeting shall be put in place or driven by men skilled in such work. Sheeting shall remain in place until backfill has been carried to a point two feet above the top of the pipe and then withdrawn. Whenever trench timber sheeting is required by the Town to be left in place, the backfill shall be placed to a point two feet above the top of the pipe and the sheeting cut off at this depth. In quicksand or soft ground, sheeting shall be driven to such depth below the bottom of the trench as necessary to insure safety during construction. The use of a trench box shall be permitted for protection of

workmen when such boxes have been designed, constructed, and maintained in a manner to provide protection equal to or greater than the sheeting and shoring required for the situation.

The neglect, failure, or refusal of the engineer or Town to order the use of bracing or sheeting; or to order sheeting, bracing, struts, or shoring to be left in place; or the giving or failing to give the order, if directed, as to the manner or methods of placing or driving sheeting, bracing, jacks, wales, rangers, etc., shall not in any way, or to any extent, relieve the contractor of any responsibility concerning the conditions of excavation or of any of his obligations under the contract; nor shall any delay, whether caused by any action or lack of action on the part of the contractor, of by any act of the Town or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve the contractor from the necessity of property and adequately protecting the excavation from caving or slipping, not entitle him to any claim for extra compensation. The contractor shall, at his expense, protect from direct or indirect injury, all pipes, tracks, walls, buildings, and other structures of property in the vicinity of his work, whether above or below the ground or that may appear in the trench.

1.53 Bedding – The class of bedding shall be determined by the engineer to provide the required support for the soil and load condition encountered. Class A, B, or C bedding as described below and as shown on system plans shall be used as required.

1. Class A

a. Concrete Cradle – The pipe shall be bedded in a monolithic cradle of plain or reinforced concrete having a minimum thickness of one-fourth the inside pipe diameter or a minimum of four inches under the barrel and extending up the sides for a height equal to one-fourth the outside diameter. The cradle shall have a width at least equal to the outside diameter of the pipe barrel plus 8 inches. Backfill above the cradle and extending to 12 inches above the crown of the pipe shall be compacted carefully.

b. Concrete Arch – The pipe shall be embedded in carefully compacted granular material having a minimum thickness of four inches and shall extend halfway up the sides of the pipe. The top half of the pipe shall be covered with a monolithic concrete arch having a minimum thickness of one-fourth the inside diameter at the crown and a minimum width equal to the outside pipe diameter plus eight inches.

2. Class B

a. Compacted Granular Bedding – The pipe shall be bedded in compacted material placed on a flat trench bottom. The granular bedding shall have a minimum thickness of four inches and shall extend halfway up the pipe barrel at the sides. The remainder of the sides/fills and a minimum depth of 12 inches over the top of the pipe shall be filled with carefully compacted material. (See Section 1.55 "Backfilling")

3. Class C

a. Compacted Granular Bedding – The pipe shall be bedded in compacted granular material placed on a flat trench bottom. The granular bedding shall have a minimum thickness of four inches under the barrel and shall extend 1/10 to 1/6 of the outside diameter up the pipe barrel at the sides.

1.54 Installation – The installation of water mains and appurtenances shall conform to AWWA Standard C600, latest revision, the manufacturer's recommendations, and the recommendation of the engineer or Director of Engineering and GIS. All construction within State maintained right-of-way requires approval of the Virginia Department of Transportation (VDOT). Pipe delivered to the site shall be carefully inspected for defects. Any pipe found to be broken or defective prior to or after installation shall be removed and replaced at the contractor's expense. Pipe and fittings may be strung out along the route of construction with the bells facing in the direction in which the work is to proceed. Pipe shall be placed where it will cause least interference with traffic, and shall be subject to VDOT policies when placed within the right-of-way.

Pipe shall be carefully handled and lowered into the trench. Special care shall be taken to insure that each length shall abut against the next in such manner that there shall be no shoulder or unevenness of any kind along the inside of the bottom half of pipelines.

The pipes shall be thoroughly cleaned before they are laid and shall be kept clean until acceptance of the completed work. The upper end of the pipelines shall be provided with a water tight stopper carefully fitted so as to keep dirt and other substances from entering. This stopper shall be kept in the line at all times when laying is not in progress.

1. Separation-The following factors shall be considered in providing adequate separation of water mains and sanitary sewer mains: materials and types of joints for water and sanitary sewer mains, soil conditions, service branch connections into the water and sanitary sewer mains, compensating variations in the horizontal and vertical separations, space for repairs and alterations of water and sanitary sewer mains, offsetting of pipes around manholes, and identification of the physical restraints preventing normal separation.

a. Parallel – Water mains shall have a minimum horizontal separation of 10 feet from any existing or proposed sanitary sewer, sanitary sewer manhole or storm drain line, measured edge-to-edge. When local conditions prevent a horizontal separation of 10 feet, the water main may, with the Director of Engineering and GIS 's approval, be laid closer to the sanitary sewer or storm drain line provided that it is a separate trench and that the bottom (invert) of the water main is as least 18 inches above the top (crown) of sanitary sewer or storm drain line. Where this vertical or horizontal separation cannot be obtained the sanitary sewer or storm drain line shall be constructed of AWWA approved ductile iron water pipe pressure tested in place to 50

psig with no leakage prior to backfilling. Sanitary sewer manhole shall be of watertight construction and tested in place. Parallel separation between water mains and stormwater conveyance channels shall be a minimum of 2 feet from edge of pipe to edge of channel.

b. Crossing – Waterlines 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 local conditions prevent this separation, the following construction shall be used:

(1) Sewer passing over or under the waterlines shall be constructed of AWWA approved ductile iron water pipe (minimum ten feet), pressure-tested in place of 50 psig without leakage prior to backfilling. Transition shall be made with mechanical coupling.

(2) Water lines passing under sewers shall, in addition, be protected by providing: A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line; adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking water line; and the length of both the water line and sewer line shall be centered at the point of the crossing so that joints will be equidistant and as far as possible from the sewer.

b. Manholes – No water pipes shall pass through or come in contact with any part of a sewer or sewer manhole.

c. Stormwater Conveyance Channels – Water mains shall not be installed under stormwater conveyance channels extending parallel with the channel. Perpendicular crossings are permitted.

2. Surface Water Crossing – Surface water crossings under water present special problems and should be discussed with the Director of Engineering and GIS prior to final plan preparation. No water mains shall pass over surface water. Water mains passing under surface water shall be of a special type of construction utilizing flexible water-tight joints. The water main shall be installed within a casing per Section 1.41, 3 of these Specifications. Also, valves shall be located at both ends of the surface water crossing so that the section can be isolated for testing and repairs. The valves shall be easily accessible and not subject to flooding.

3. Appurtenances

a. Valves – Valves shall be installed on all temporary dead end lines, on small branching mains as close as possible to the larger main, and on loop networks. Valves shall also be placed on water mains so that a break or failure will not affect more than 800 feet of main. All tees shall be

isolated by three valves unless otherwise directed by the Director of Engineering and GIS. Crosses shall be isolated by four valves.

b. Valve Boxes – Valve boxes shall be installed plumb, directly over valves with carefully compacted backfill around the valve box. Valve box covers shall be fully exposed and flush with the finished street or ground surface, except as noted in Section 1.43, Valve Boxes.

c. Fire Hydrants – Hydrants shall be set within the right-of-way a minimum of 18 inches above established finished grade; to the centerline of the pumper nozzle. Hydrants shall be placed on firm foundation with adequate drainage being provided by placing coarse gravel or crushed stone from the bottom of the trench to at least six inches above the drainage openings in the bowl of the hydrant. Bridle rods and rod collars shall be used with the rods being at least ¾-inch stock thoroughly protected with acid resistant paint. All backfill shall be compacted to the established finished grade and the hydrant shall be checked to insure proper working order. A 4-½-inch pumper nozzle must be turned to face the street and/or paved area.

d. Post indicating valves (PIV) shall be installed a minimum of 40 feet from a building and in accordance with National Fire Protection Agency (NFPA) 13-Chapter 4-Section A-4-6.1.1.1.

e. All installations of cross-connection and backflow prevention devices will be in accordance with the Town's Cross-Connection Control and Backflow Prevention Regulations and shall meet the requirements of A.S.S.E. Installation of a RPZ device in a pit is prohibited.

4. Special Crossing – When a crossing is to be installed beneath a highway, railroad, stream, petroleum or gas pipeline or other major obstruction, all operations and materials shall conform to the requirements of the Owner(s) or agencies having jurisdiction over said crossing. The contractor shall obtain approval of all materials and methods to be employed before such work is started, and obtain any required permits. See Section 1.54(2) for requirement for surface water crossings.

5. Blocking – All tees, bends, plugs, and caps shall be substantially braced, blocked, and/or anchored to prevent any movements by providing adequate thrust blocks of 3,000 psi concrete. Blocking shall be placed between solid, undisturbed earth and the fitting to be anchored, and shall be placed so that pipe and fitting joints will be accessible for repair. Concrete shall be Class A3, General Use, as specified in Section 219 of the VDH&T's Road and Bridge Specifications.

1.55 Backfilling – After visual inspection by the Town Inspector, all trenches and excavation shall be backfilled on the same day that the trench or excavation was opened. Backfill shall consist of approved materials free from large clods of earth or

stone larger than one inch in diameter, deposited in six-inch layers, thoroughly and carefully compacted by mechanical tampers. Backfill under or within two feet of existing or proposed pavement, curb and gutter, sidewalk or other asphalt and/or concrete structures shall be backfilled completely with 21-B stone deposited in not more than six-inch layers and compacted to a density of at least 95 percent of the maximum dry density as determined by AASHTO Method T-99.

Excavations within existing public streets that are perpendicular to the travelway shall be backfilled with flowable fill that meets the Virginia Department of Transportation Special Provision for Flowable Backfill.

Due to potential settlement and damage to the waterline, utilities that are located under or within two feet of existing or proposed pavement, curb and gutter, sidewalk or other asphalt and/or concrete structures and are within a Public Utility Easement shall be backfilled with 21-B stone deposited in not more than six-inch layers and compacted to a density of at least 95 percent of the maximum dry density as determined by AASHTO Method T-99.

The Director of Engineering and GIS Department may waive this requirement and allow the use of soil backfill if the a written request to use soil as a backfill material is submitted to the Engineering and GIS Department and the following compaction specification is used.

A. Documentation of the results of the Standard Proctor test that provides the maximum dry density and the optimum moisture content of the soil or soils to be used as backfill material.

B. Soil shall be placed in horizontal, loose lifts not exceeding 8-inches in thickness and shall be compacted to at least 95 percent of maximum dry density per ASTM D-698, Standard Proctor. No rocks larger than 3-inches in any dimension shall be included in the fill material.

C. Density tests shall be performed every 50 feet of length of main on each lift of material placed and compacted. A qualified compaction technician shall be on site during all backfill operations to ensure that each lift is placed at the proper moisture content and compacted to meet the above standard.

D. Any areas that exhibit excessive pumping, weaving or rutting shall be excavated and replaced with material at the proper moisture content and re-compacted to meet the above standard.

E. Density testing results shall be submitted to the Engineering and GIS Department on a weekly basis. These results shall include the elevation of the lift or depth below subgrade, the percent compaction achieved on each lift, and the Standard Proctor test used to determine the results.

F. Any density tests that shows that the lift has failed to meet 95 percent of Standard Proctor shall be recompacted, scarified and allowed to dry if the moisture content is too high, and retested. Density test results shall be designated as a re-test.

G. Failure to comply with this procedure shall result in revocation of the use of soil as backfill material and the Engineering and GIS Department will require the use of 21 B stone as backfill.

H. Upon completion of the installation of the water line, a certification letter signed and sealed by a professional engineer licensed to practice in the Commonwealth of Virginia shall be provided to the Engineering and GIS Department that states that a compaction technician was on-site during all backfilling operations and witnessed the placement of each lift and that each lift was tested and meets the compaction requirements. The Town will not accept the water line into the Town's water system until this certification letter is received by the Engineering and GIS Department.

Excavations within the public right of way that are parallel to the travelway either under pavement or concrete or within 2 feet of pavement or concrete shall be backfilled with 21B stone deposited in not more than six-inch layers and compacted to a density of at least 95 percent of the maximum dry density as determined by AASHTO Method T-99.

Excavations that are located within a Public Utility Easement but not under or within two feet of pavement or concrete may be backfilled with suitable material deposited in not more than six-inch layers and compacted to a density of at least 95 percent of the maximum dry density as determined by AASHTO Method T-99.

1.56 Cleaning and Site Restoration – All areas utilized during the construction activities of the contractor shall be cleaned to the satisfaction of the Town. Undesirable materials shall be disposed of off-site by the contractor at no expense to the Town. All areas shall be restored to a condition equal to or better than that existing prior to construction. This work shall be included in the cost of the various applicable items.

1.57 Erosion and Sediment Control – All disturbed areas not designated for pavement and sidewalk replacement, structural use, and the like shall be stabilized. All stabilization measures and materials shall be in accordance with the specifications contained with the Virginia Erosion and Sediment Control Handbook, 1992 Edition, and/or any subsequent revisions or editions.

## 1.60 TESTING AND INSPECTION

1.61 Pressure Tests – All newly laid pipe, or any valved section thereof, shall be subjected to a hydrostatic pressure of 200 psig. Tests for leakage shall be conducted concurrently at each valved section with the pressure test. The maximum length of pipe tested shall be 1,000 feet. Pressure tests shall be of at least a two-hour duration, shall be in accordance with AWWA C-600, latest revision and must be witnessed by authorized personnel of the Engineering and GIS Department. The hydrostatic test boundaries shall be each valved section of the waterline and each valve shall be, at a minimum, subjected to test pressure on one side. All taps on the water main shall be completed and corporation stops installed prior to performing the pressure testing.

Pressure testing of the sprinkler line shall be performed at 200 psi and in accordance with the requirements of the Uniform Statewide Building Code and witnessed by the Building Official or Building Inspector. Public Works shall install a gate valve at the property line or easement line at the time of the installation of the sprinkler line. Public Works will perform the pressure testing of the line from the water main to the gate valve at the property line or easement line. The contractor shall perform the pressure testing from the gate valve at the property line or easement line to the building. Upon completion of the testing and acceptance of the line, the Town shall make the gate valve at the property line or easement line inoperable.

1.62 Flow Testing – All new hydrants shall be flow tested in accordance with the National Fire Protection Association standards.

A. Gauges and Equipment: The contractor shall furnish all pumps, fittings and gauges as necessary to fill the line with potable water, dispel air from the system, and pressurize the pipeline for the tests. The engineer reserves the right to test gauges on a dead weight tester to determine their accuracy. The contractor shall provide and install an approved backflow preventer in the water supply line, between the newly laid pipeline and the existing distribution system. The contractor shall provide a means to directly measure quantities of water added during the test to maintain the prescribed pressure.

B. Water for the pressure and flow tests will be furnished by the Town without charge to the contractor. If the pressure test is unsuccessful, and in the opinion of the engineer, an additional test or tests are required, the contractor will be charged for water used in those additional tests. The volume of water used shall be estimated.

C. Evaluation of Pressure and Leakage Tests: After the specified pressure is attained and stabilized, any pressure drop during the duration of the test may be considered as test failure. Any leakage, either visually evident, or evident due to the necessity for adding water during the test, shall be considered test failure. The

contractor shall repair and correct any and all leaks in order to achieve a successful pressure test. Once stabilized only allowable leakage can be added to keep the pressure within 5 pounds per square inch (psi) of the test pressure. Test pressure must be achieved at the end of the test or the test shall be considered a failed test using the formula to determine loss. Allowable leakage shall be calculated per the following formula:

$$\text{Allowable Leakage (gals/hr)} = \frac{(\text{Length of Line in feet})(\text{Diameter of Pipe in inches})(\text{Pressure in psi})^{1/2}}{148{,}000}$$

1.63 Disinfection of Water Mains – New water mains shall be disinfected in accordance with the most current Virginia Department of Health Waterworks Regulations. During the months of June through September, additional chlorine may be required to obtain passing bacteriological tests due to the fact that the Town utilizes chloramines as the disinfectant for the distribution system and the warmer temperatures may cause the chlorine to dissipate quicker. A chlorine concentration of at least 100 mg/L in the water is recommended. This will be evaluated on a case by case basis during these months.

A. All water mains shall be disinfected prior to being placed in operation.

B. Prior to disinfection, all water mains shall be flushed unless the tablet method of disinfection is used. All valves and hydrants shall be operated during this operation. Flushing velocities should not be less than 2.5 feet/second.

C. Methods of chlorine application

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

2. Slug Method – Potable water shall be introduced into the main at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the main 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 1,000 feet to insure that adequate residual is maintained. As the chlorinated water passes valves and appurtenances, they shall be operated to insure disinfection of these appurtenances.

3. Tablet Method – This method shall not be used if nonpotable water or foreign materials have entered the mains or if the water temperature is below 5 C (41 F). The tablets shall be placed in each section and in all appurtenances. Enough

tablets shall be used to insure that a chlorine concentration of 25 mg/L is provided in the water. They shall be attached by an adhesive to the top of the pipe in the water. They shall be attached by an adhesive to the top of the pipe sections and crushed or rubbed in all appurtenances. The adhesive shall be acceptable to the Engineering and GIS Department. The velocity of the potable water in the main shall be less than one foot/second. The water shall then remain in contact with the pipe for 24 hours. All valves and appurtenances shall be operated while the chlorinated water is in the main.

This method shall not be used if nonpotable water or foreign materials have entered the mains or if the water is below 41°F (5°C).

D. Final Flushing – After the required retention period, the chlorinated water shall be flushed from the main using potable water. The water that is flushed shall be de-chlorinated by discharging the water over dechlorination tablets in a manner approved by the Engineering and GIS Department.

E. Bacteriological Sampling – After the mains have been flushed, the water mains shall be tested in accordance with 12 VAC 5-590-800, 3 of the Virginia Department of Health Waterworks Regulations. Samples shall be collected at regular intervals, not exceeding 1,000 feet, throughout the length of the main.

1. All chlorine residual determinations shall be made using only those methods approved by the Engineering and GIS Department.

2. Two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipes, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedure must be repeated. Samples shall be taken from section spaced fairly equal distances apart, at a maximum interval of 1,000 feet.

3. Supervision – The disinfection procedure shall be carried out by the contractor under the supervision of the Engineering and GIS Department. Water mains shall be placed in service only after final approval has been issued by the Director of Engineering and GIS contingent upon test result.

1.64 Final Inspection – A final inspection will be made when all items of work are complete. If any items of work remain incomplete at the time of final inspection, such as cleanup and minor stabilization, a "punch" list will be prepared and a date set for completion of punch list items. All items of work must be completed by the contractor unless otherwise directed by the Director of Engineering and GIS.

1.80 (Reserved)

1.90 SIDEWALK, CURB AND GUTTER, DRAINAGE STRUCTURES

The contractor shall remove and replace only those portions of sidewalk, curb and gutter and drainage structures as is absolutely necessary to complete work under the contract.

## 2.0 CONSTRUCTION ON HIGHWAYS, STREETS AND ADJACENT AREAS

2.01 Contractors Responsibilities: The contractor shall be responsible for the removal and replacement of any and all types of pavement disturbed or damaged during the course of, and as a result of, his construction activities. In all cases the area shall be restored to as good as, or better than, that which existed prior to construction in both appearance and function, and to the satisfaction of the engineer and/or governing authority. Pavement replaced shall be the thickness of existing pavement, or four inches, whichever is greater, removed. In addition, the contractor shall provide a one-year warranty against pavement deflection.

2.02 Patching Portland Cement Concrete Pavement: Existing concrete shall be removed from areas shown on the plans or designated by the engineer. Undisturbed portions of the existing pavement adjacent to areas to be patched shall be left with neatly trimmed or sawn edges, having a vertical face, intersecting the surface, of not less than 1 ½ inches and shall be free from foreign substances. In areas from which concrete has been removed, the subgrade shall be dressed, brought to grade, and compacted. Unsuitable subbase material shall be removed, disposed of and replaced with material in accordance with Section 2.10 of these Specifications.

Concrete shall be deposited on the subgrade spaded, tamped, or vibrated so that it completely fills the area of the patch and all irregularities in the edges of the adjacent pavement.

Joints shall be placed to coincide with joints in the existing pavement, unless otherwise directed. All concrete shall be finished to conform to the cross-section of existing pavement.

The patch and existing pavement for a distance of 8 feet shall be tested by means of a 10-foot straightedge laid parallel to the centerline of the road, and irregularities in the patch in excess of ¼-inch shall be corrected, except that this tolerance will be ½-inch in the 10 feet where the patch is to receive overlay.

Portland cement concrete patching shall not be subjected to vehicular traffic until the compressive strength of the patching material has attained 2,000 psi.

2.03 Patching Bituminous Concrete Pavement: Existing surface and base courses shall be removed from areas shown on the plans or designated by the engineer. Edges of pavement to be removed shall be neatly linecut, using suitable power equipment, for a depth equal to the combined depth of existing base and surface courses of bituminous materials. In areas from which bituminous concrete has been removed, the subgrade shall be dressed, brought to grade and compacted. Unsuitable subbase material s hall

be removed, disposed of, and replaced with material accordance with Section 2.10 of these Specifications.

Unless otherwise specified, a tack or prime coat of bituminous material shall be applied between the subgrade surface and the bituminous paving mixture and between courses of bituminous paving mixtures.

Contact surfaces of curbing, gutters, manholes and other structures shall be painted with a thin uniform coating of bituminous material prior to the bituminous paving mixture being placed against them.

Bituminous concrete paving mixtures, of the type and thickness shown on the plans, shall be deposited, tamped or rolled to achieve breakdown. If the air temperature is such that the minimum laydown temperature cannot be maintained during the breakdown rolling, a temporary surface shall be applied and final surface course shall be installed at a later time.

Surface course shall be finished to conform to the cross section of existing pavement.

The patch and existing pavement for a distance of 8 feet shall be tested by means of a 10-foot straightedge laid parallel to the centerline of the road, and irregularities in the patch in excess of ¼-inch shall be corrected, except that this tolerance will be ½-inch in the 10 feet where the patch is to receive overlay.

The surface of the compacted course shall be protected until the material has cooled sufficiently to carry normal traffic without marring.

On new subdivision streets and streets not yet accepted by the Town, no patches shall be allowed and full lane repairs are required. On existing Town streets, if one (1) cut is made in a travel lane, the repair patch shall extend 1 foot on each side of the trench. If multiple cuts are made in a travel lane, the entire travel lane shall be overlayed. If multiple cuts are made in the entire street, the entire street shall be overlayed.

The asphalt pavement and base stone shall be replaced to the original thickness of the existing street. If more than six (6) inches of asphalt is required to meet this, the asphalt shall be placed and compacted in multiple lifts.

## 2.10 UNSTABLE SUBGRADE

In the event that unsuitable materials are encountered at or below the level of the pipe bed, such material shall be removed and replaced as directed by the Director of Engineering and GIS . Approved material for replacement shall be loose earth, sand, gravel, or crushed rock.

## 2.20 BORING AND JACKING

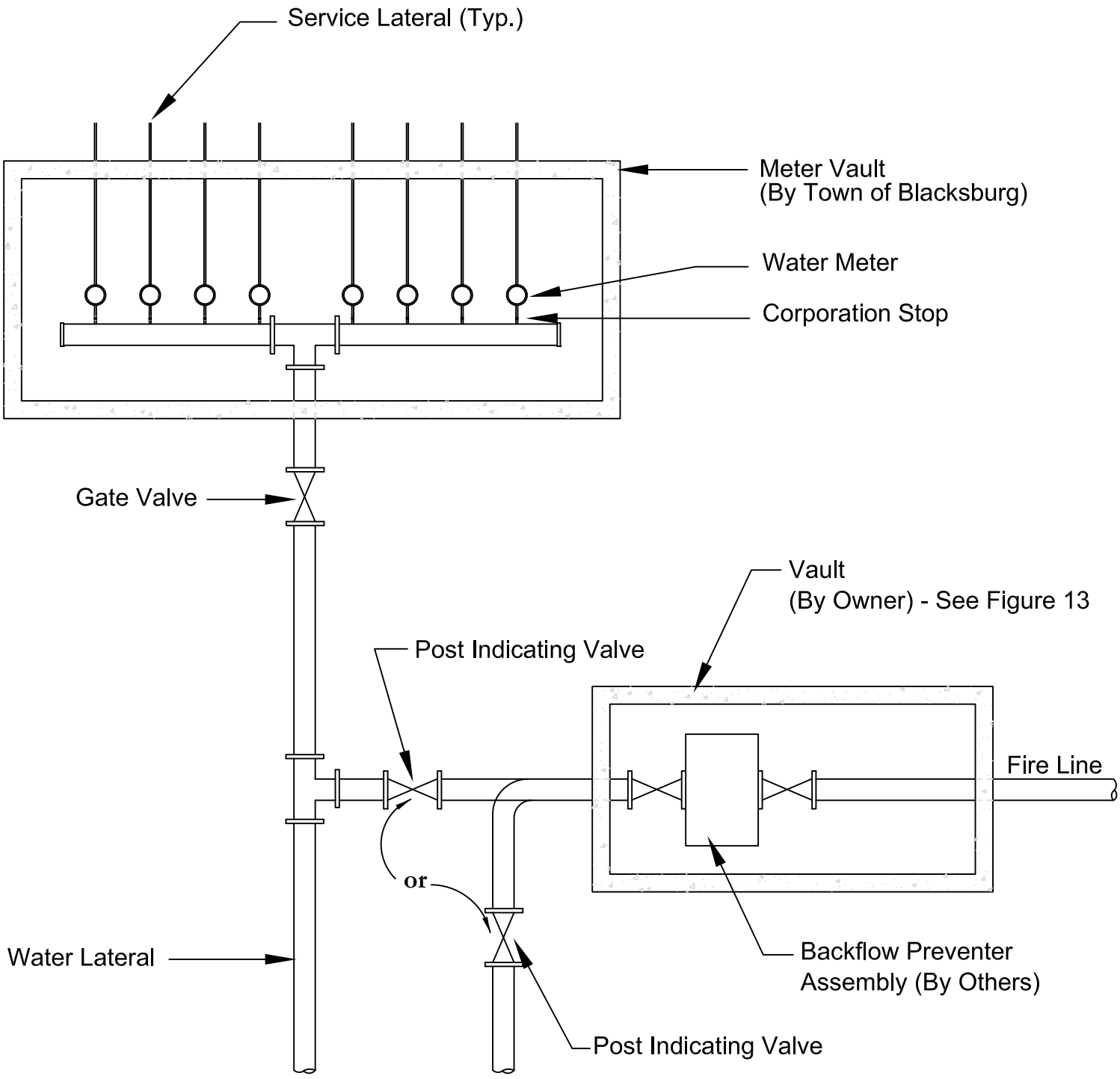
Pipelines shall be installed by conventional boring and jacking methods at such locations as are shown on the plans (or authorized in writing) in accordance with the standard details. Casing pipe shall meet the requirements of Section 1.42, 3 of these Specifications. The casing shall be so installed as to prevent the formation or accumulation of water within the casing and shall be constructed with even bearing throughout its length. The ends of the casing shall be suitably protected against the entrance of foreign material and sealed.

## 2.30 WELLS, STORAGE AND PUMPING FACILITIES

Wells, storage tanks and pumping facilities shall meet all applicable requirements of the Virginia Department of Health, the American Water Works Associations, and the National Fire Protection Association; and shall be approved by the Director of Engineering and GIS, and by the Virginia Department of Health.

TOWN OF BLACKSBURG

APPENDIX "A" – CONSTRUCTION DETAILS
TABLE OF CONTENTS




**Fire line connection to Main required to be seperate unless approved by Engineering & GIS Director.**

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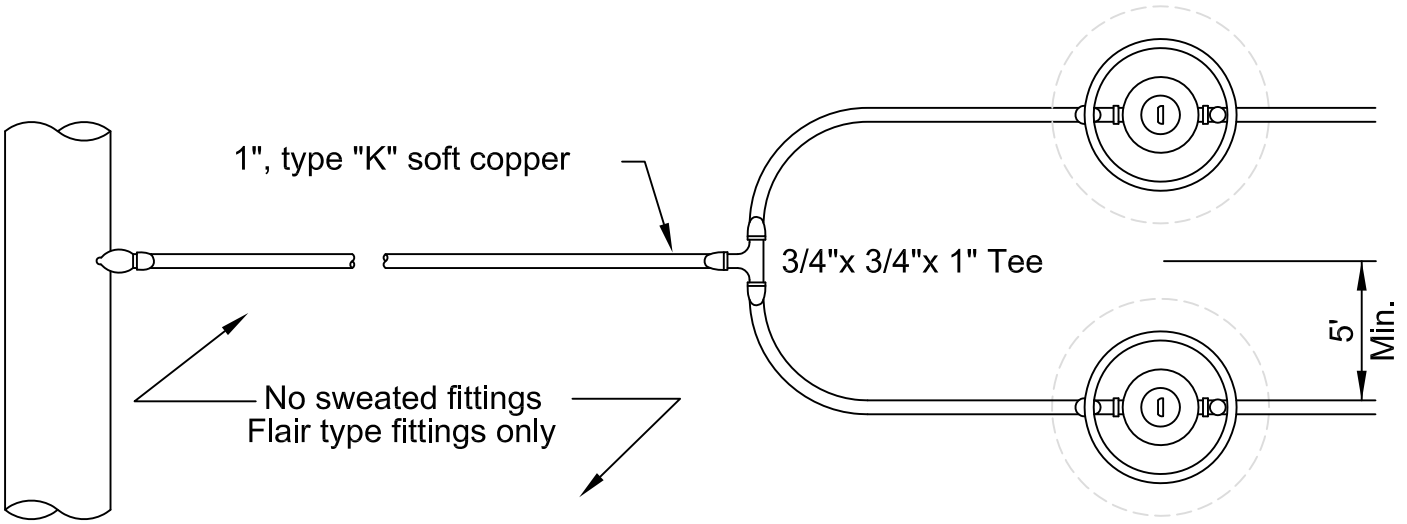
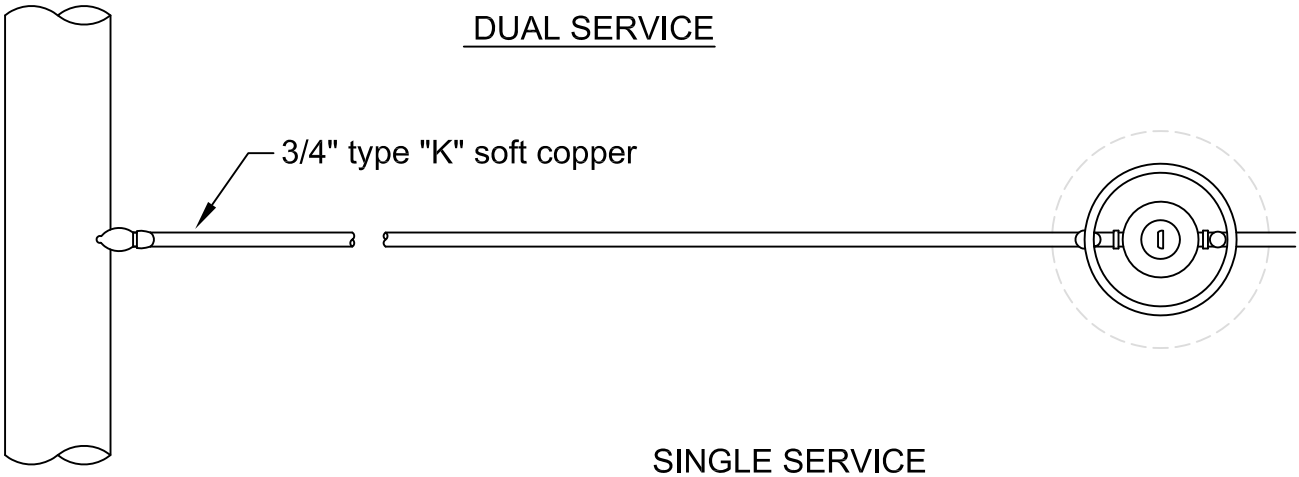
**Typical Meter**
**Fire Line Connection**

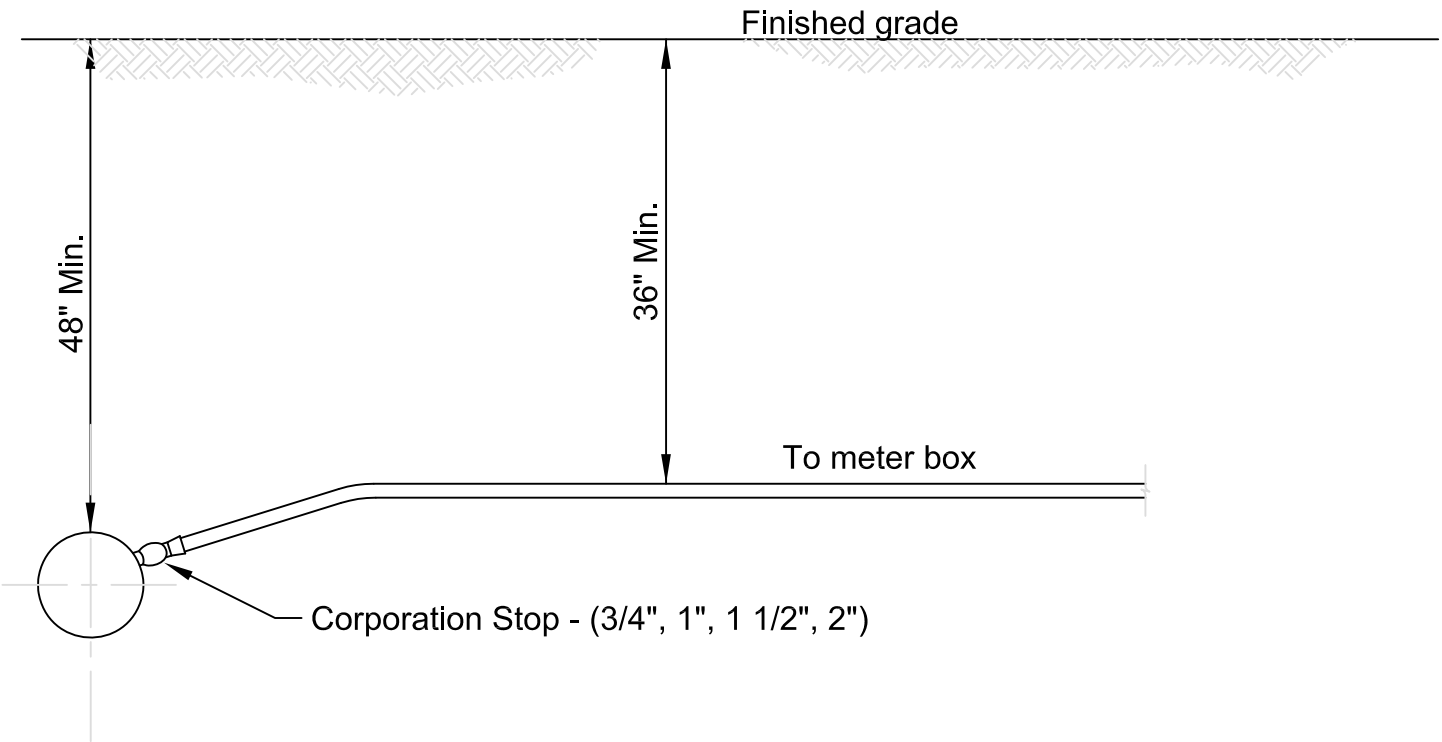
DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 1.0




DUAL SERVICE




SINGLE SERVICE

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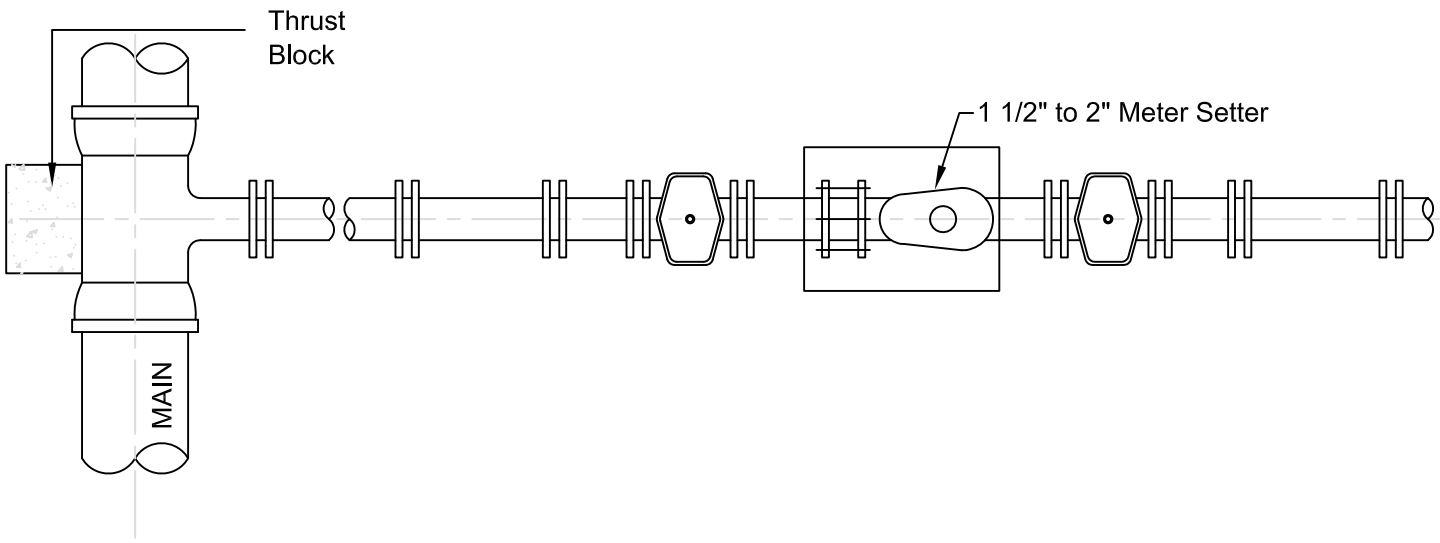
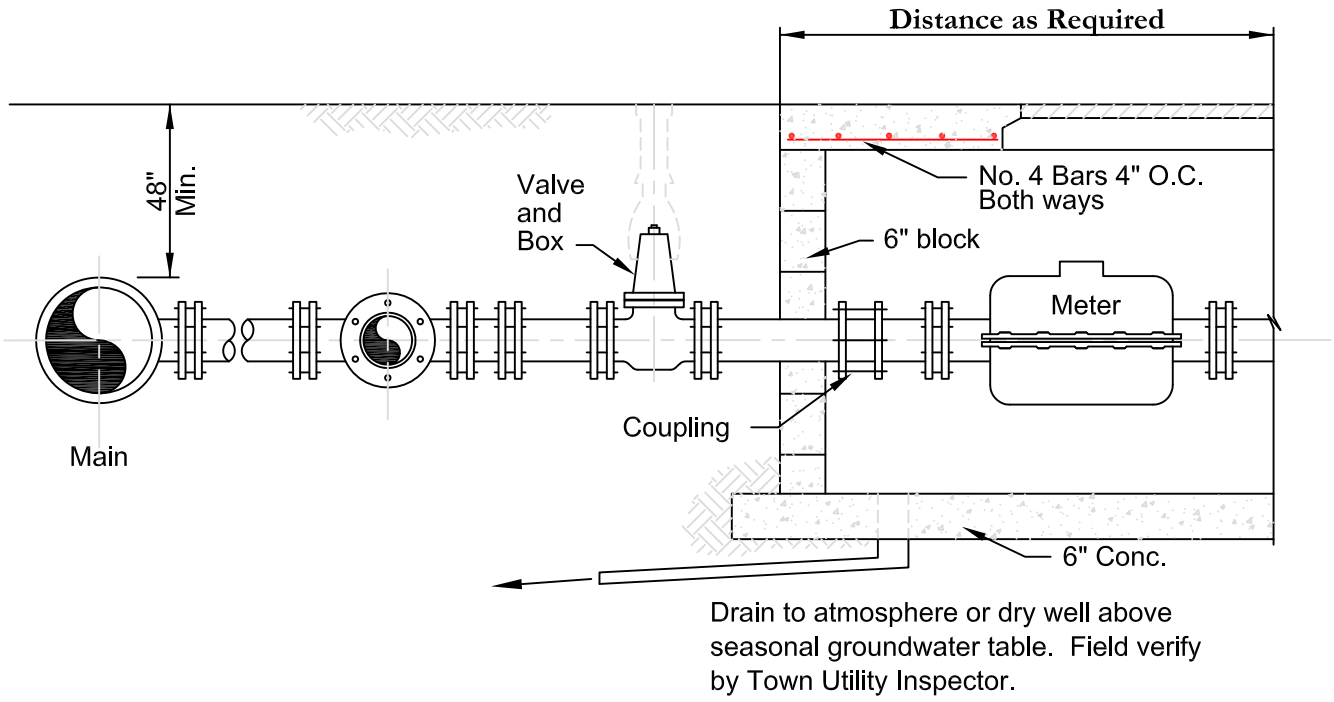
**Dual and Single Service Installation**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 2.0




PLAN




SECTION

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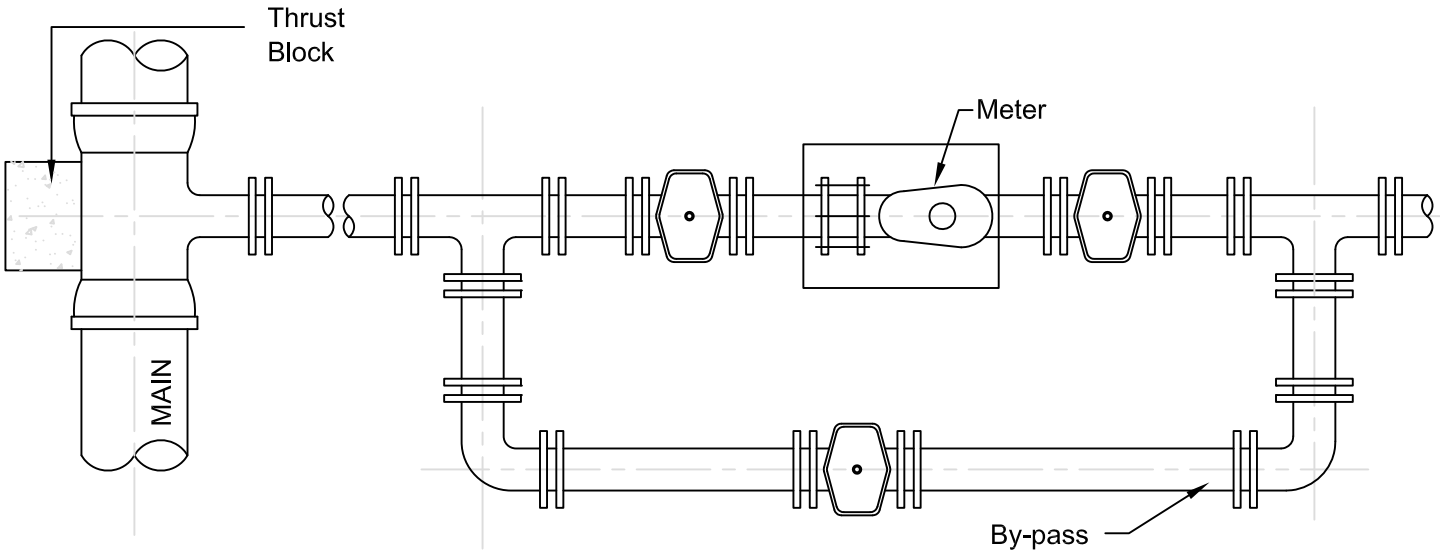
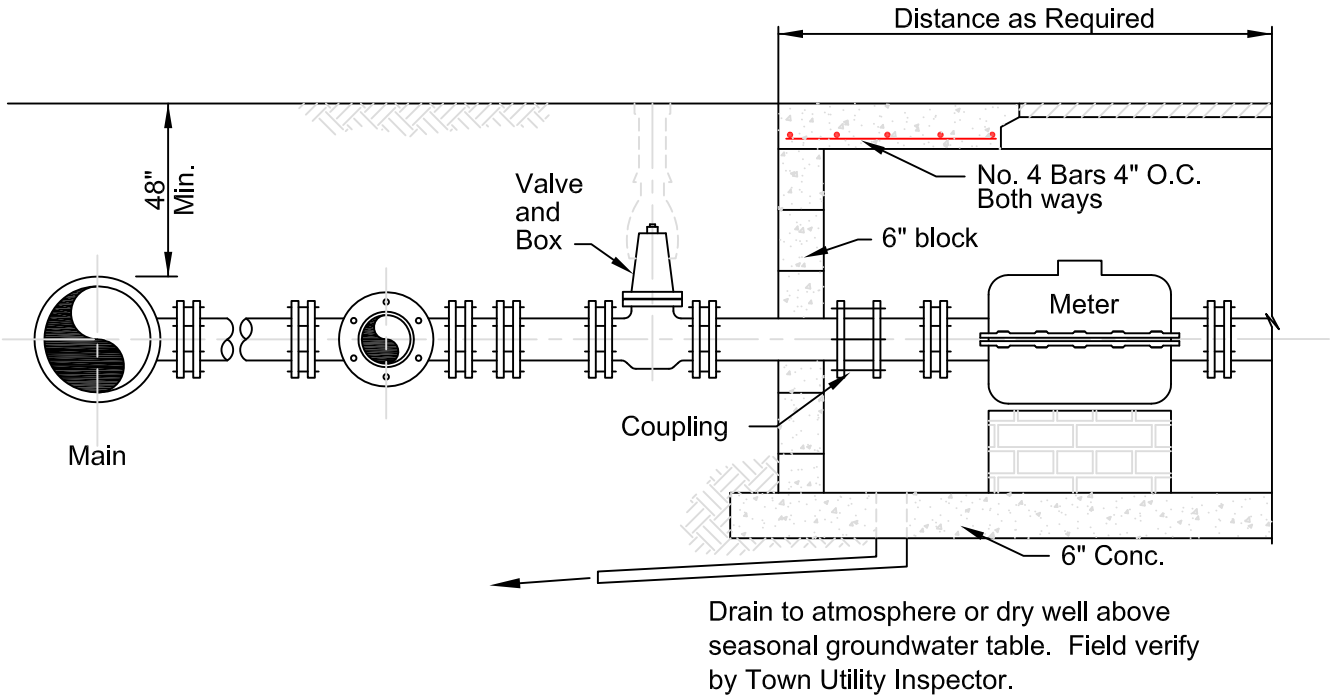
**Large Meter for**
**1 1/2" to 2" Line and Larger**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 2.2




PLAN




SECTION

Recommendation: Connections near the inlet and outlet side of the pits or vaults should be restrained.

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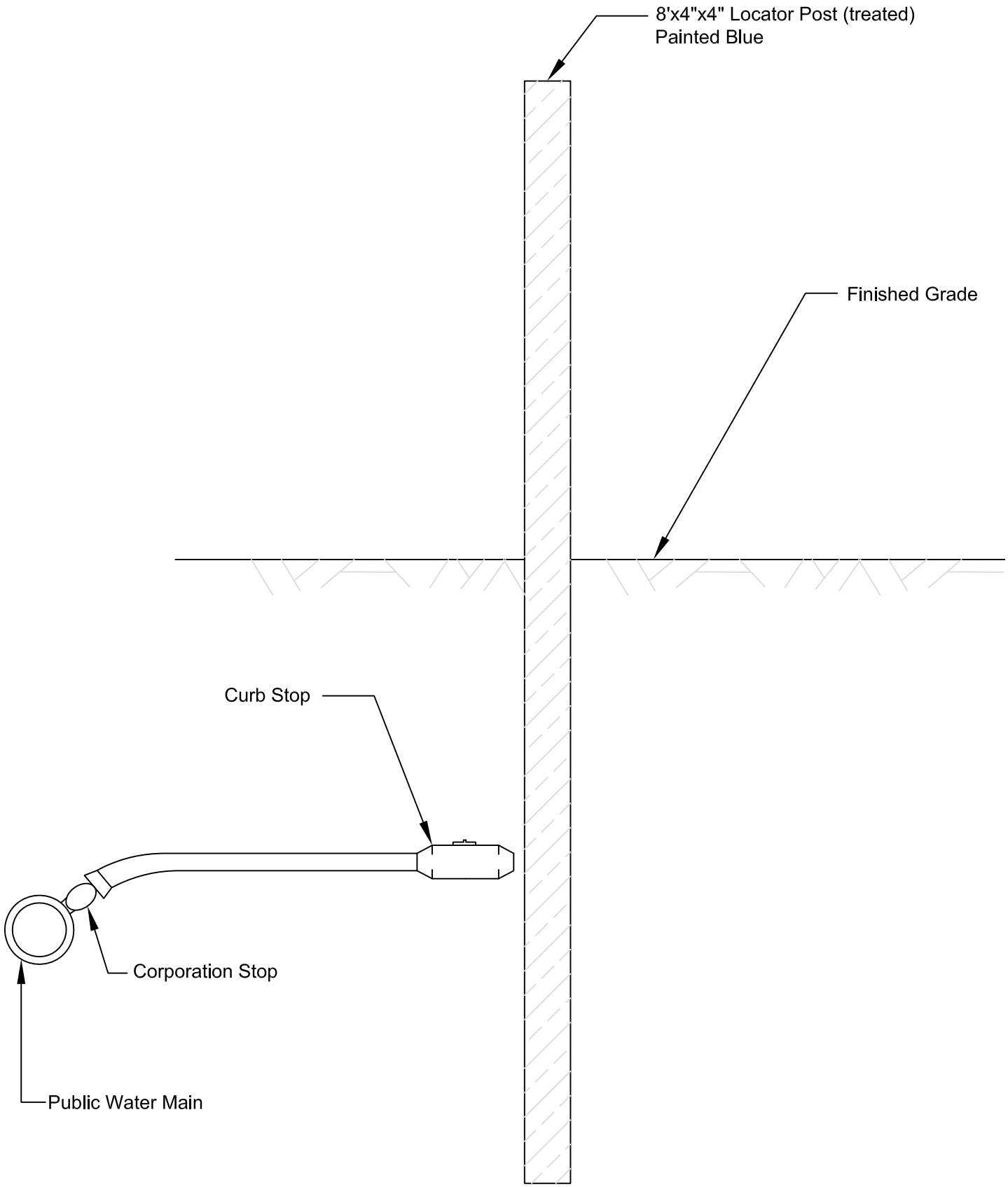
**Large Meter 4"
Line and Larger**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 2.3

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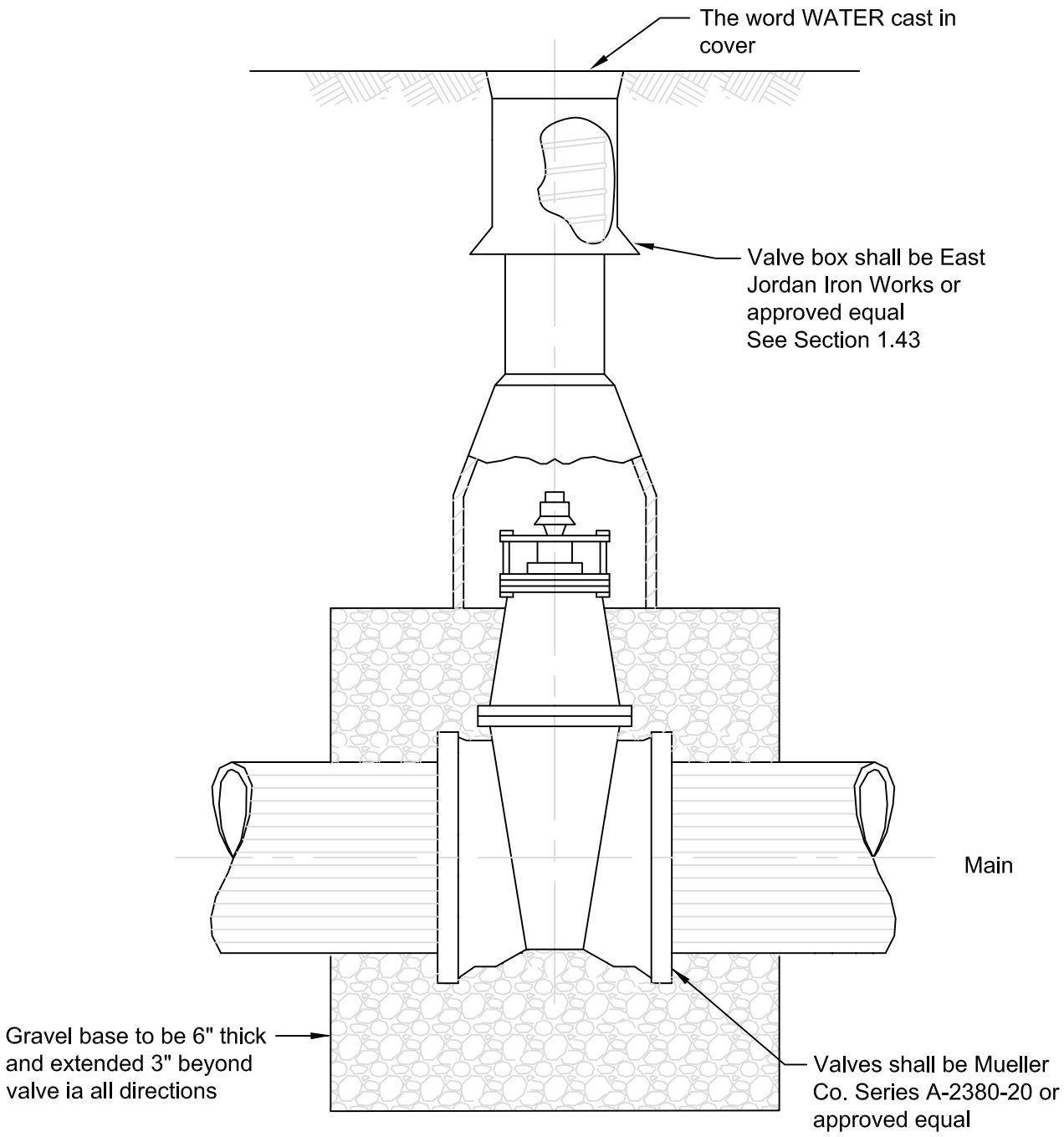
**Lateral Staking for Service Connection**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 2.4

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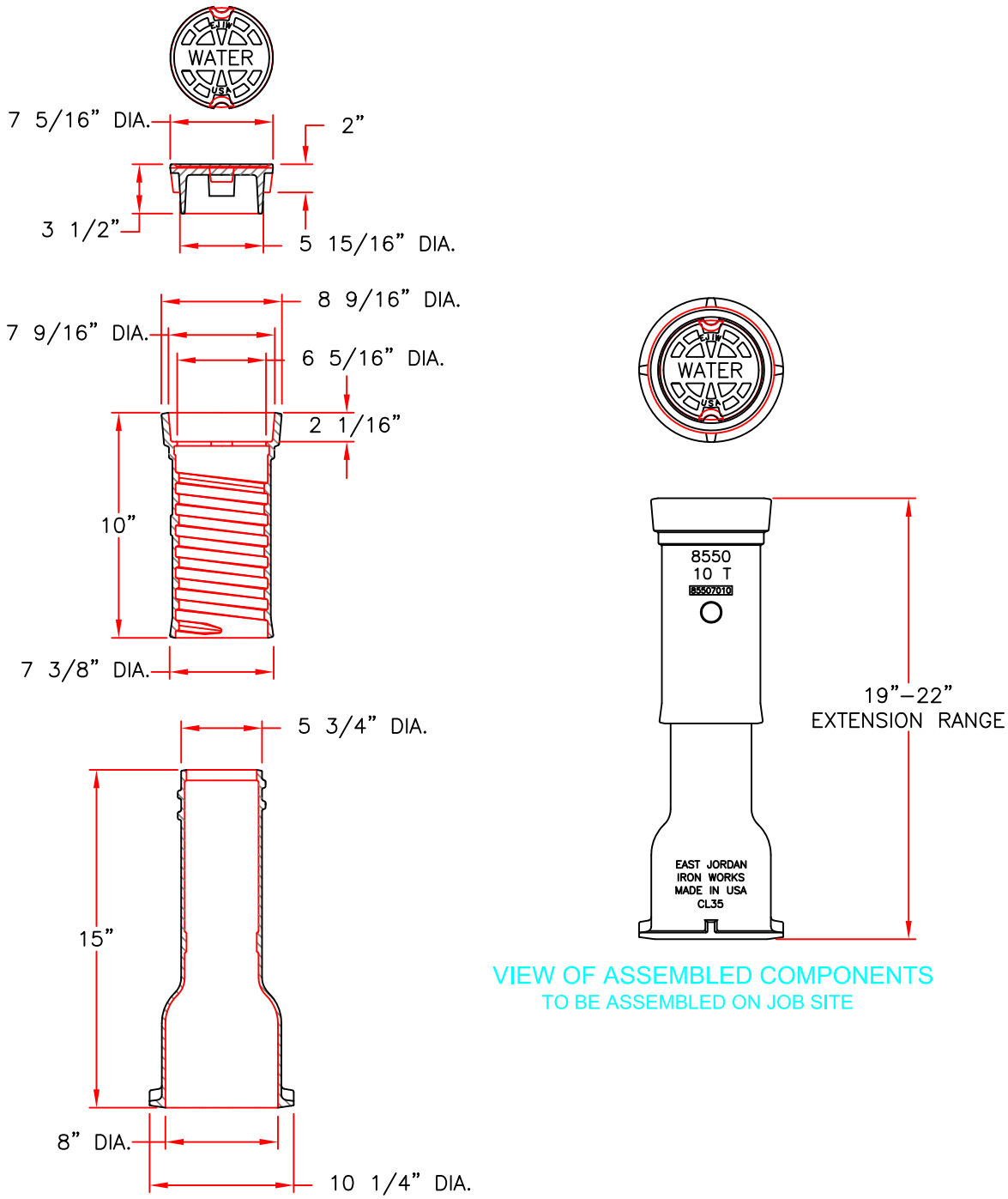
**Typical Gate Valve and Valve Box**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 3.0




VIEW OF ASSEMBLED COMPONENTS
TO BE ASSEMBLED ON JOB SITE

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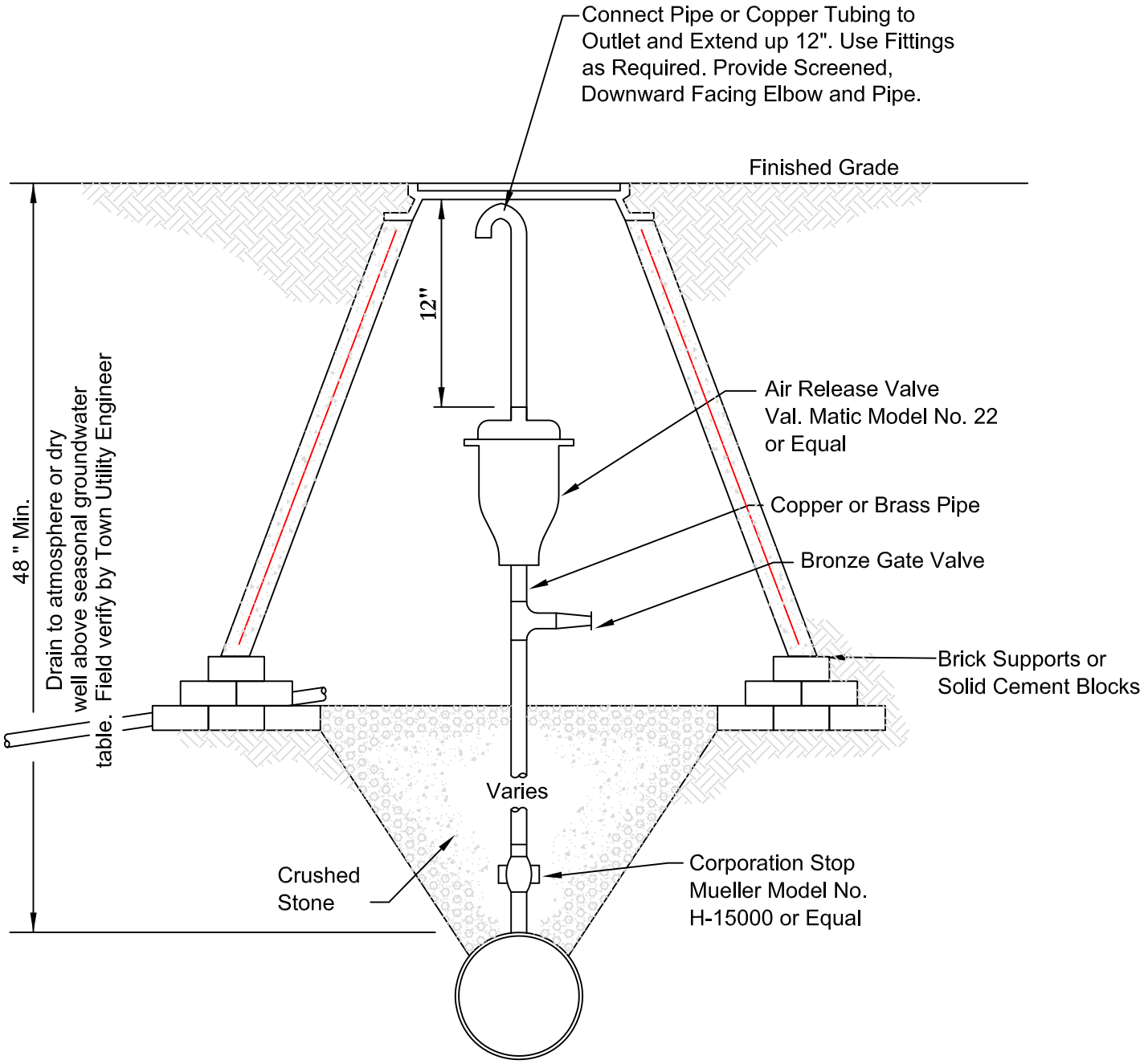
**Valve Box**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 3.1

NOTES:

1. A precast manhole cone and cover with "water" cast on the lid shall be used.
   An adequate foundation shall be installed so the water line doesn't support the manhole cone.

2. For water lines smaller than 12" use a 1" A.R.V. and fittings. For water lines 12" and larger use a 2" A.R.V. and fittings.





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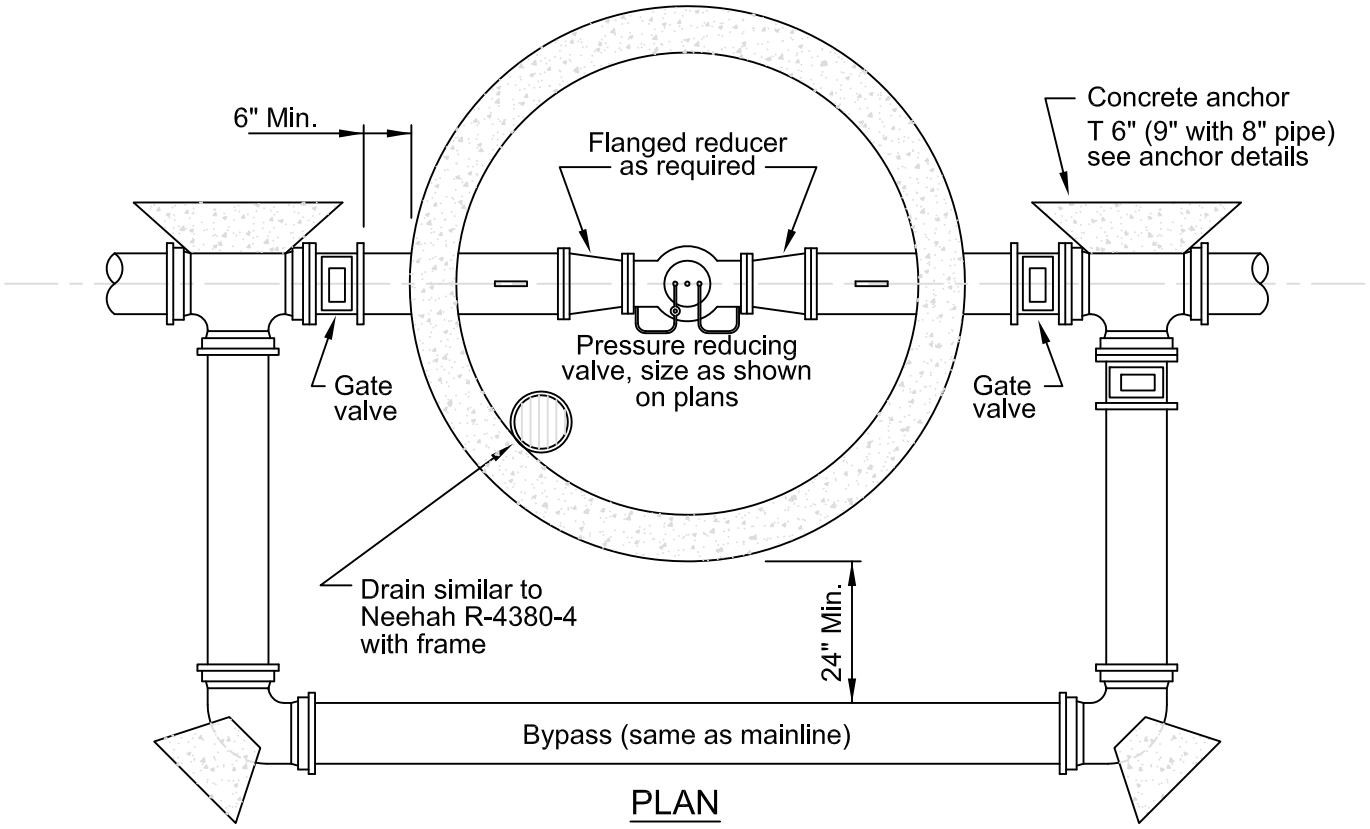
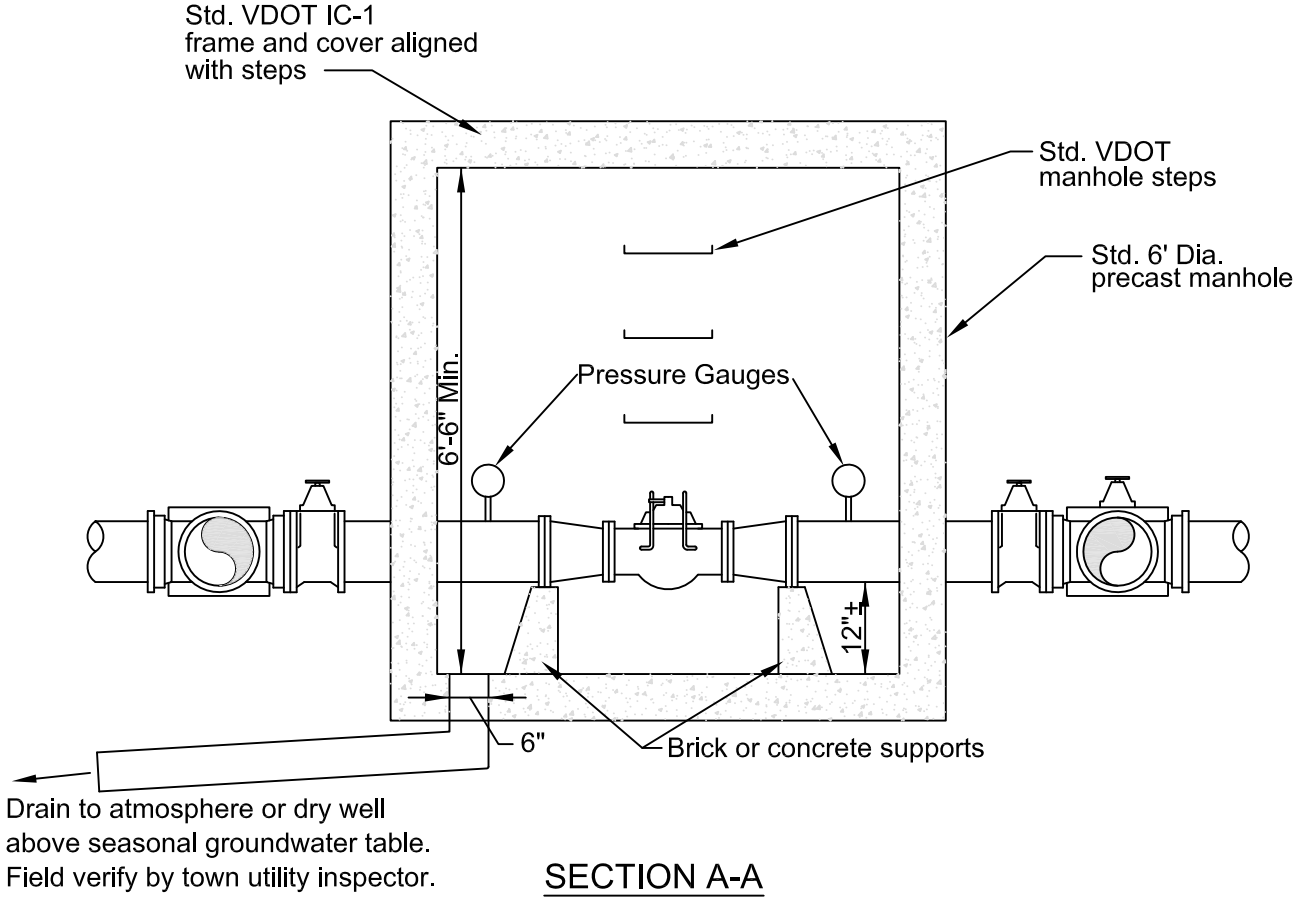
**AUTOMATIC**
**AIR RELEASE VAVLE**

DATE: 10/1/2014
SCALE: N.T.S
FIGURE NO.
Figure 4.0




PLAN




SECTION A-A

Recommendation:

Main line pressure regulating valves should display the design outlet pressure and range of the inlet pressure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**Pressure Reducing Valve**

DATE: 10/1/2014

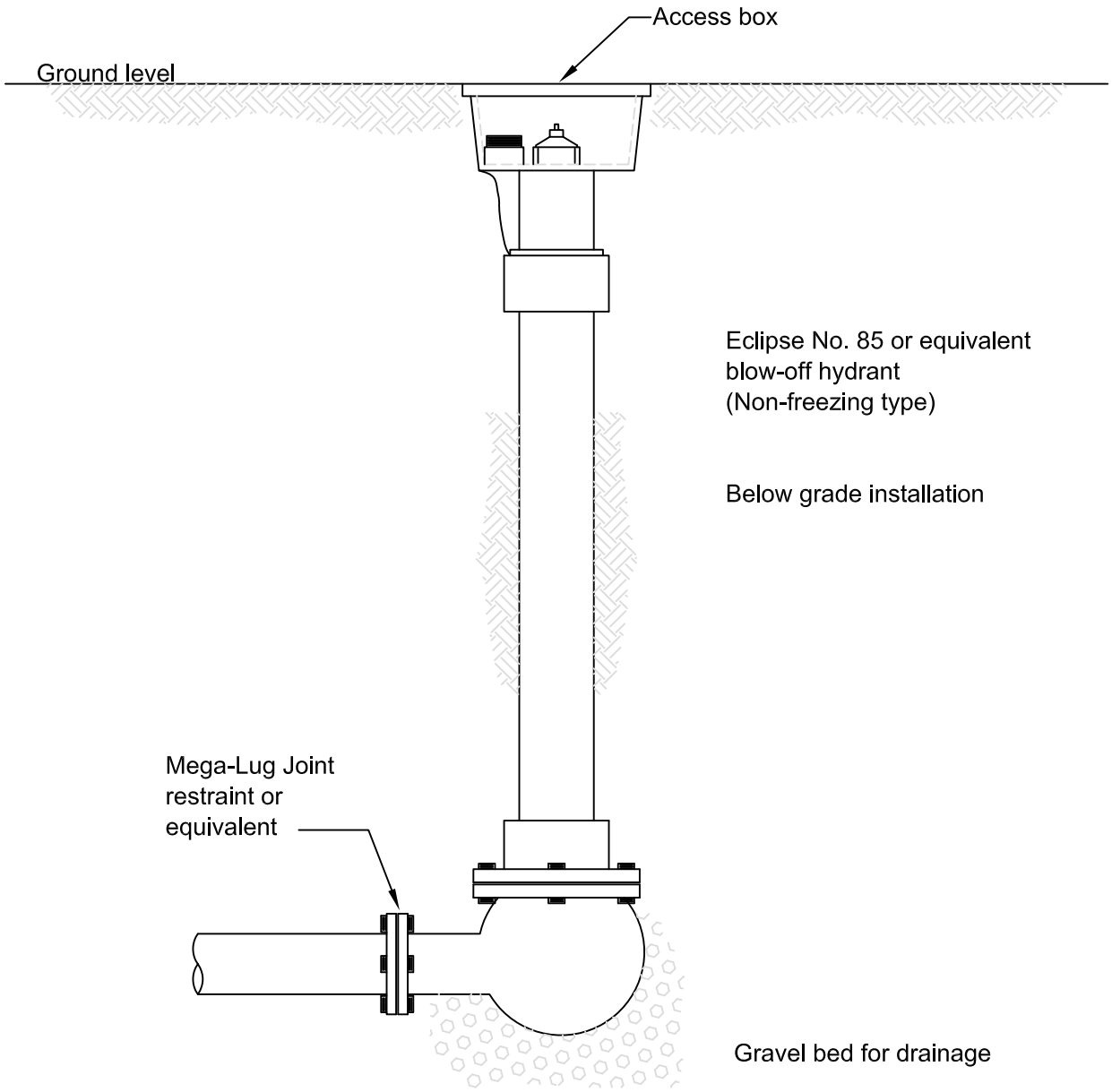
SCALE: N.T.S.

FIGURE NO.

Figure 5.0

**NOTES:**

1. 1 1/2" to be used on 4" mains or smaller.
2. 2" to be used on 6" mains or larger.
3. Fire hydrants shall be provided at the end of lines 12" and larger.
4. The drain hole for the fire hydrant must be placed in a grave pit above the ground water table in an area not subject to flooding or the hydrant will be sealed and marked for manua dewatering after use. Town Utility Inspector to verify water table.

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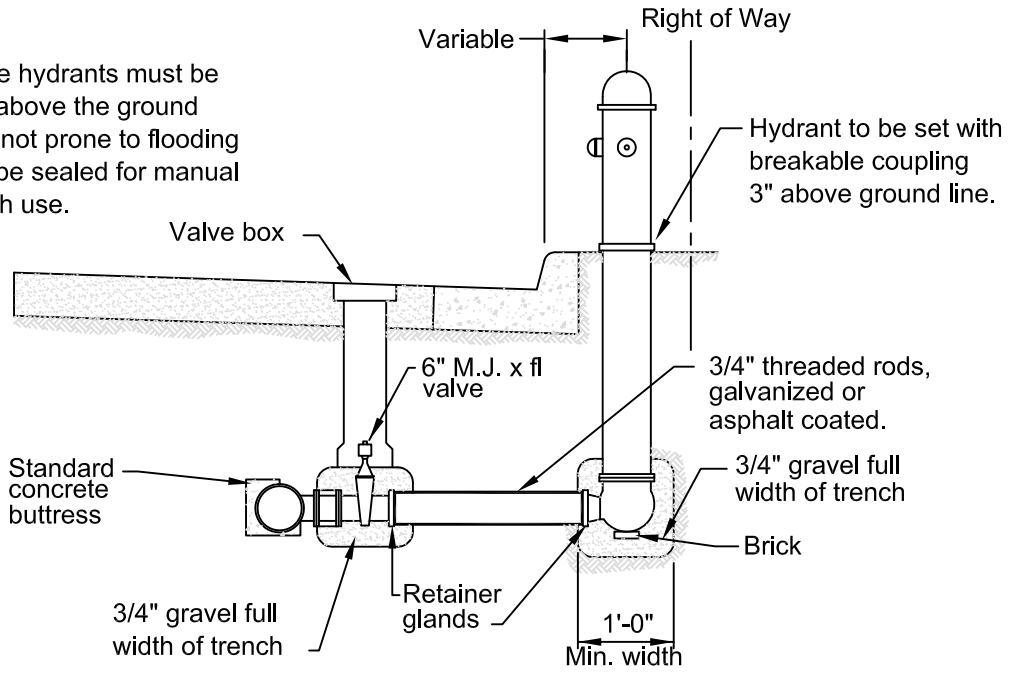
**Pre-Fab Dead End Blowoff**
**and**
**Manual Air Release**

DATE: 10/1/2014
SCALE: N.T.S
FIGURE NO.
Figure 6.0

NOTE:

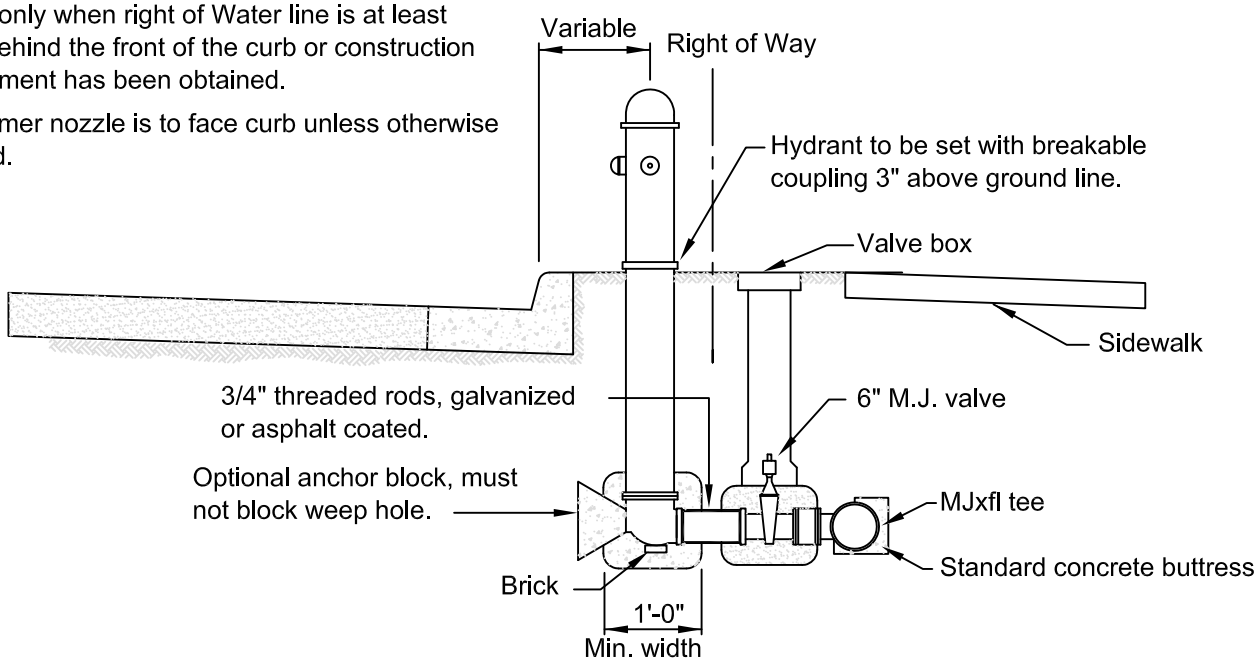
1. The drain hole for the hydrants must be located in gravel pit above the ground table and in an area not prone to flooding or the hydrant must be sealed for manual dewatering after each use.




ALTERNATE HYDRANT SETTING

NOTE:

1. Use only when right of Water line is at least 10' behind the front of the curb or construction easement has been obtained.
2. Steamer nozzle is to face curb unless otherwise noted.




TYPICAL HYDRANT SETTING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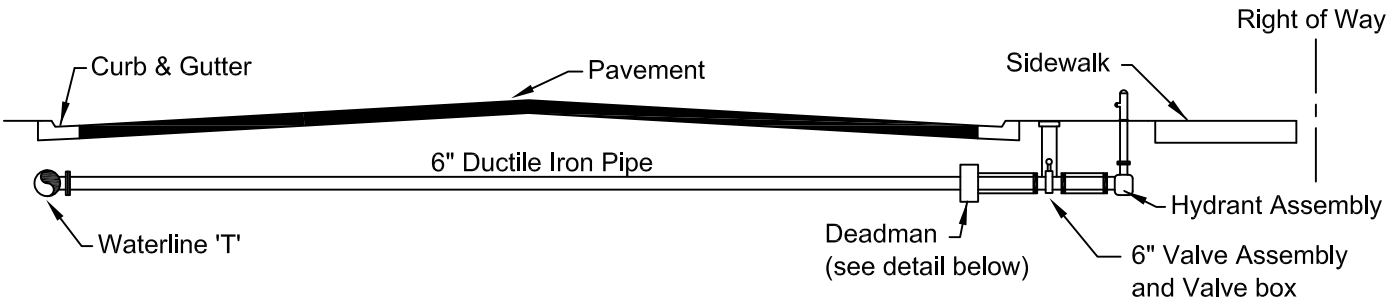
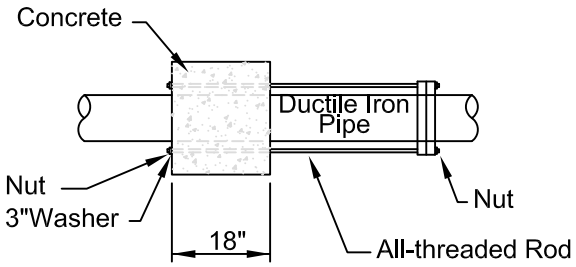
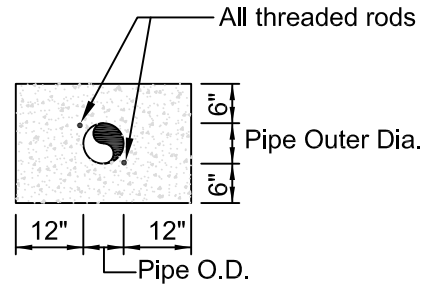
**Fire Hydrant Setting**
**Road with Curb & Gutter**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 7.0




Deadman Detail
(Side View)




Deadman Detail
(Front View)

NOTE:

1. The drain hole for the fire hydrants must be placed in a gravel pit above the ground water table in an area not subject to flooding or the hydrant will be sealed and marked for manual dewatering after use. Town Utility Inspector to verify water table.
2. Concrete anchor shall extend into sides of trench a minium of 12" into solid ground and both sides of the excavation.

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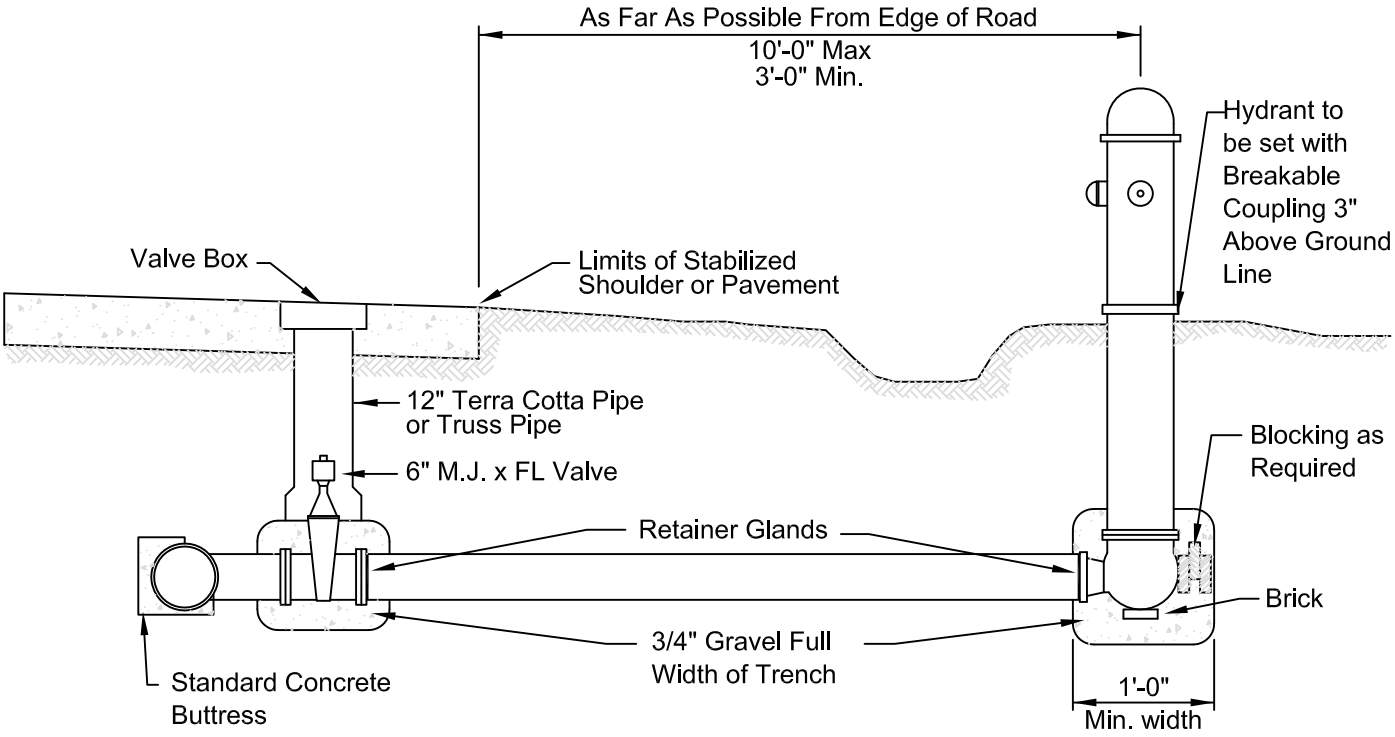
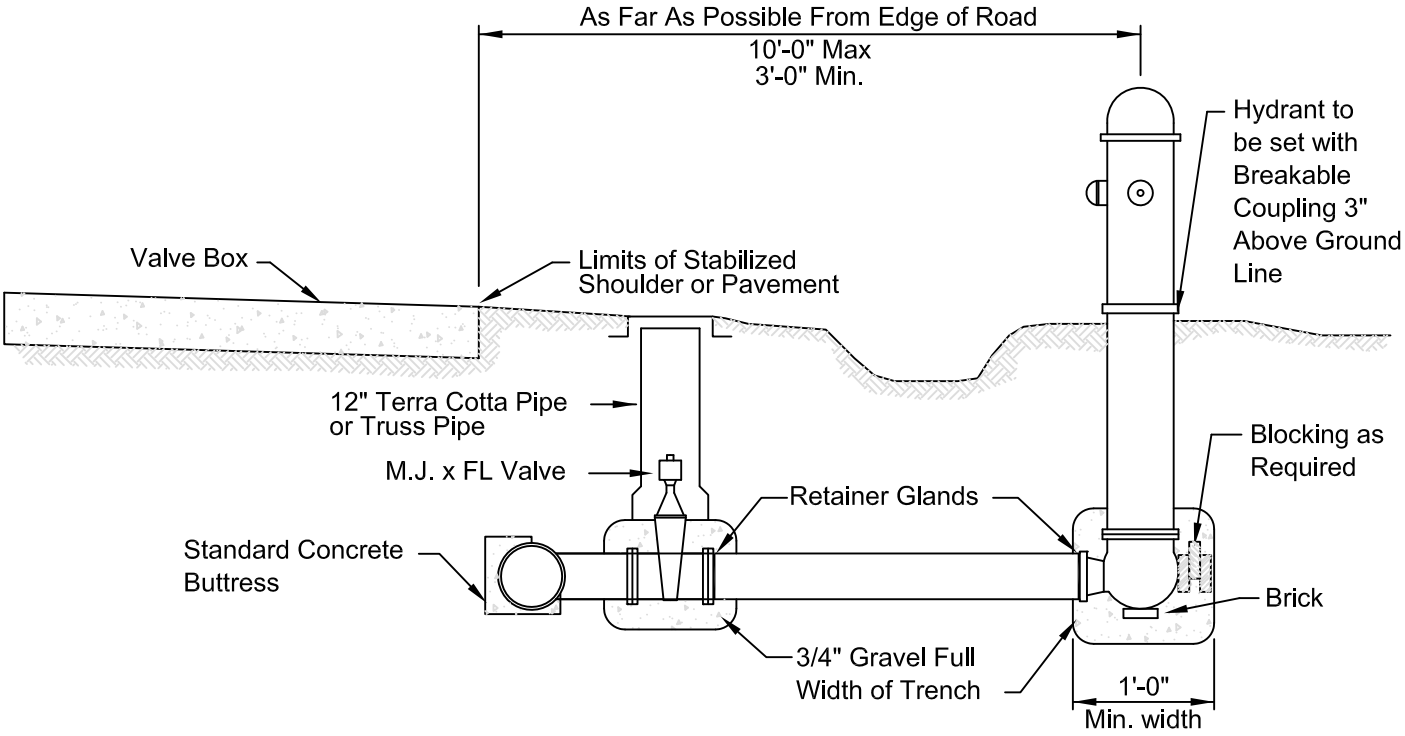
**Fire Hydrant Setting**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 7.1




PIPE INSTALLED UNDER ROAD




PIPE INSTALLED OUT OF ROAD

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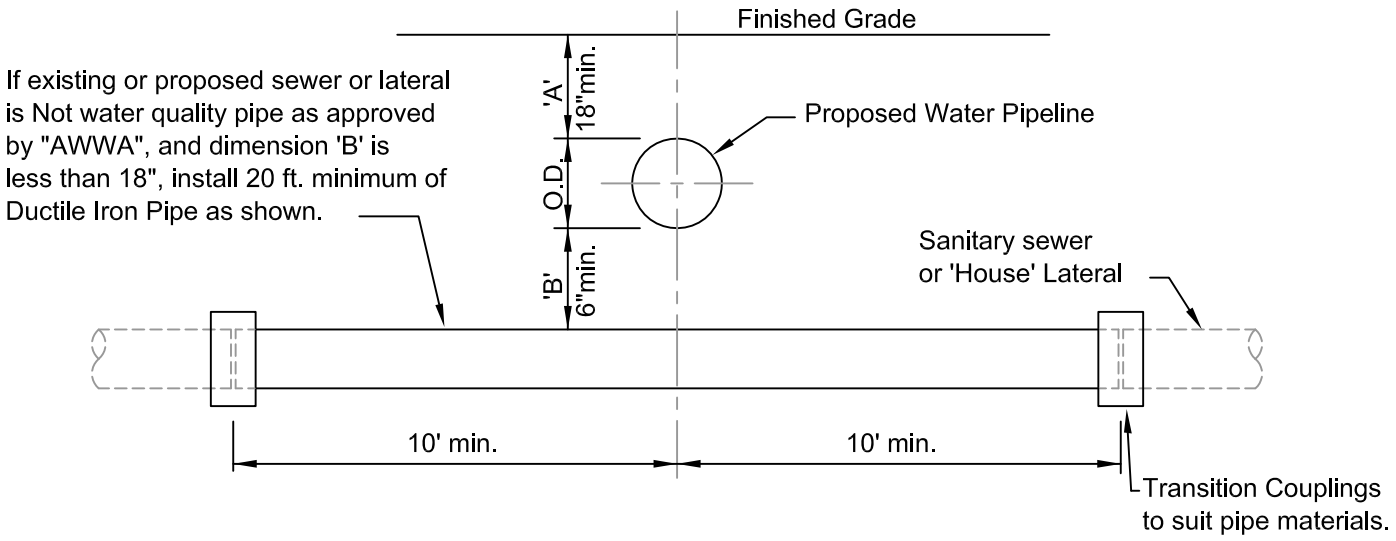
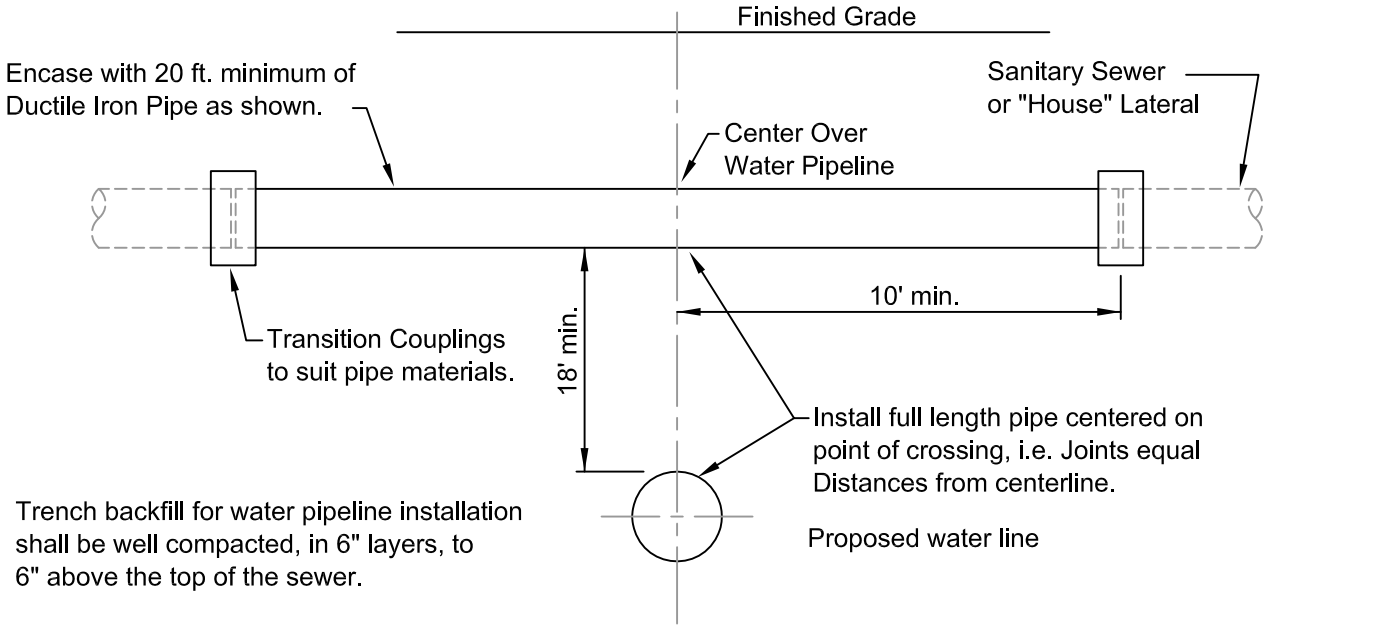
**Fire Hydrant Setting**
**Road without Curb & Gutter**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 7.2




WATER PIPELINE CROSSING
ABOVE SEWER OR LATERAL




WATER PIPELINE CROSSING
BELOW SEWER OR LATERAL

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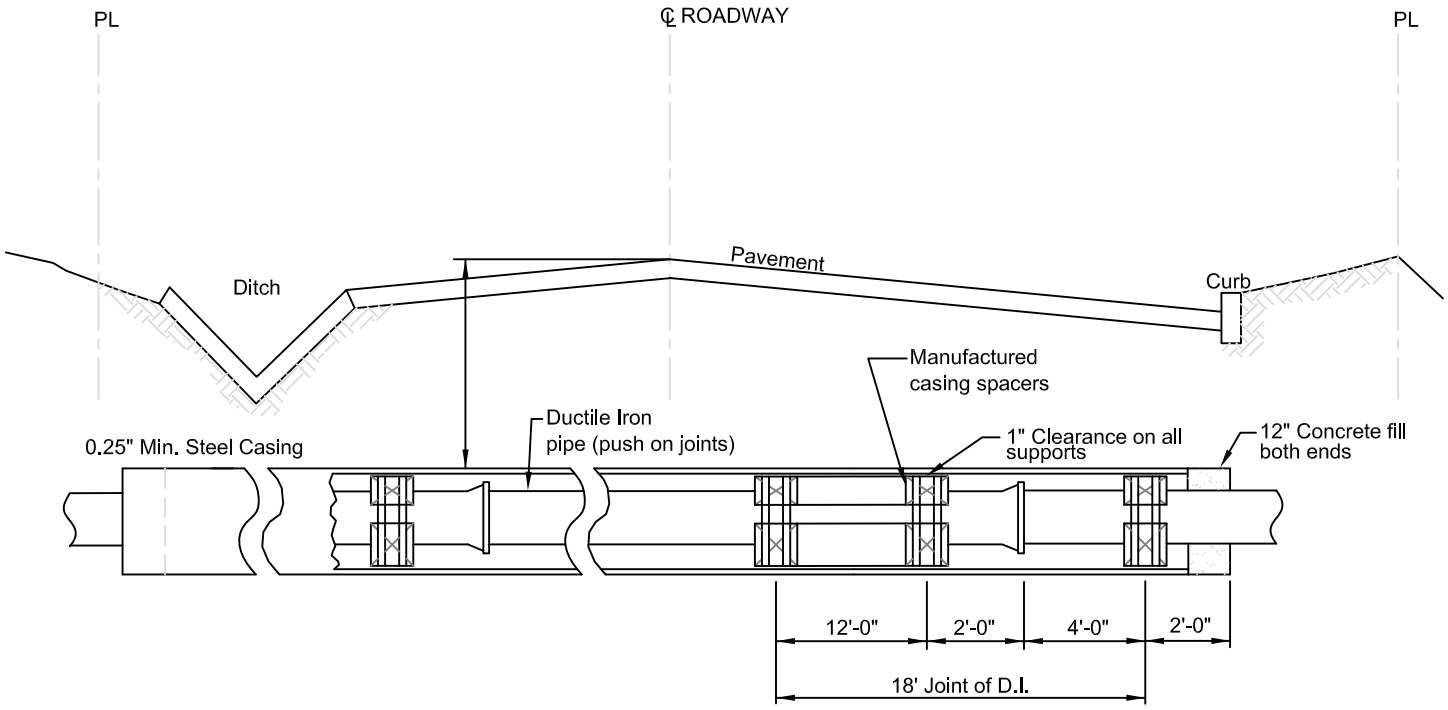
**Water/Sanitary Sewer Crossings**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 8.0

NOTE:

1. Steel casing to extend to back of curb, ditch, sidewalk, etc. or a minimum of 3' beyond the edge of pavement.





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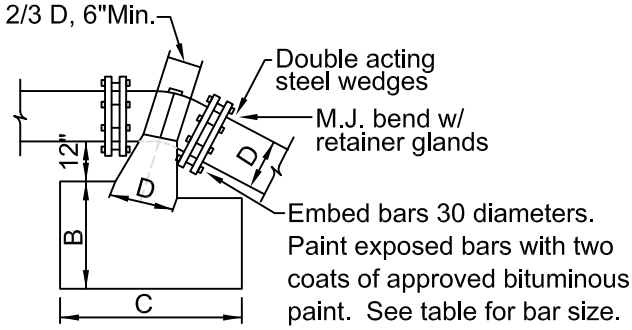
## Typical Highway Boring

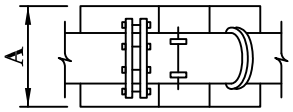
DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 9.0




ELEVATION

REINFORCING BARS

| Size | 1/64 | 1/32 | 1/16 | 1/8 |
|---|---|---|---|---|
| 6" | | 3-#6 | 3-#6 | 3-#6 |
| 8" | | 3-#6 | 3-#6 | 3-#6 |
| 10" | | 3-#6 | 3-#6 | 3-#6 |
| 12" | | 3-#6 | 3-#6 | 3-#6 |
| 16" | | 3-#6 | 3-#6 | 3-#6 |
| 20" | 3-#6 | 3-#6 | 3-#6 | 4-#6 |
| 24" | 3-#6 | 3-#6 | 3-#6 | 5-#6 |
| 30" | 3-#6 | 3-#6 | 5-#6 | 5-#7 |
| 36" | 3-#6 | 4-#6 | 5-#7 | 6-#7 |

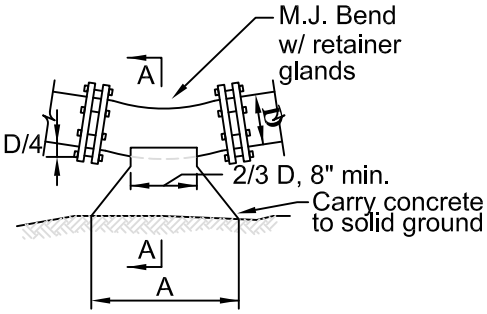



PLAN

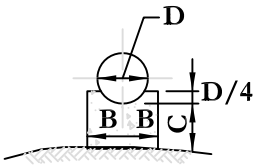
Anchorage for vertical bends

ANCHORAGE FOR VERTICAL BENDS

| Bend | | 6" | 8" | 10" | 12" | 16" | 20" | 24" | 30" |
|---|---|---|---|---|---|---|---|---|---|
| 1/64 | A | | | | | | 2'-2" | 2'-6" | 3'-6" |
| | B | | | | | | 2'-0" | 2'-6" | 2'-6" |
| | C | | | | | | 4'-6" | 4'-6" | 5'-0" |
| 1/32 | A | 1'-6" | 1'-6" | 1'-5" | 3'-0" | 3'-6" | 4'-0" | 4'-3" | 4'-6" |
| | B | 1'-3" | 1'-9" | 1'-3" | 2'-0" | 2'-0" | 2'-6" | 2'-6" | 2'-8" |
| | C | 2'-0" | 2'-6" | 2'-9" | 3'-0" | 4'-0" | 5'-0" | 5'-9" | 6'-6" |
| 1/16 | A | 2'-0" | 3'-4" | 3'-8" | 4'-0" | 4'-4" | 4'-8" | 5'-0" | 5'-4" |
| | B | 1'-9" | 2'-3" | 2'-6" | 2'-6" | 2'-6" | 2'-8" | 3'-8" | 4'-6" |
| | C | 2'-6" | 2'-8" | 3'-10" | 4'-0" | 5'-6" | 7'-6" | 8'-6" | 8'-6" |
| 1/8 | A | 2'-6" | 3'-0" | 4'-0" | 4'-6" | 5'-2" | 5'-6" | 6'-0" | 6'-6" |
| | B | 2'-6" | 2'-9" | 3'-0" | 3'-6" | 4'-0" | 4'-6" | 5'-6" | 6'-0" |
| | C | 3'-0" | 4'-0" | 4'-6" | 4'-9" | 6'-6" | 8'-6" | 9'-6" | 11'-0" |




ELEVATION




SECTION A-A

Buttress for vertical bends

BUTTRESS FOR VERTICAL BENDS

| Bend | | 6" | 8" | 10" | 12" | 16" | 20" | 24" | 30" |
|---|---|---|---|---|---|---|---|---|---|
| 1/64 | A | | | | | | 1'-8" | 2'-0" | 2'-6" |
| | B | | | | | | 10" | 1'-0" | 1'-3" |
| | C | | | | | | 10" | 1'-0" | 1'-1" |
| 1/32 | A | 6" | 8" | 10" | 1'-0" | 1'-4" | 1'-8" | 2'-0" | 2'-6" |
| | B | 7" | 8" | 9" | 10" | 1'-0" | 1'-2" | 1'-4" | 1'-7" |
| | C | 7" | 7" | 8" | 8" | 9" | 10" | 1'-0" | 1'-1" |
| 1/16 | A | 9" | 1'-0" | 1'-6" | 1'-9" | 2'-3" | 3'-0" | 3'-6" | 4'-2" |
| | B | 7" | 7" | 8" | 10" | 1'-0" | 1'-2" | 1'-4" | 1'-7" |
| | C | 7" | 7" | 8" | 8" | 9" | 10" | 1'-0" | 1'-1" |
| 1/8 | A | 1'-3" | 1'-8" | 2'-1" | 2'-6" | 3'-4" | 4'-2" | 5'-0" | 6'-3" |
| | B | 7" | 8" | 9" | 11" | 1'-3" | 1'-6" | 1'-9" | 2'-3" |
| | C | 7" | 8" | 10" | 11" | 1'-3" | 1'-6" | 1'-9" | 2'-3" |

**Notes:**

1. All concrete to be 3000 P.S.I.
2. Buttress dimensions shown are minimum.
   Dimensions are based upon soil bearing pressure of 3000 P.S.F. and static water pressure of 150 P.S.I.

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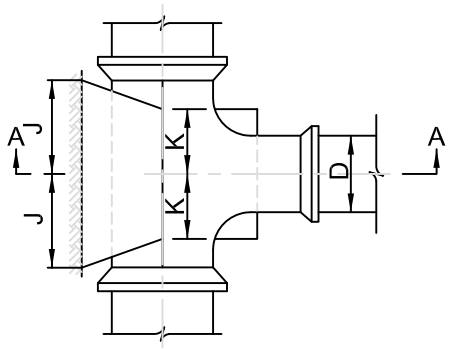
**Buttresses and Anchorage for Vertical Bends**

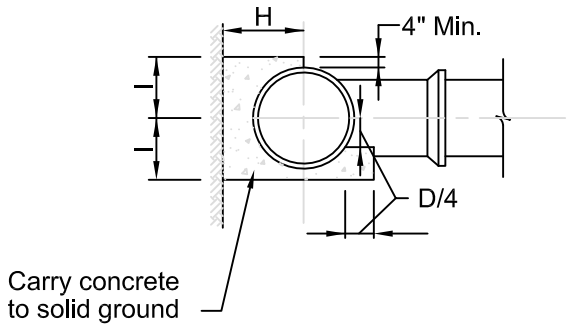
DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 10.0

Notes:

1. All concrete to be 3000 P.S.I.
2. Buttress dimensions shown are minimum. Dimensions are based upon soil bearing pressure of 3000 P.S.F. and static water pressure of 150 P.S.I. when pressure exceeds 150 P.S.I. or where soil bearing pressure is less than 3000 P.S.F. special buttress design is required.




PLAN VIEW




SECTION A-A

| SIZE OF BRANCH | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D | 6" | 8" | 10" | 12" | 18" | 20" | 24" | 30" | 36" |
| H | 8" | 9" | 10" | 1'-0" | 1'-2" | 1'-4" | 1'-6" | 1'-9" | 2'-0" |
| I | 8" | 10" | 1'-0" | 1'-3" | 1'-8" | 2'-1" | 2'-6" | 3'-1" | 3'-9" |
| J | 6" | 8" | 1'-0" | 1'-0" | 1'-4" | 1'-8" | 2'-0" | 2'-6" | 3'-0" |
| K | 6" | 8" | 8" | 8" | 10" | 1'-2" | 1'-4" | 1'-6" | 1'-10" |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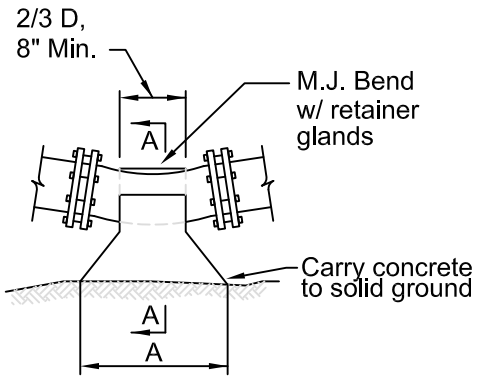
**Buttress for Tees**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 10.1

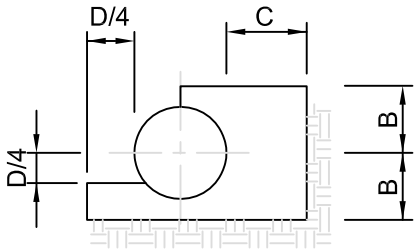
Notes:

1. All concrete to be 3000 P.S.I.
2. Buttress dimensions shown are minimum.
   Dimensions are based upon soil bearing pressure of 3000 P.S.F. and static water pressure of 150 P.S.I. Special buttress design is required when conditions encountered vary from these conditions.

| Bend | | 6" | 8" | 10" | 12" | 16" | 20" | 24" | 30" | 36" |
|---|---|---|---|---|---|---|---|---|---|---|
| 1/64 | A | | | | | | 1'-6" | 2'-0" | 2'-6" | 3'-0" |
| | B | | | | | | 10" | 1'-0" | 1'-3" | 1'-6" |
| | C | | | | | | 10" | 1'-0" | 1'-1" | 1'-2" |
| 1/32 | A | 6" | 8" | 10" | 1'-0" | 1'-4" | 1'-6" | 2'-0" | 2'-6" | 3'-0" |
| | B | 6" | 8" | 9" | 10" | 1'-0" | 1'-2" | 1'-4" | 1'-7" | 1'-11" |
| | C | 7" | 7" | 8" | 8" | 9" | 10" | 1'-0" | 1'-1" | 1'-2" |
| 1/16 | A | 9" | 1'-0" | 1'-6" | 1'-9" | 2'-3" | 3'-0" | 3'-6" | 4'-2" | 5'-4" |
| | B | 7" | 8" | 9" | 10" | 1'-0" | 1'-2" | 1'-4" | 1'-7" | 2'-0" |
| | C | 8" | 9" | 10" | 11" | 1'-2" | 1'-4" | 1'-4" | 1'-9" | 2'-0" |
| 1/8 | A | 1'-3" | 1'-8" | 2'-1" | 2'-6" | 3'-4" | 4'-2" | 5'-0" | 6'-3" | 7'-6" |
| | B | 7" | 8" | 9" | 11" | 1'-3" | 1'-6" | 1'-8" | 2'-0" | 2'-6" |
| | C | 8" | 9" | 10" | 11" | 1'-2" | 1'-4" | 1'-9" | 2'-3" | 2'-8" |
| 1/4 | A | | 2'-3" | | 3'-6" | | | | | |
| | B | | 9" | | 12" | | | | | |
| | C | | 9" | | 12" | | | | | |




PLAN




SECTION A-A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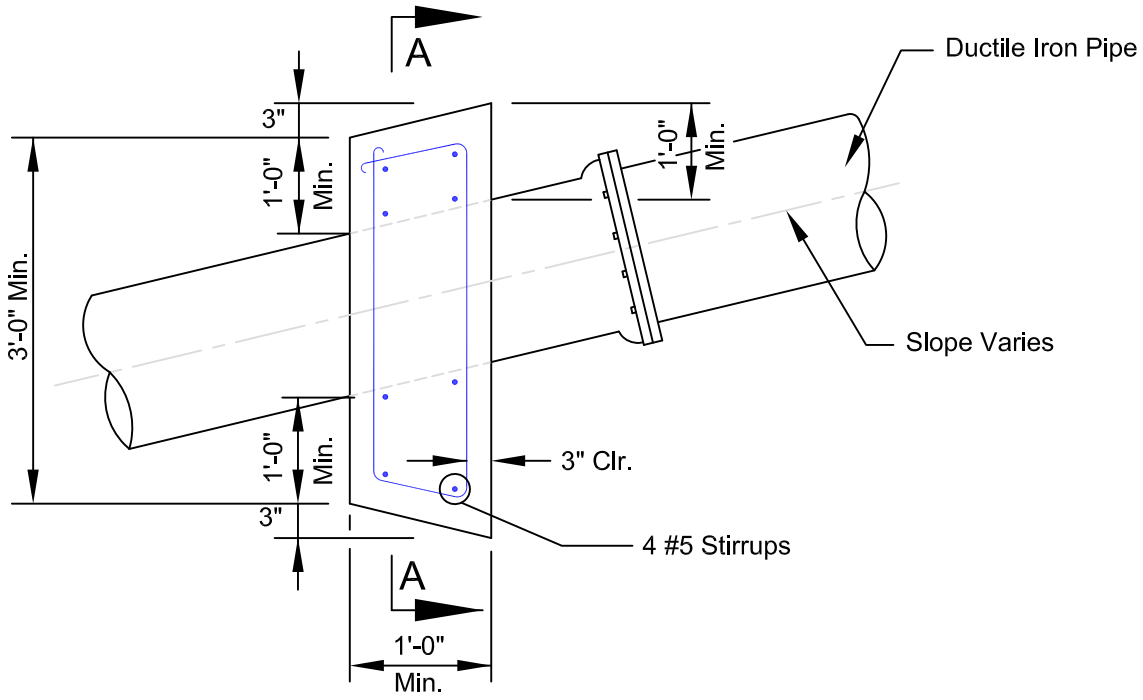
**Buttresses for Horizontal Bends**

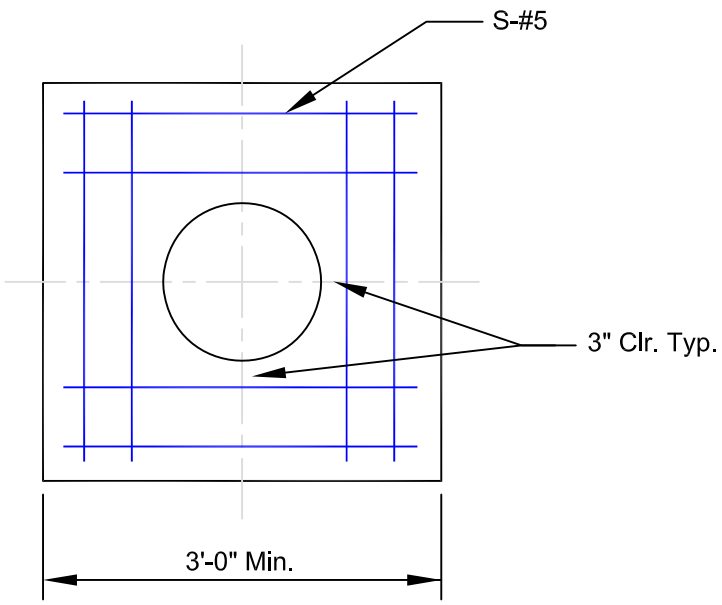
DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 10.2

NOTES:

1. f'c = 3000 PSI @ 28 days.
2. All reinforcing steel to be ASTM A-615 Grade 60.
3. Carry all bearing surfaces to firm subgrade, place concrete anchor up against downgrade side of bell.
4. For use on pipes placed on slopes over 20%. Installed on downhill sides of each bell end of pipe.




PLAN VIEW




SECTION A-A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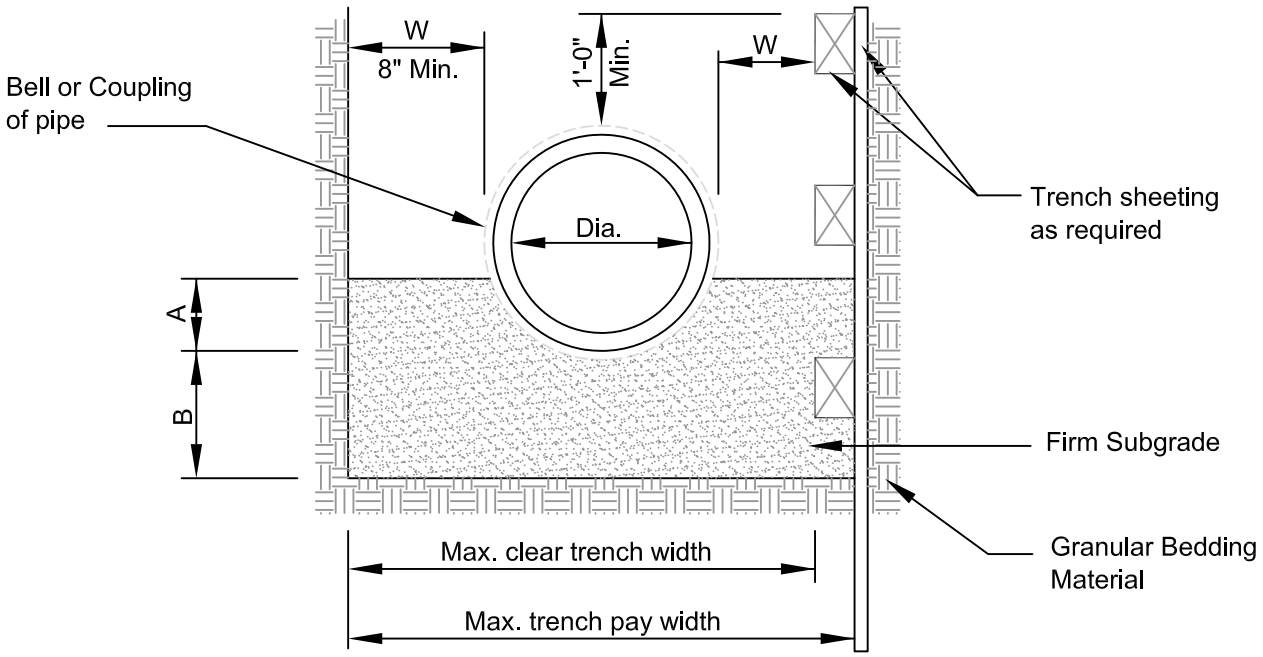
**Concrete Anchor for 6", 8", 10" and 12" Pipe**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 10.3




| DIA. | A | W | B |
|---|---|---|---|
| 4" | 3" | 12" | 6" |
| 6" | 4" | 11" | 6" |
| 8" | 5" | 10" | 6" |
| 10" | 5" | 8" | 6" |
| 12" | 5" | 8" | 6" |
| 15" | 5" | 8" | 6" |
| 12" x 18" | 5" | 8" | 6" |
| 20" x 21" | 7" | 8" | 6" |
| 24" | 8" | 12" | 6" |
| 27" | 8" | 12" | 6" |
| 30" | 8" | 12" | 6" |
| 33" | 10" | 15" | 6" |
| 35" | 10" | 15" | 6" |
| 42" | 15" | 15" | 6" |
| 45" | 15" | 15" | 6" |
| 54" | 15" | 15" | 6" |
| 60" | 15" | 15" | 6" |
| 64" | 21" | 15" | 6" |
| 72" | 21" | 15" | 6" |
| 78" | 25" | 15" | 6" |
| 84" | 25" | 15" | 6" |
| 90" | 25" | 15" | 6" |
| 96" | 25" | 15" | 12" |
| 102" | 30" | 15" | 12" |
| 108" | 32" | 24" | 12" |
| 114" | 34" | 24" | 12" |
| 120" | 36" | 24" | 12" |

NOTES:

1. Where specially required, i = 2000PSI @ 28 days concrete and saddle blocks shall be used in lieu of the gravel cradle.
2. The granular materials for bedding shall be (ASTM C33 67) washed gravel or crushed stone for 90" and smaller.
3. Maximum clear trench width shall be 2w plus the outside diameter of the pipe.
4. Elliptical pipe shall be bedded in sand. See contract drawings for amount of bedding required.

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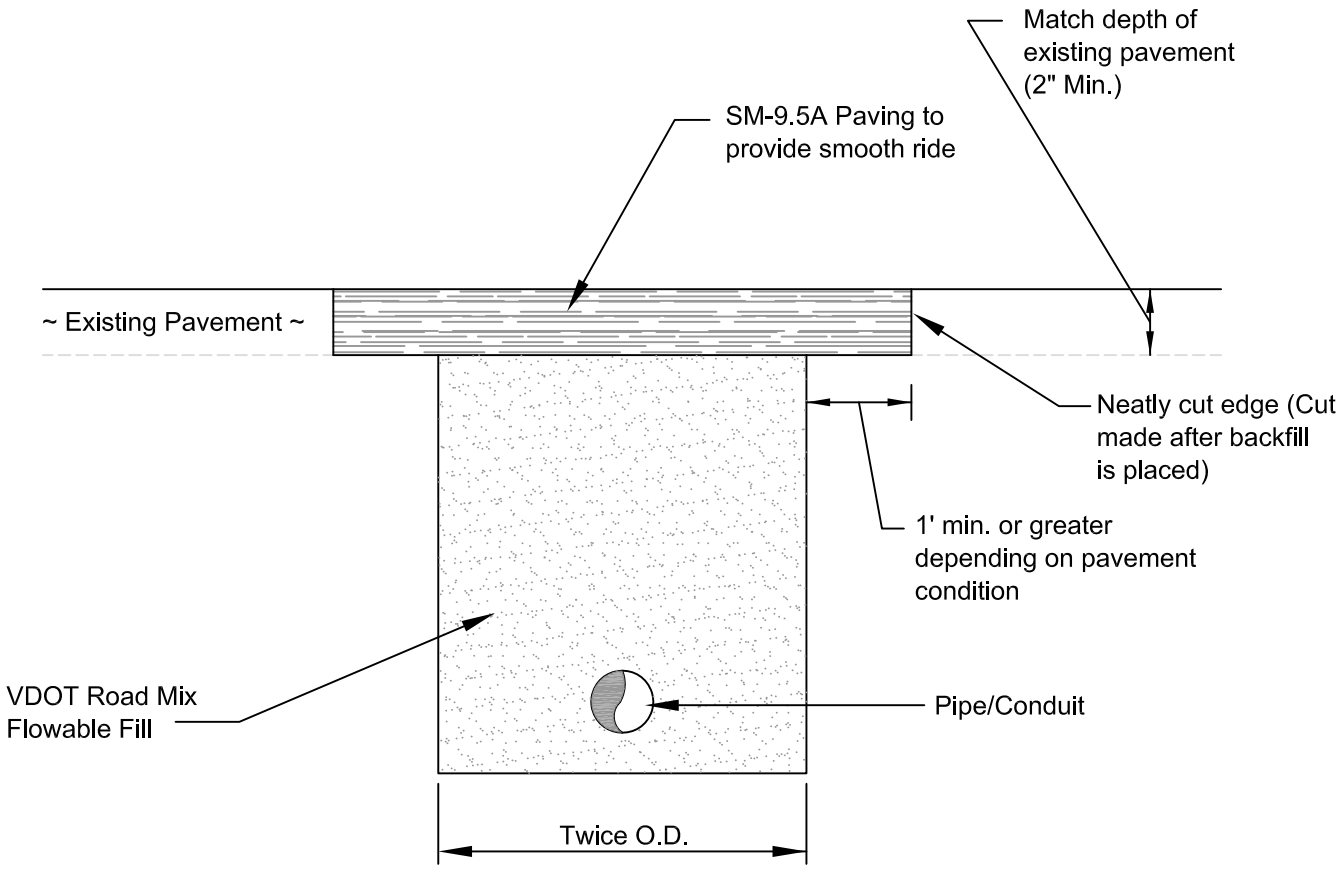
**Bedding and Trench Widths**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 11.0




NOTES:

1. Repaired surface to be at least as good as original surface.
2. Paving to be placed within 5 working days of utility repair.
   Flowable fill to be brought up to bottom of asphalt with 7/8" cold rolled steel plates to cover trench.
3. During cold weather, cold mix to be used as temporary measure on primary streets (for determination of primary street call Utility Inspector), 21B on other streets. Permanent SM-9.5A paving to be placed within 3 weeks of start up of hot mix plants. Check stone or plates at least daily until resurfaced.
4. Safety measures are required: for example: flag men at all times the street is obstructed, barricades at night, bracing etc.
5. Excavation permits are required for all cuts in the Town right-of-way.
6. Contact the Town Utility Inspector (961-1126) prior to starting work (non-emergency) and prior to finishing work.
7. Excavated material may be used as temporary backfill in an emergency street cut, but is to be removed and replaced with flowable fill not later than the next day.

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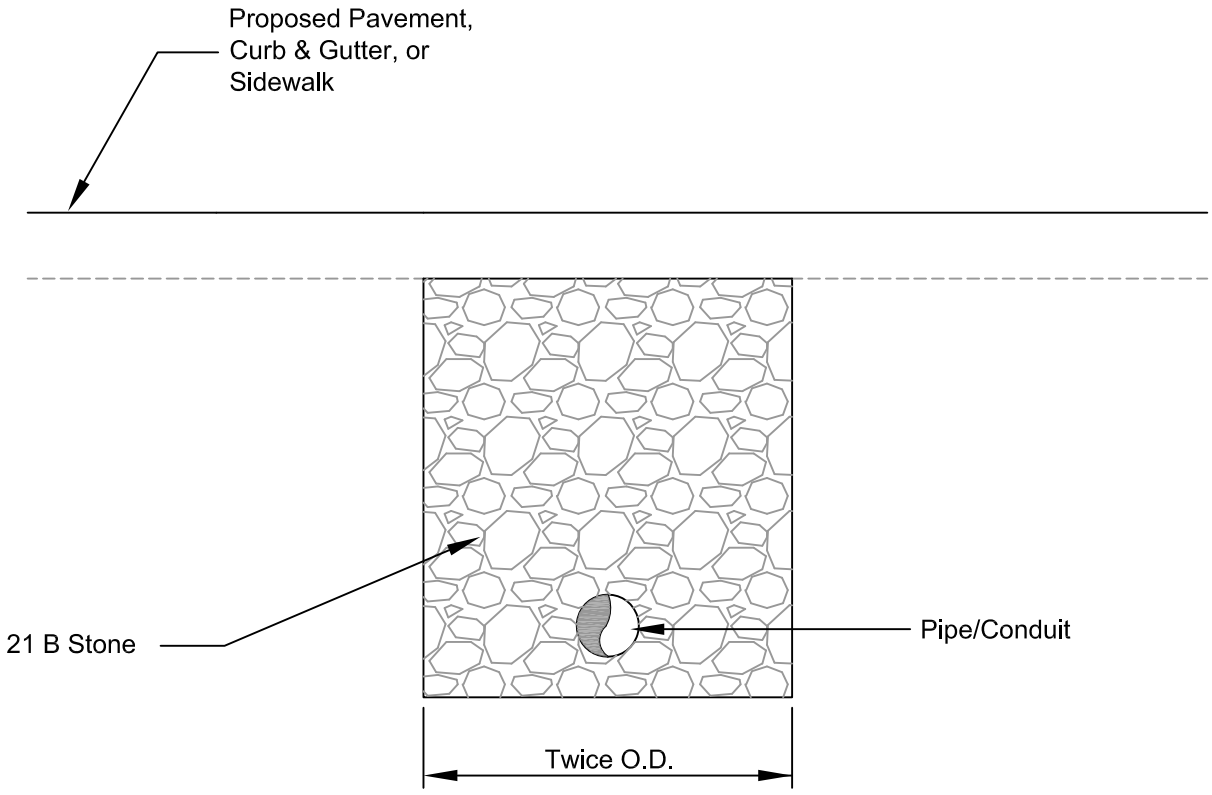
**Standard Utility Cut Repair**
**(for work within the existing pavement, curb & gutter, or sidewalk)**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 12.0

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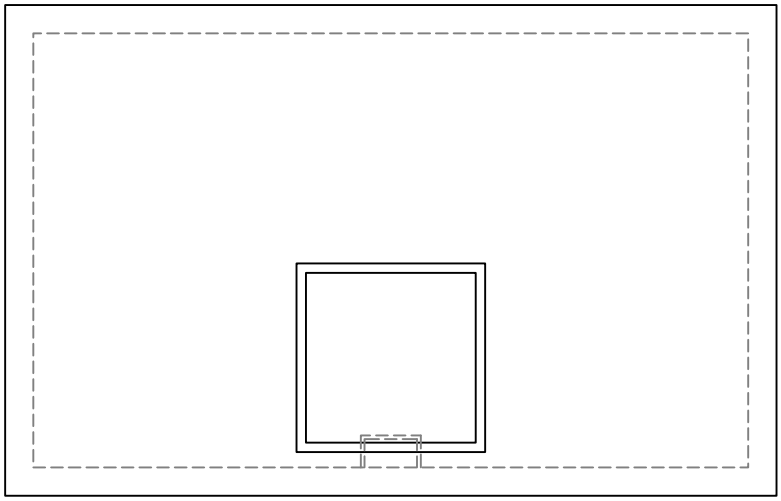
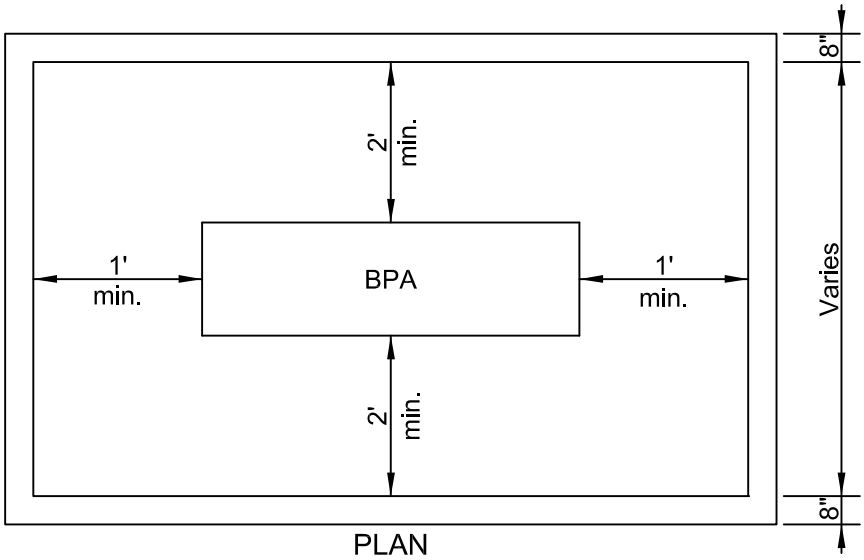
**Standard Utility Installation**
**(for work within proposed pavement, curb & gutter, or sidewalk)**

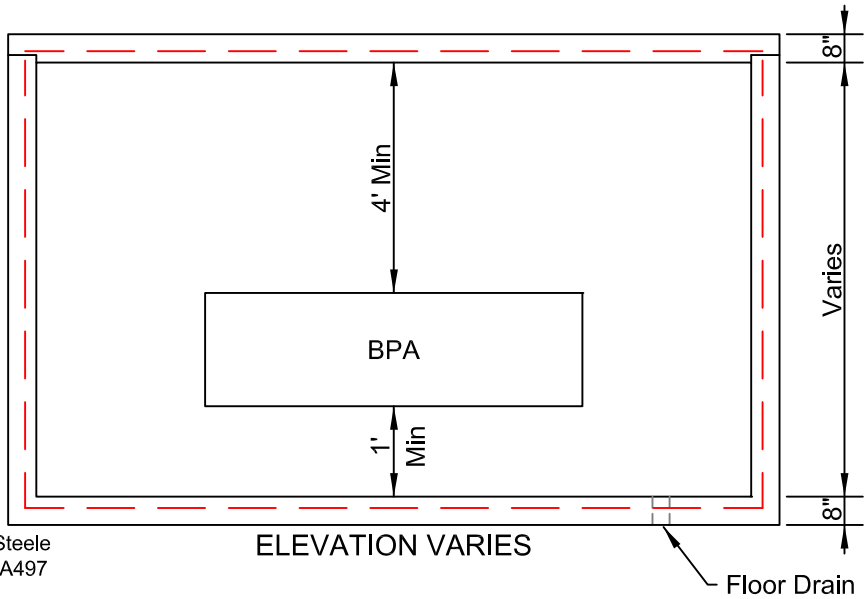
DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 12.1



PLAN - HATCH LOCATION




PLAN




ELEVATION VARIES

Notes:
1. 4000 PSI Concrete; Grade 60 Steele
2. Reinforcing Meets ASTM A615/A497
3. 4" floor drain centered in floor.
4. Manhole Steps @ 16" C. to C.
5. Non-Traffic loading.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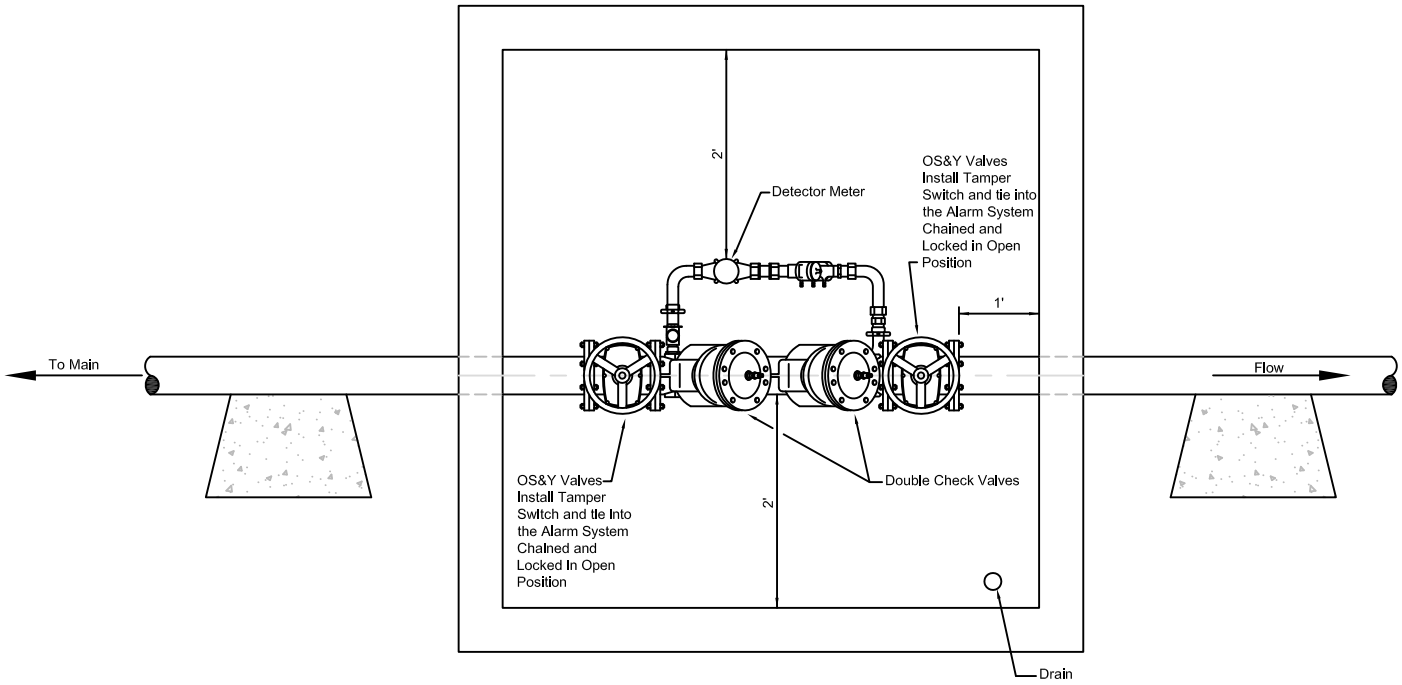
**Detector Check Vault**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 13.0

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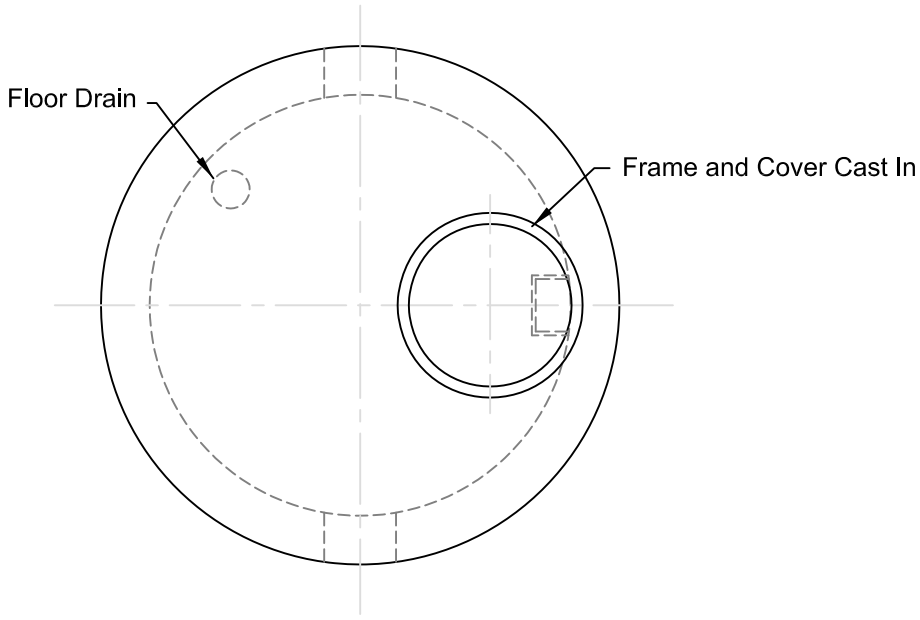
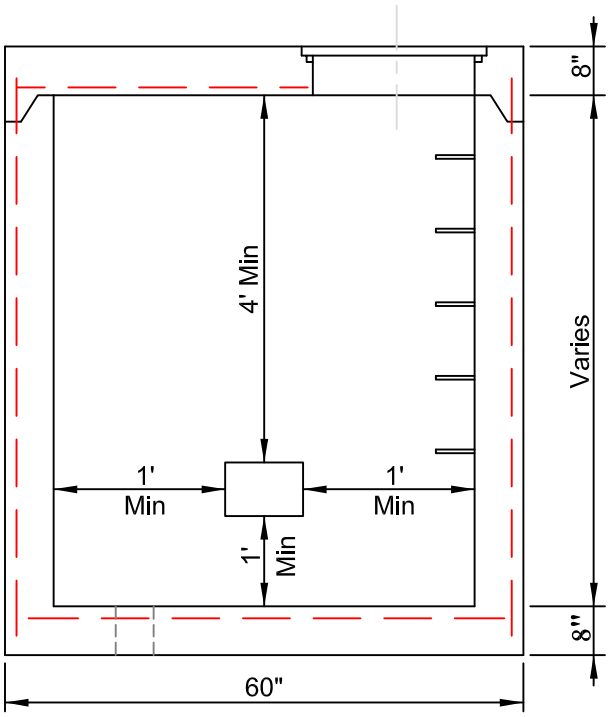
**Sprinkler Line**
**Dimensions of Double Gate Check Assembly**
**Will Vary Dependent of Line Size**
**Assembly May be Installed in Building if within 100 ft of Water Mian**

DATE: 10/1/2014
SCALE: N.T.S
FIGURE NO.
Figure 14.0

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**Backflow Prevention Assembly in 60" Dia. Manhole**

DATE: 10/1/2014
SCALE: N.T.S.
FIGURE NO.
Figure 15.0