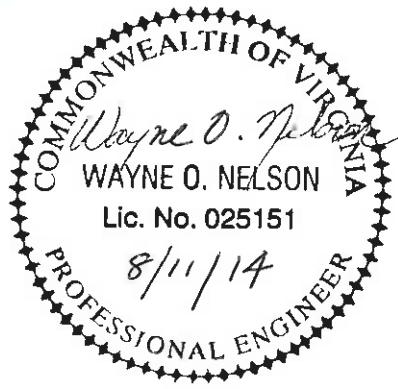


Minimum Standards and Specifications for Waterline Design and Construction



8/11/2014
Town of Christiansburg, VA



Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

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I. General Requirements

A. Introduction

1. The Town of Christiansburg's Minimum Standards and Specifications for Waterline Design and Construction are written to establish the minimum level of quality that is deemed acceptable by the Town for waterline design and construction activities.
2. While it is the Town's desire to encourage qualified professionals to seek new and better solutions to complicated technical problems, certain standard procedures and the use of these standards and specifications are necessary to promote orderly and controlled development and to expedite the construction drawing approval process.

B. Applicability

1. Under provisions established by the Virginia Department of Health, the Town may review and approve plans to modify or extend the Town's waterworks where waterlines are 12" or less in diameter and pumping or storage facilities are not required.
2. The minimum standards and specifications described herein are applicable to the design and construction of waterlines that are or will be accepted, owned, operated, and/or maintained by the Town of Christiansburg.
3. These minimum standards and specifications are supplementary to the Virginia Waterworks Regulations (latest edition), the Town's Design Manual (latest edition), and to the requirements of all other local, state, and federal agencies having jurisdiction. Where conflicts exist, the more stringent requirements shall apply. Nothing contained herein shall be construed to waive or modify any other requirements of existing regulations and/or law. Any conflicts discovered within these standards should be brought to the attention of the Director of Engineering in a timely manner.
4. These standards are to be treated as mandates rather than guidelines, unless otherwise specifically stated. The Director of Engineering may allow a variance from a given standard where a variance is needed to be consistent with good engineering practice and procedure and also considered to be in the Town's best interest. In all cases,

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variations are only considered approved if clearly shown and identified on the respective plans.

5. Design professionals, developers, contractors, material suppliers, and other users of these standards and specifications should keep in mind that the Town's objective is to provide the best public water system possible for its customers without undue cost.

C. Definitions and Abbreviations

1. The following definitions are included for reference:

- a) Design Professional: The appropriately licensed professional responsible for preparation of project plans and specifications.
- b) Owner: The individual or entity possessing ownership of real property that is to be modified through the course of a proposed project or their designee.
- c) Developer: The individual or entity that is responsible for funding and/or implementation of a proposed project or their designee.
- d) Contractor: The appropriately licensed individual or entity that actually constructs proposed infrastructure.
- e) Town: Town of Christiansburg.
- f) Town Manager: The individual appointed by Town Council to manage the day to day affairs of the Town.
- g) Director of Engineering: The appropriately licensed individual designated by the Town Manager to act as the Director of Engineering, or the Director of Engineering's designee.
- h) Town Inspector: The individual designated by the Director of Engineering to observe and inspect infrastructure construction activities.
- i) Water System Operator: The appropriately licensed individual designated by the Town Manager to operate the Town's water system, or the Water System Operator's designee.

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- j) Erosion and Sediment Control Program Administrator: The appropriately licensed individual designated by the Director of Engineering to administer the Town's Erosion and Sediment Control Program.
- k) Stormwater Management Program Administrator: The appropriately licensed individual designated by the Director of Engineering to administer the Town's Stormwater Management Program.
- l) Design Drawings: Detailed technical drawings that graphically communicate and document the desired process and product of a proposed construction project that has been prepared by and certified by an appropriately licensed Design Professional.
- m) Record Drawings: Detailed technical drawings that graphically communicate and document the actual configuration and location of a product of a completed construction project that has been prepared by and certified by an appropriately licensed Design Professional.

2. The following abbreviations are included for reference:

- a) AWWA American Water Works Association
- b) ASTM American Society for Testing and Materials
- c) ISO Insurance Services Office
- d) NFPA National Fire Protection Association
- e) psi pounds per square inch
- f) SCC State Corporation Commission
- g) VDEQ Virginia Department of Environmental Quality
- h) VDH Virginia Department of Health
- i) VDOT Virginia Department of Transportation
- j) VESCH Virginia Erosion and Sediment Control Handbook

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D. Preliminary Engineering Conference, Project Plan Review, and Approval

1. A preliminary engineering conference shall be held between the Director of Engineering, the Owner, the Developer, and the Design Professional prior to plan submittal. This requirement may be waived at the discretion of the Director of Engineering.
2. Project plans shall be submitted to the Town for review in accordance with Town Code.
3. Project plan approval is valid for 60 months from the date of approval. If construction has not commenced by the end of that period, resubmittal may be required at the discretion of the Director of Engineering.
4. If at any time the project plans are deemed inadequate in any way, as determined by the Director of Engineering, a resubmittal may be required at the discretion of the Director of Engineering.
5. After plans are approved, the Owner will be required to:
 - a) Submit 4 copies of the approved plan;
 - b) Identify an appropriately licensed Contractor for construction of the project; and
 - c) Identify an appropriately licensed professional that will be retained for completion of record drawings.

E. Project Plans

1. General
 - a) All project plans shall be submitted to the Town on 24 inch by 36 inch sheets of paper, except where other sheet sizes are specifically allowed at the discretion of the Director of Engineering. All drawings shall be at a reasonable scale and shall be modified as required by the Director of Engineering.
 - b) The cover sheet(s) shall:
 - (1) Identify the project name, Town of Christiansburg project number, location, owner, developer, and design professional.

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- (2) Include an index of plan sheets included in the plan set.
- (3) Include a legend of symbols and line types used.
- (4) Include an appropriately scaled vicinity map that is used to demonstrate the location of the project.

- c) Each plan sheet shall be signed and sealed by an appropriately licensed Design Professional in accordance with state and local laws and regulations.
- d) Drawings shall be based on the Virginia State Plane Coordinate System.

2. Design Drawings

- a) Waterline design drawings shall clearly show all existing and proposed infrastructure in the plan view. A corresponding profile view shall be shown for all proposed waterlines that are to be accepted by the Town. Any existing infrastructure crossing proposed waterlines shall be shown graphically and clearly labeled, identifying the crossing infrastructure and its respective station.

3. Record Drawings

- a) Waterline record drawings shall clearly show the actual location of all constructed infrastructure in the plan view. A corresponding profile view shall show the actual depth for all constructed waterlines that are to be accepted by the Town. Any existing infrastructure exposed during construction shall be shown graphically in its actual location and clearly labeled, identifying the crossing infrastructure and its respective station.

4. Digital Information

- a) Digital information shall be in the Virginia State Plane Coordinate System, shall be drawn to scale, shall be geographically accurate, and shall be submitted in a format that is acceptable to the Director of Engineering.

F. Infrastructure Construction Security

1. A bond or other valuable form of guaranteed financial security, as deemed acceptable by the Director of Engineering, shall be dedicated to

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the Town as a guarantee of performance for the construction of all infrastructure.

2. In the event that any Contractor, Developer, or Owner fails to complete construction of a respective proposed infrastructure, the respective security may be utilized to complete, repair, or restore the infrastructure, any related infrastructure and/or item that was or was not altered as intended and as a result of infrastructure construction.

G. Infrastructure Construction Permit

1. Prior to initiating construction of any waterline, the Contractor shall obtain an infrastructure construction permit from the Town.

H. Infrastructure Coordination

1. It is the responsibility of the Design Professional to coordinate infrastructure design such that there are no conflicts between any existing and any proposed infrastructures. If a conflict is encountered during construction it is the responsibility of the Design Professional of record to resolve the conflict to the satisfaction of the Director of Engineering.

2. It is the responsibility of the Contractor to protect existing underground infrastructures during construction in accordance with the laws and regulations of the Underground Utility Damage Prevention Act and the SCC.

I. Erosion and Sediment Control and Stormwater Management

1. Infrastructure construction is subject to the requirements of Chapter 16 of the Christiansburg Town Code, Erosion and Sediment Control and Stormwater Management, unless deemed exempt by the Director of Engineering, the Erosion and Sediment Control Program Administrator, and/or the Stormwater Management Program Administrator.

J. Location

1. All waterlines to be accepted, owned, operated, and/or maintained by the Town shall lie within rights-of-way or easements dedicated to the Town of Christiansburg. Easements shall have a minimum width of 15 feet. Increased easement widths may be required at the discretion of the Director of Engineering.

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K. Deviation From the Approved Plan

1. If the Owner, Developer, or Contractor desires to deviate from the approved plan, authorization by the Director of Engineering is required. Revisions to the approved plan may be required at the discretion of the Director of Engineering.

L. Inspections

1. All waterline construction work shall be inspected by a Town Inspector under the direction of the Director of Engineering.

2. When deficiencies in materials or workmanship are identified, the inspector shall notify the Contractor. If deficiencies are not corrected to the satisfaction of the Town Inspector, the Town Inspector shall notify the Director of Engineering for further consideration and corrective action.

3. Substantial Completion Inspection

a) Upon completion of all waterline construction work and site restoration, the Contractor shall request an inspection for acceptance of infrastructure by the Town. Upon the Contractor's request, the Director of Engineering shall conduct a thorough and comprehensive inspection of the constructed waterline and identify in writing any deficiencies found that require correction.

b) The Contractor shall correct each item to the satisfaction of the Director of Engineering.

M. Substantial Completion and Acceptance by Town

1. The following conditions must be met prior to acceptance of any infrastructure by the Town:

a) Passing of all applicable tests;

b) Completion of substantial completion inspection;

c) Correction of any deficiencies noted during substantial completion inspection;

d) Certification that all work was completed in accordance with the approved plans and specifications by a civil engineer registered as a Professional Engineer in the Commonwealth of Virginia; and

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- e) Completion, submittal, review, and acceptance of Record Drawings.
2. When all requirements have been met for acceptance by the Town, the Director of Engineering will issue a certificate of substantial completion and acceptance. The infrastructure will then become property of the Town to be operated and maintained by the Town, with a warranty to repair defects in materials and workmanship for a period of one year. The duration of warranty period may be altered at the discretion of the Director of Engineering.
3. Upon acceptance of the respective waterline and at the discretion of the Director of Engineering the Town may release a portion of the infrastructure construction security.

N. Final Inspection

1. After a period of one year, the Director of Engineering shall again conduct a thorough and comprehensive inspection of the constructed waterline and identify in writing any deficiencies that require correction.
2. The Contractor shall correct each item to the satisfaction of the Director of Engineering.
3. Upon successful completion of the final inspection and any required corrections, the Town will release all remaining security for the respective waterline.

O. Safety

1. It is the Contractor's responsibility to initiate, maintain, and supervise all safety precautions and programs throughout construction of every project. This responsibility does not relieve any Subcontractors of their responsibility for the safety of people and property in the performance of their work.

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II. Water System Design Standards and Specifications

A. General

1. Water system design shall be in accordance with all federal, state, and local guidelines.
2. A detailed analysis shall be performed by an appropriately licensed Design Professional to demonstrate any proposed changes to the water system meets the requirements set forth in these standards and specifications.
3. If a project is to be constructed in phases, a separate analysis shall be performed for each phase, and a separate comprehensive analysis shall be performed for the total project.
4. Upon receiving a written request, the Town shall provide flow and pressure availability to the Design Professional.
5. Where the Town's existing infrastructure does not provide adequate capacity, the Owner will be required to construct additional storage and/or pumping facilities.
6. All potable water pumping and storage facilities shall be reviewed and approved by the Virginia Department of Health at the expense of the Owner.

B. Capacity

1. The design capacity of the waterworks shall exceed the maximum daily water demand of the system. Waterworks shall normally be designed on the following basis of water consumption. If deviations are made, they shall be based on sound engineering knowledge substantiated in the report prepared by the Design Professional and approved by the Director of Engineering.

- a) Daily water consumption rates (annual daily water demand):

Dwellings, per person	100 gpd
High schools with showers, per person	16 gpd
Elementary schools without showers, per person	10 gpd
Boarding schools, per person	75 gpd
Motels at 65 gallons per person, minimum per room	130 gpd
Trailer courts at three persons per trailer, per trailer	300 gpd

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Restaurants, per seat	50 gpd
Interstate or through highway restaurants, per seat	180 gpd
Interstate rest areas, per person	5 gpd
Service stations, per vehicle served	10 gpd
Factories, per person, per eight-hour shift	15-35 gpd
Shopping centers, per 1,000 sq.ft. of ultimate floor	300 gpd
Hospitals, per bed	300 gpd
Nursing homes, per bed	200 gpd
Home for the aged, per bed	100 gpd
Doctor's office in medical center	500 gpd
Laundromats, 9 to 12# machines, per machine	500 gpd
Community colleges per student and faculty member	15 gpd
Swimming pools, per swimmer	10 gpd
Theaters, drive-in type, per car	5 gpd
Theaters, auditorium type, per seat	5 gpd
Picnic areas, per person	5 gpd
Camps, resort, day and night with limited plumbing,	50 gpd
Picnic areas, per person	5 gpd
Luxury Camps with flush toilets, per camp site	100gpd

2. The system shall be designed to provide fire flows in accordance with ISO requirements in addition to peak day domestic and commercial demands, but not less than 1,000 gpm at each fire hydrant. The Town may require increased design fire flows at the discretion of the Director of Engineering. Where these requirements cannot be met, the Town may require building sprinklers and fire resistive construction at the discretion of the Building Official.
3. Minimum acceptable effective finished water storage for domestic purposes shall not be less than 200 gallons per equivalent residential connection at minimum pressure.
4. The system shall be designed to maintain a minimum working (under flow) pressure of 20 psi at all points in the system based on the greater of maximum hour or maximum day plus applicable fire flows. Applicable fire flows shall be selected by coordination between the water supply owner, design consultant, local officials and local fire marshall. When the number of residential units is less than 1,000, the formula $Q=11.4N^{0.544}$; is acceptable for estimating maximum hour domestic demand flow, where Q=total gallons per minute and N=total number of residential units. The Town can require a higher design pressure if indicated by site conditions.

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5. Where the pressure at the service tap exceeds 80 psi, the provisions of the Uniform Statewide Building Code shall apply.

C. Water Main Design

1. The minimum pipe size for distribution shall be four inches in diameter. The minimum pipe size where fire protection is provided shall be six inches in diameter. Pipes of lesser diameter may be used in the following instances:

- a) 1. When the run is less than 300 feet, two-inch pipe may be used; and
- b) 2. When the run is less than 600 feet but more than 300 feet, three-inch pipe may be used.

2. Changes in vertical and horizontal alignment shall be accomplished by the use of joint deflection and fittings of equivalent nominal diameter. Bending of pipe shall not be used. Joint deflection shall not exceed the pipe manufacturer's recommendations.

3. Water mains shall have a minimum depth of 36 inches, measured from the top of the pipe to the finished ground surface.

4. Water mains shall be designed to minimize dead ends in the system. Where dead ends occur, flushing hydrants shall be provided in accordance with the Town's Standard Details.

5. No flushing device shall be directly connected to any sewer.

6. Where future extensions are anticipated, a restrained gate valve shall be installed with a minimum of one length of pipe installed beyond the respective gate valve, reaching beyond any pavement, sidewalks, or other infrastructure that would require demolition for construction of the future waterline.

7. Surface water crossings, both over and under water shall be discussed with the Director of Engineering prior to plan preparation. Where above water crossings are used, the pipe shall be:

- a) Adequately supported,
- b) Protected from freezing,
- c) Protected from damage,

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- d) Accessible for repair and replacement, and
- e) Above the 100 year flood elevation or protected from floating debris.

8. Where under water crossings are needed:

- a) The pipe shall be of special construction having flexible watertight joints,
- b) Valves shall be provided at both ends of the water crossing so that the section can be isolated for tests or repair,
- c) Valves shall be easily accessible and not subject to flooding, and
- d) Sample taps shall be available at each end of the crossing and at a reasonable distance from each side of the crossing and not subject to flooding or leaks.

D. Separation of Utilities

1. General

- a) Under normal conditions, no other utility shall be constructed within 5 feet, measured horizontally, of a Town accepted, owned, operated, and/or maintained waterline during a parallel installation.
- b) Under unusual conditions, other utilities may be constructed within 5 feet of a Town accepted, owned, operated, and/or maintained waterline, but not closer than three feet, measured horizontally, of a Town utility during a parallel installation.
- c) Any other utility that crosses a Town accepted, owned, operated, and/or maintained waterline shall maintain a minimum vertical separation of 6 inches.

2. Separation of Water Mains and Sewers

- a) The following factors shall be considered in providing adequate separation of water mains and sewers:
 - (1) Materials and types of joints for water and sewer mains;
 - (2) Soil conditions;

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- (3) Service branch connections into the water and sewer mains;
- (4) Compensating variations in the horizontal and vertical separations;
- (5) Space for repairs and alterations of water and sewer mains;
- (6) Offsetting of pipes around manholes; and
- (7) Identification of physical constraints preventing normal separation.

b) Parallel Installation

- (1) Under normal conditions water mains shall be laid at least 10 feet horizontally from a sewer or sewer manhole. The distance shall be measured edge to edge.
- (2) Under unusual conditions when local conditions prevent a horizontal separation of 10 feet, the water main may be laid closer to a sewer or sewer manhole provided that:
 - (a) The bottom (invert) of the water main shall be at least 18 inches above the top (crown) of the sewer;
 - (b) Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfilling; and
 - (c) The sewer manhole shall be watertight construction and tested in place.

c) Crossing

- (1) Under normal conditions water lines crossing sewers shall be laid to provide a separation of at least 18 inches between the bottom of the waterline and the top of the sewer whenever possible.

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(2) Under unusual conditions when local conditions prevent a vertical separation described in subdivision (c) (1) of this section, the following construction shall be used:

(a) Sewers passing over or under water mains shall be constructed of the materials described in subdivision b) (2) (b) of this section; and

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

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

(ii) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the waterline; and

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

d) No water pipes shall pass through or come in contact with any part of a sewer manhole.

E. Fire Hydrants

1. It is the Town's desire to provide the best fire protection possible for our residents and businesses without placing an undue burden on project owners. With that in mind, the Town will strive to meet the guidelines established by the NFPA; however, those guidelines will be applied at the discretion of the Director of Engineering and Fire Marshal and not necessarily be considered as a minimum standard and/or specification.

2. In residential areas fire hydrants shall be placed at street intersections and at intermediate locations as required by the Fire Marshal. In no case shall the distance between fire hydrants exceed 1,000 feet as measured along the centerline of accessible streets.

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3. Fire hydrants shall be located within 50 feet of any standpipe or sprinkler system fire department connection where those systems are required.
4. The maximum distance from a fire hydrant to the most remote part of the structure it is intended to serve, as measured along the centerline of the travel way, shall not exceed:
 - a) Industrial Buildings 250 Feet
 - b) School Buildings 300 Feet
 - c) Commercial, Church, & Office Buildings 350 Feet
 - d) Apartments, Multi-Family Structures, & Townhouses 250 Feet
 - e) Single Family Structures 500 Feet
5. Fire hydrants shall not be located within the collapse zone for any structure.
6. Fire hydrant locations shall be independent of those hydrants located on the opposite side of the street along primary streets as determined by the Director of Engineering and the Fire Marshal.
7. Fire hydrants in residential areas shall be capable of delivering a minimum of 1,000 gallons per minute during peak design flow conditions where the existing water system has adequate capacity. Where the existing water system is not adequate to provide these flows, extensions shall be designed such that these flows are obtainable if the existing system is upgraded.

F. Valves

1. Gate valves shall be provided at the connection point for all water main extensions and shall be located as close to the connecting fitting as is practical. Additional valves shall be provided intermittently with a maximum spacing of 1,000 feet between any two valves.
2. Gate valves shall have the same nominal diameter as the water main to which they are connected.
3. A gate valve shall be installed on each fire hydrant lateral.
4. Valves shall not be located in ditches.

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5. Valve boxes shall be installed over every gate valve. The box shall be in alignment with the valve stem and centered over the valve nut. In paved areas, boxes shall be adjusted so that the covers are flush with the paved surface. In areas that are not paved, the box shall be adjusted so that the covers are flush with the immediate area.
6. Air-release valves shall be provided at prominent peaks in supply mains and shall not be directly connected to any sewer.
7. Blow off valves shall be provided at all dead ends and shall not be directly connected to any sewer.
8. Chambers or pits containing valves, blow off valves, meters, or other appurtenances shall not be connected directly to any sanitary sewer. Such chambers shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits underground. Sump pumps may be used where other means are not practical.
9. All utility structures and lids shall be designed for H2O loading.

G. Service Connections

1. Water service lines shall be in conformance with the AWWA Standard C600 and the Uniform Statewide Building Code, latest editions.
2. Backflow prevention devices shall be provided in accordance with the Town's backflow prevention program.
3. A separate water service connection shall be made for each customer, unless otherwise approved by the Director of Engineering.
4. All service connections on water mains previously accepted, owned, operated, and/or maintained by the Town shall be completed by Town personnel at the Owners expense. Service connections on water mains that have not been previously accepted, owned, operated, and/or maintained by the Town shall be made by the Contractor under system pressure.
5. All water service connections, except those that are used solely for fire protection, shall be metered.
6. Water meters shall be placed on the property, right-of-way, or easement line, whichever applies as determined by the Director of Engineering, and located a distance greater than 5 feet, measured

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horizontally, from all property corners, unless otherwise approved by the Director of Engineering.

7. Water meters shall be installed by the Town at the Owner's expense.

III. Material Standards and Specifications

A. General

1. All materials used shall be in conformance with the most recent standards set forth by AWWA and the Safe Drinking Water Act.
2. All materials are subject to review and approval by the Director of Engineering. Special materials may be required at the discretion of the Director of Engineering.
3. The materials specified herein shall be applicable to all waterlines that are or will become accepted, owned, operated, and/or maintained by the Town.

B. Pipe

1. All pipe used for potable water distribution shall be approved by the National Sanitation Foundation for water distribution piping.
2. Ductile iron pipe shall be used for all water lines with a nominal diameter of 3 inches and larger.
 - a) Ductile iron pipe shall meet the requirements of AWWA standard C151.
 - b) Pipe shall have an asphaltic exterior coating, shall have a cement mortar interior lining, and shall be thickness class 50 or greater.
 - c) Push-on joints may be used in accordance with the manufacturer's recommendations.
3. Copper pipe shall be used for all water lines with a nominal diameter of less than 3 inches.
 - a) Copper pipe shall be seamless, type "K" copper, meeting the requirements of ASTM B88.

C. Valves

1. Gate valves with a nominal diameter of 3 inches and larger shall be Mueller 2360 or 2361 Series, or approved equivalent type gate valve constructed and tested in accordance with AWWA standard C509 or C515, latest edition, and shall have a body constructed of ductile iron or grey iron, with a resilient wedge and seat, a non-rising bronze stem, a two

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inch nut opening counter-clockwise, and shall have a pressure rating of 250 psi.

2. Valves with a nominal diameter of less than 3 inches shall be constructed and tested in accordance with AWWA standard C800, latest edition.

D. Valve Boxes

1. Valve boxes, base extensions, head and cover shall be standard cast iron, grey iron, or ductile iron, 2 or 3 piece telescoping valve boxes.

2. Valve box covers shall be marked "Water".

E. Fittings

1. All fittings with a nominal size of 3 inches and larger shall be mechanical joint constructed of ductile iron and shall be in accordance with AWWA standard C153, latest edition, and shall have a pressure rating of 350 psi.

2. All fittings with a nominal size of less than 3 inches shall be constructed and tested in accordance with AWWA standard C800, latest edition.

F. Fire Hydrants

1. Fire Hydrants shall be American Darling B-84-B, or approved equivalent dry-barrel type fire hydrant, and shall also be constructed in accordance with AWWA standard C502.

2. Fire Hydrants shall have a six inch connection base and shall be equipped with two 2 ½ inch hose connections and one 5 ¼ inch pumper connection. Hydrants shall be operated by a National Standard 1 ½ inch pentagonal nut, opening counter-clockwise. Hydrants shall be painted in accordance with NFPA standards.

IV. Construction Standards and Specifications

A. General

1. Except as specifically modified below, water line construction shall meet the requirements of AWWA standard C600, latest edition.
2. All existing valves are to be operated by Town personnel only.
3. All taps on existing water mains shall be performed by Town personnel, unless otherwise and specifically approved by the Director of Engineering and the Water System Operator.
4. All materials shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall any materials be dropped. Pipe shall be handled such that any coating or lining is not damaged.
5. Construction of all water mains and appurtenances shall be in strict accordance with the approved plans and specifications.
6. All materials shall be new and unused, unless otherwise approved by the Director of Engineering.
7. The Contractor shall notify the Town Inspector a minimum of 48 hours prior to each construction activity. If rock, differing site conditions, or unsuitable site conditions are discovered during excavation, the Town Inspector shall be contacted immediately for further inspection.

B. Excavation and Bedding

1. Trenches shall be excavated such that pipe can be laid to the alignment and depth required and shall not be excavated more than 150 feet in advance of completed pipe laying operations. Trenches shall be excavated to a sufficient width for placement of pipe and fittings without conflicting with unexcavated material, sheeting, shoring, or bracing.
2. The Contractor shall do all sheeting, shoring, and bracing necessary to perform work, protect existing infrastructure, and protect excavations as required for safety in accordance with local, state, and federal safety regulations.
3. Where consistent with safety and space considerations, excavated material is to be placed on the uphill side of trenches. Trenches are not to be left open overnight unless adequate safety precautions are taken.

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4. Trenches shall be excavated to provide a uniform and continuous bearing support for pipe on solid and undisturbed ground at every point between bell holes. Any section of trenches excavated below the final grade of the pipe shall be backfilled with approved select material and thoroughly compacted.
5. Where excavation is made in fractured rock, boulders, or other rocky material, sub grade shall be obtained by backfilling a minimum of six inches of thoroughly compacted select material. Ledge rock, boulders, large stones, and any projection of stone or rock shall be removed to provide a clearance of at least six inches below and at least twelve inches on each side of the pipe and appurtenances being installed.
6. Where unsuitable soil conditions are encountered, unsuitable material shall be removed and replaced with thoroughly compacted select material.
7. Bell holes shall be provided at each joint to permit proper jointing.
8. No pipe or fittings shall be submerged or installed in water.
9. Pipe and fittings shall not be installed where trench conditions are not suitable in the opinion of the Director of Engineering.
10. Bedding shall be continuous, uniform, and placed in accordance with the pipe manufacturer's recommendations.

C. Installation of Pipe and Fittings

1. Proper implements, tools, and equipment shall be used in accordance with the material manufacturer's recommendations during the installation of all pipe and appurtenances.
2. All materials shall be handled with care and placed into the trench by suitable devices and equipment in accordance with the material manufacturers recommendations for handling such that materials are not damaged. Materials shall not be dropped or dumped during handling.
3. All materials shall be inspected for damage and defects prior to and during installation.
4. All lumps, blisters, and excess coatings shall be removed from both ends of ductile iron pipe. The outside of the spigot end and the inside of the bell end shall be wiped clean and dry prior to installation.

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

5. Special care shall be taken to prevent foreign material or water from entering the pipe during installation. No materials, clothing, tools, or other objects shall be stored in the pipe prior to installation.
6. As each length of pipe is installed, the end of the pipe shall be centered with the pipe that has already been installed, the joint shall be assembled, and then the pipe shall be brought to the correct alignment and grade. The alignment and grade of the pipe shall not be adjusted by direct contact with mechanized equipment.
7. All waterlines shall be properly supported.
8. Where it is practical, waterlines shall be installed with the bell end of the pipe facing the direction of installation.
9. No waterline shall terminate with a capped or plugged valve. A minimum of one length of pipe shall be installed, properly restrained, and capped or plugged.
10. When construction is not in progress, a watertight plug shall be placed in the open end of the pipe.
11. Joint deflection shall not exceed the pipe manufacturer's recommended maximum deflection.
12. Cutting of pipe shall be done in accordance with the pipe manufacturer's recommendations and in a neat and workmanlike manner, preventing damage to the pipe and pipe lining. Cut ends and rough edges shall be ground smooth and for push on joint connections shall be beveled by methods recommended by the manufacturer.

D. Fire Hydrants

1. A 2 foot cubed drainage pit shall be excavated beneath each fire hydrant location. The drainage pit shall be filled with coarse gravel and shall be brought to an elevation 6 inches above the drain port. Under no circumstances shall a hydrant drain to a sanitary sewer or storm sewer. Where field conditions do not allow for the installation of a drainage pit or where the groundwater level prevents proper drainage, a different method shall be utilized at the discretion of the Director of Engineering.
2. Fire hydrants shall have a minimum vertical separation of 18 inches between the bottom of the 4 ½ inch nozzle and finished grade in the area

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

adjacent to the hydrant. A minimum horizontal clearance of four feet shall be maintained in all directions.

E. Service Lines

1. Service line installation shall be in accordance with AWWA Standard C600.
2. Service line taps shall be installed at the 10 o'clock or 2 o'clock position on the circumference of the pipe.
3. A direct tap shall be made under system pressure and a corporation stop shall be installed at the connection to the water main for all service line connections. Tapping sleeves or saddles may be allowed at the discretion of the Director of Engineering.
4. Compression type fittings shall be used for all water service line fittings. Other fitting types may be required or allowed at the discretion of the Director of Engineering.
5. Water service lines shall be terminated with a curb stop thirty inches, measured horizontally, from the proposed water meter location.

F. Backfill

1. No waterline shall be covered before inspection by the Town is complete, except where specifically allowed by the Town Inspector.
2. Backfill from the lowest excavation point, around the pipe, and up to a level one foot above the top of the pipe shall consist of thoroughly compacted select material.
3. Backfill from one foot above the top of the pipe to sub-grade shall consist of thoroughly compacted suitable material as specified on the plans and shall not contain stones larger than six inches in their greatest dimension. Where the backfill material is not specified on the plans, and at the discretion of the Director of Engineering, the excavated material may be used where it consists of loam, clay, sand, gravel, or other suitable material.

G. Site Restoration

1. All lands disturbed during waterline construction shall be restored to a condition that is equivalent to or better than their condition prior to construction as determined by the Director of Engineering.

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

2. From the sub-grade elevation to the final surface elevation, one of the following surface coverings shall be used, unless otherwise approved by the Director of Engineering:

- a) Vegetation shall be established by sod or permanent seeding as described in the VESCH.
- b) Gravel: No less than 6 inches of thoroughly compacted VDOT 21-A stone shall be applied.
- c) Pavement: Asphalt or concrete shall be repaired in accordance with applicable VDOT or Town standards.

H. Testing

1. Pressure and leakage testing shall be conducted simultaneously in accordance with AWWA Standard C600 and shall be observed by the Town Inspector.
2. Each test shall have a minimum duration of two hours.
3. Each length of pipe installed shall be subjected to a hydrostatic pressure of not less than 150 psi or 150% of the operating pressure, whichever is greater, as measured at the lowest elevation.
4. Each valved section of water line shall be tested. Each valve shall be subjected to testing on at least one side.
5. No leakage is allowed.

I. Disinfection and Flushing

1. After testing, but prior to final inspection, all new water mains and lateral lines shall be flushed and disinfected in accordance with AWWA standard C651.
2. The disinfecting solution shall remain in the pipe for no less than 24 hours, after which time a chlorine residual of 10 ppm is required in all parts of the line.
3. Following chlorination all piping shall be thoroughly flushed. Flushing shall achieve a flow velocity not less than 2.5 feet per second. All hydrants and valves shall be exercised during flushing.
4. Dechlorination shall be performed when super-chlorinated water is flushed from water mains.

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

5. Following flushing, the water in the new water main shall be tested for quality. At least two consecutive satisfactory bacteriological samples shall be taken for every 1,200 feet of pipe in accordance with the Virginia Waterworks Regulations, latest edition. The Contractor is responsible for all costs associated with disinfection, flushing, and testing of installed facilities.

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

V. Waterworks Personnel and Qualifications

A. Owner

Town of Christiansburg, a Virginia Municipal Corporation

Town Manager: Barry D. Helms, PE

Assistant Town Manager: Randy Wingfield

B. Engineering and Inspections

Director of Engineering: Wayne O. Nelson, PE

Utility Program Manager: Jessie C. Nester, PE

Town Inspector: Paul L. Vest

Building Official: Jerry Heinline, CBO

C. Operations

Director of Public Works:

Ricky Bourne, Class V Waterworks Operator

Superintendant of Field Operations:

James Lancianese, Class V Waterworks Operator

Assistant Superintendant of Field Operations:

Thomas Sullivan, Class V Waterworks Operator

Foreman:

Leon Martin, Class V Waterworks Operator

D. Fire Department

Fire Marshal: Billy Hanks

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

VI. Standard Notes

A. Design Drawing Notes

1. The following notes shall be placed on every plan set that contains proposed waterline infrastructure:

a) General Infrastructure Notes

- (1) All infrastructures shall be constructed, inspected, and tested in accordance with the regulations, standards, and specifications set forth by the Commonwealth of Virginia and the Town of Christiansburg (Town).
- (2) All infrastructures to be accepted, owned, operated, and/or maintained by the Town shall be constructed within rights-of-way or easements dedicated to the Town.
- (3) Utility lateral service lines shall cross the property line at least 5 feet from any property corner, measured horizontally.
- (4) A minimum horizontal separation of 10 feet shall be maintained between sanitary sewer lines and waterlines in accordance with note # 1, unless otherwise approved in writing by the Town.
- (5) A minimum vertical separation of 18 inches shall be maintained between water and sanitary sewer lines, with sanitary sewer lines at a lower elevation than waterlines, in accordance with note # 1, unless otherwise approved by the Director of Engineering.
- (6) A minimum horizontal separation of 10 feet shall be maintained between underground electrical lines and waterlines, unless otherwise approved in writing by the Town and electrical utility company.
- (7) The minimum depth of cover on all utilities shall be 3 feet.

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

(8) It is the responsibility of the Developer to coordinate the location of all utilities prior to acceptance by the Town. No other utility shall be located within 5 feet, measured horizontally, of any utility to be maintained by the Town, except where crossing of utilities is required.

(9) The Director of Engineering shall be notified 48 hours prior to the start of construction.

(10) All below grade infrastructure to be maintained by the Town shall be inspected by the Town Inspector prior to covering, except where specifically allowed by the Town Inspector.

(11) The Town Inspector shall witness all testing and shall be provided with all test results.

(12) Existing utilities shall only be operated by Town personnel.

(13) The Contractor shall be responsible for the installation of all utility service lines beyond the property line for Town accepted, owned, operated, and/or maintained utilities.

b) Potable Water Notes

(1) All waterlines shall be constructed, inspected, and tested in accordance with AWWA Standard C600, latest revision, and the regulations, standards, and specifications set forth by the Commonwealth of Virginia and the Town of Christiansburg (Town).

(2) Installation of taps on existing water mains, water meters, and water meter boxes shall be performed by Town personnel at the Owner's expense. The location and installation of each item shall be coordinated by the Developer and the Contractor.

(3) Water meter and box locations shall be at the property line or easement line unless otherwise approved by the Director of Engineering.

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

- (4) All water mains shall be pressure class 350 or greater ductile iron pipe. Service lines shall be seamless, type 'K' copper, from the water main to the water meter.
- (5) Waterline joints may be deflected to maintain proper alignment. Deflection shall be in accordance with the pipe manufacturer's recommendations. A bend and thrust block, or other approved mechanical restraining device, shall be required where deflection is not suitable as determined by the Director of Engineering.
- (6) Flushing and disinfection shall be performed by the Contractor in accordance with note # 1.
- (7) Final grade shall be obtained prior to the request for the installation of water meters. Any changes to the water meter or box after initial installation shall be performed by Town personnel at the Owner's expense.

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

VII. Test Form



Owner:	Water Main leakage Test		
Contractor:	Criterion		
Field location:	Test Number	Sheet	of
JN: Plan Sheet Reference:	Calculated by:		Date:
Job:	Checked by:		Date:

Inspector: Paul Vest

L allowable leakage, in gallons per hour

$$L = SD \frac{\sqrt{P}}{133,200}$$

Signature:

S length of pipe tested, in feet

D nominal diameter of the pipe, in inches

P average pressure during the test in PS

multiply by 2 for 2 hour test

If Test fails, complete:

Identify Section(s) that failed None

Leak (was) (was not) located. Describe Leakage found

Plan Sheet of :Station +

Describe corrective action

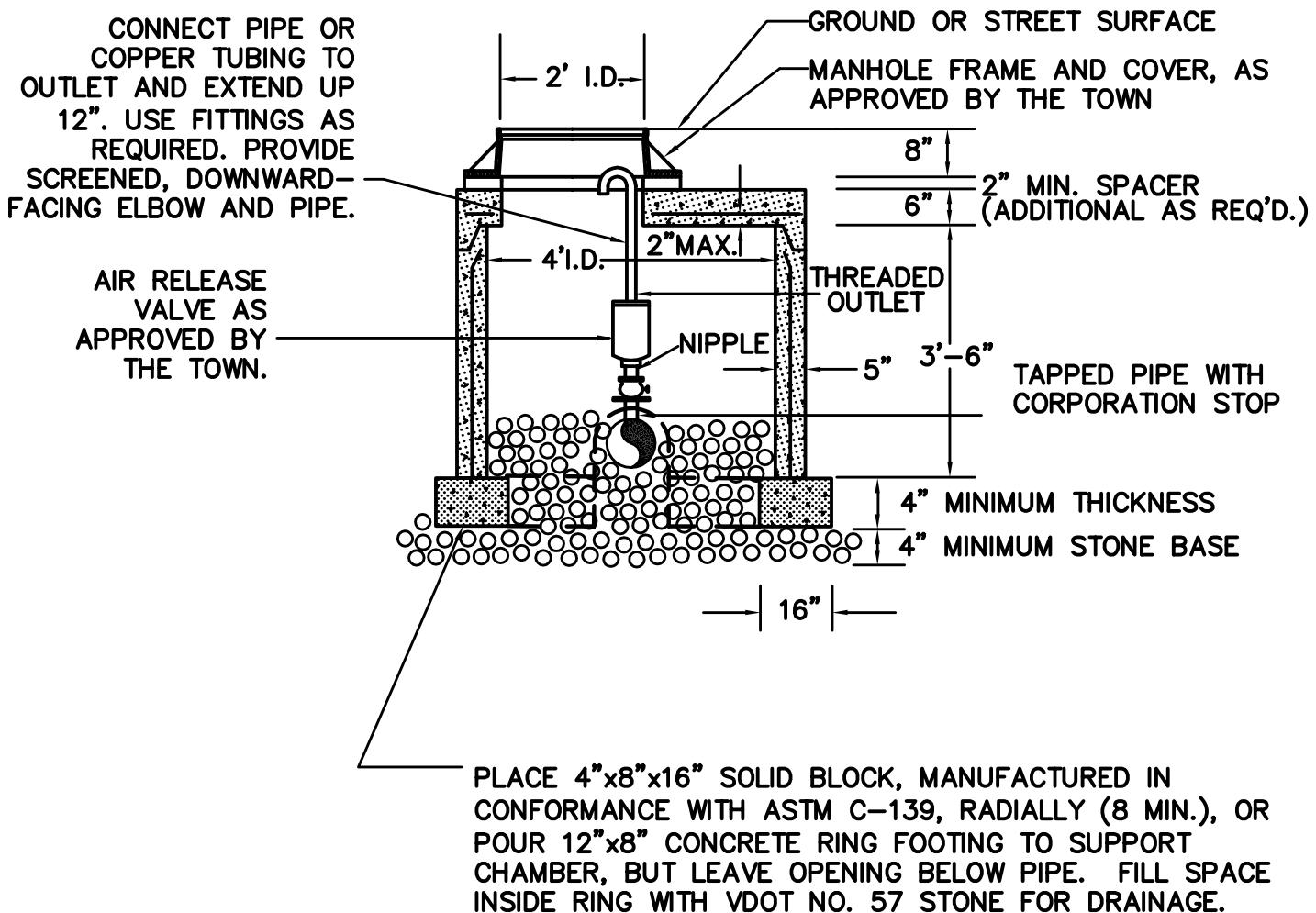
For test results after repair, refer to test# **Inspector**

Minimum Standards and Specifications for Waterline Design and Construction
Town of Christiansburg, VA

VIII. Standard Details

NOTES:

1. MANHOLE MATERIALS AND FABRICATION IN ACCORDANCE WITH ASTM C478.
2. SIZE OF AIR RELEASE VALVE AND SIZE OF TAP AS SPECIFIED ON PLANS.
3. THIS DETAIL SHALL NOT BE USED IN AREAS OF HIGH GROUNDWATER. IF EVIDENCE OF HIGH GROUNDWATER IS FOUND DURING CONSTRUCTION, THE INSPECTOR SHALL BE NOTIFIED FOR FURTHER GUIDANCE.

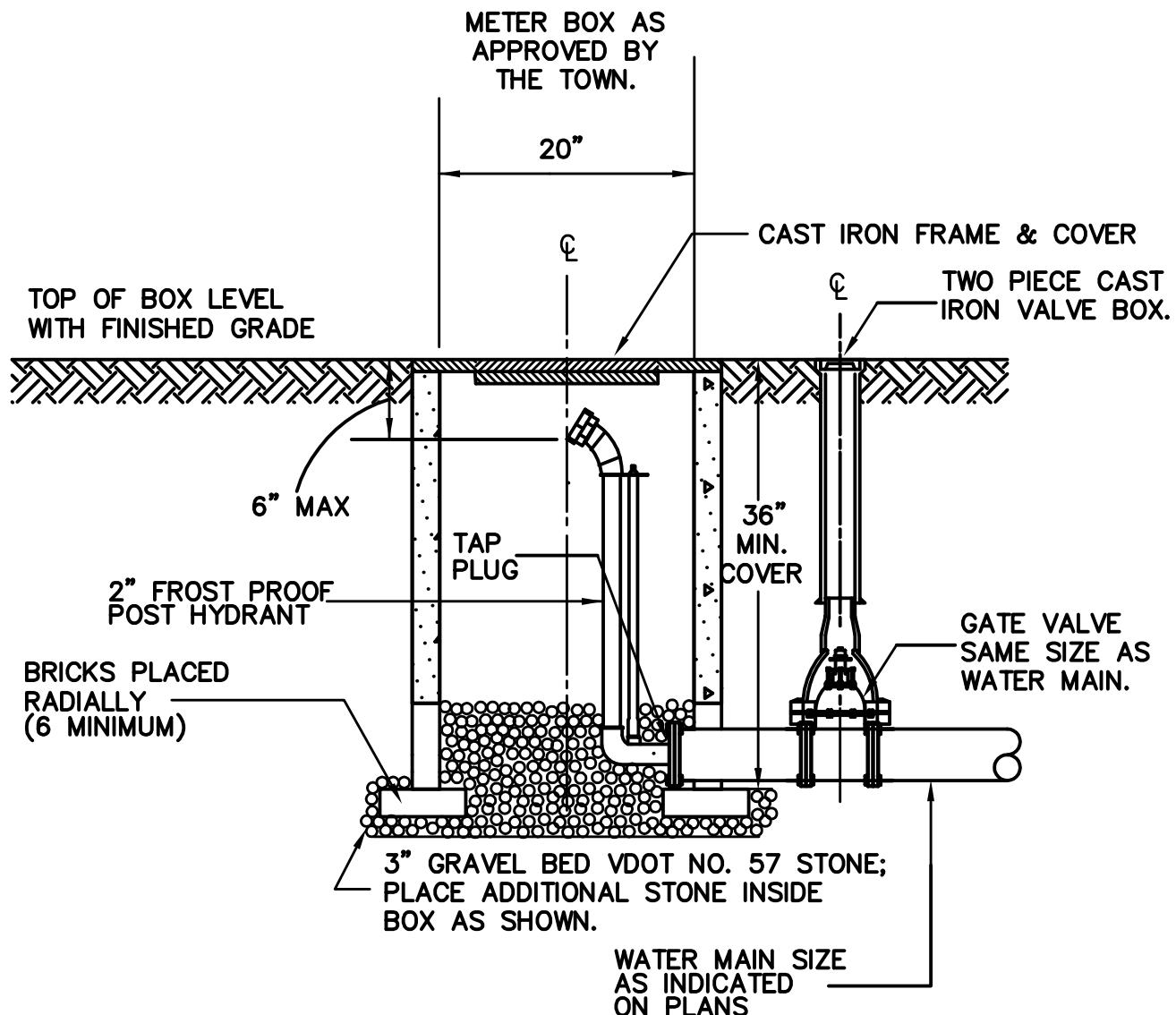


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PRECAST CHAMBER FOR
AIR RELEASE VALVE
(WATER)

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
AR-I

NOTE: VALVE AND PLUG SHALL BE MECHANICALLY RESTRAINED IN ACCORDANCE WITH DETAIL CA-4. THE TOWN WILL FIELD LOCATE EACH BLOW OFF THAT MAY BE AFFECTED BY SEASONAL HIGH GROUNDWATER OR SURFACE WATER. EACH WEEP HOLE SUBJECT TO CONTAMINATION WILL BE SEALED, THE BLOW OFF MARKED, AND THE BLOW OFF LOCATION MAPPED FOR MANUAL DEWATERING.

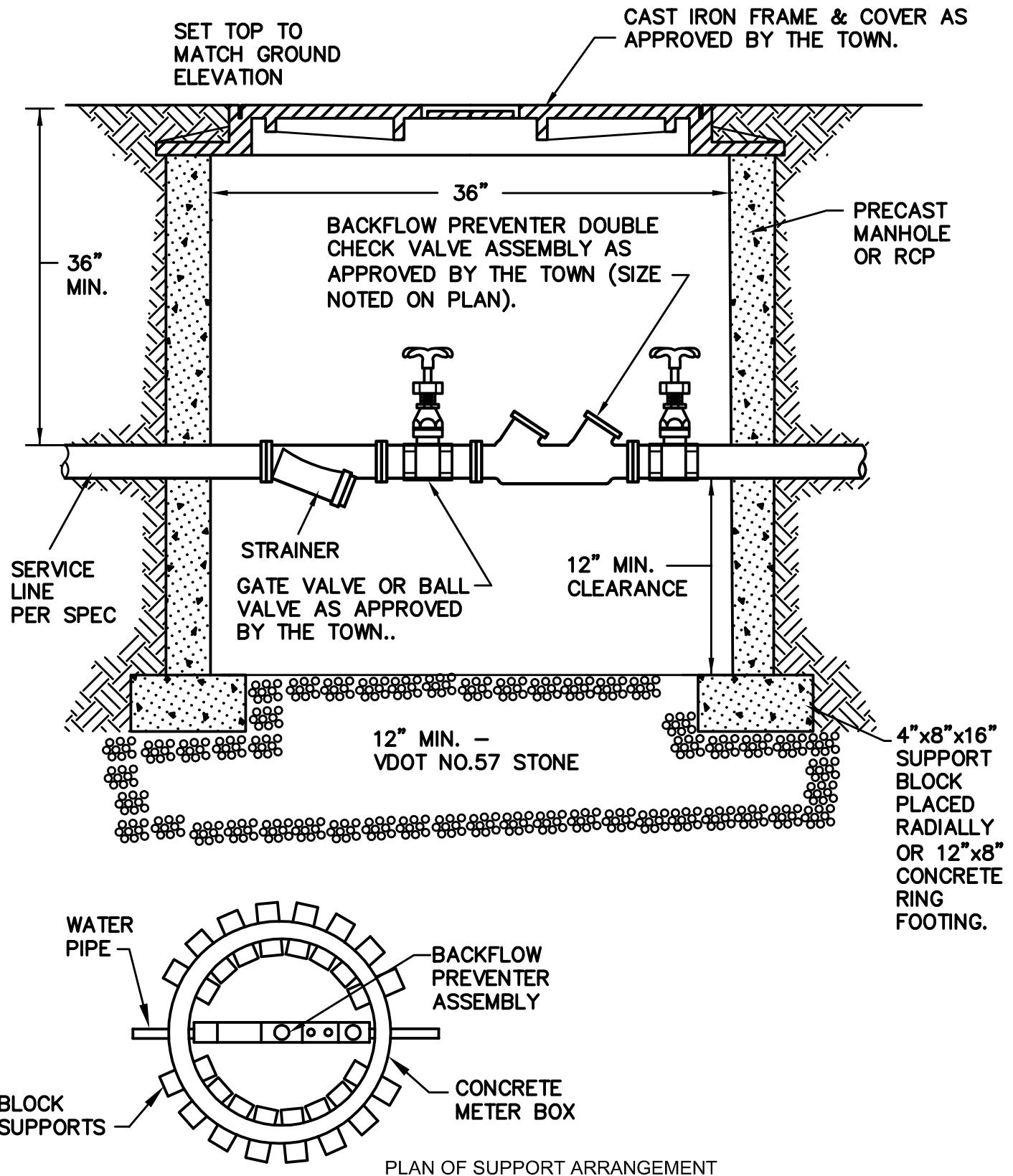


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BLOW-OFF
ASSEMBLY

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
BO-1

NOTE: BACKFLOW PREVENTER DOUBLE CHECK VALVE SHALL BE EQUIPPED WITH FOUR TEST PORTS.



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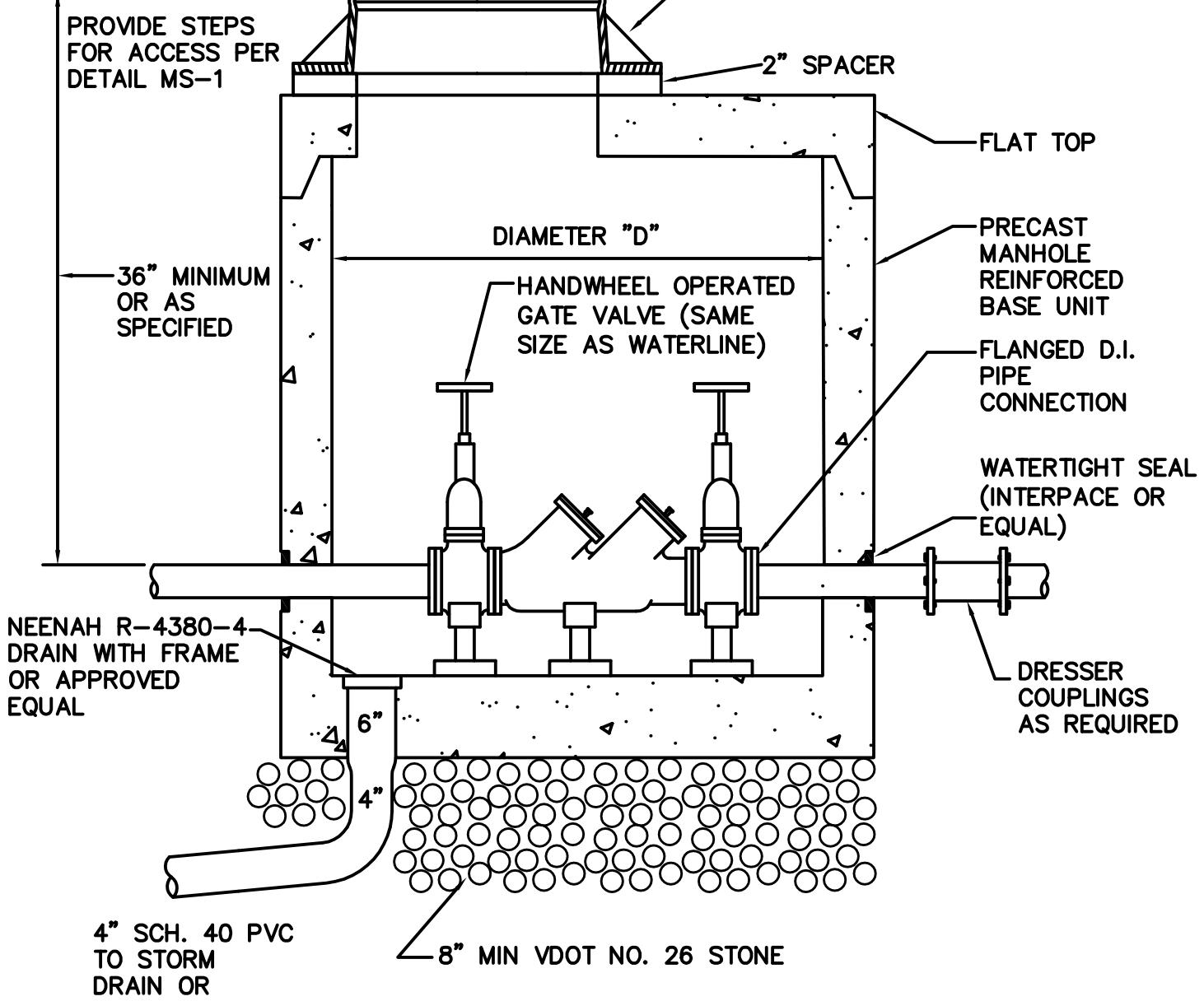
BACKFLOW PREVENTER
DOUBLE CHECK VALVE
ASSEMBLY (3/4" TO 2")

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
BP-1

NOTE: BACKFLOW PREVENTER DOUBLE CHECK VALVE SHALL BE EQUIPPED WITH FOUR TEST PORTS.

SET TOP TO MATCH FINISHED SURFACE ELEVATION

FRAME AND COVER AS APPROVED BY THE TOWN.



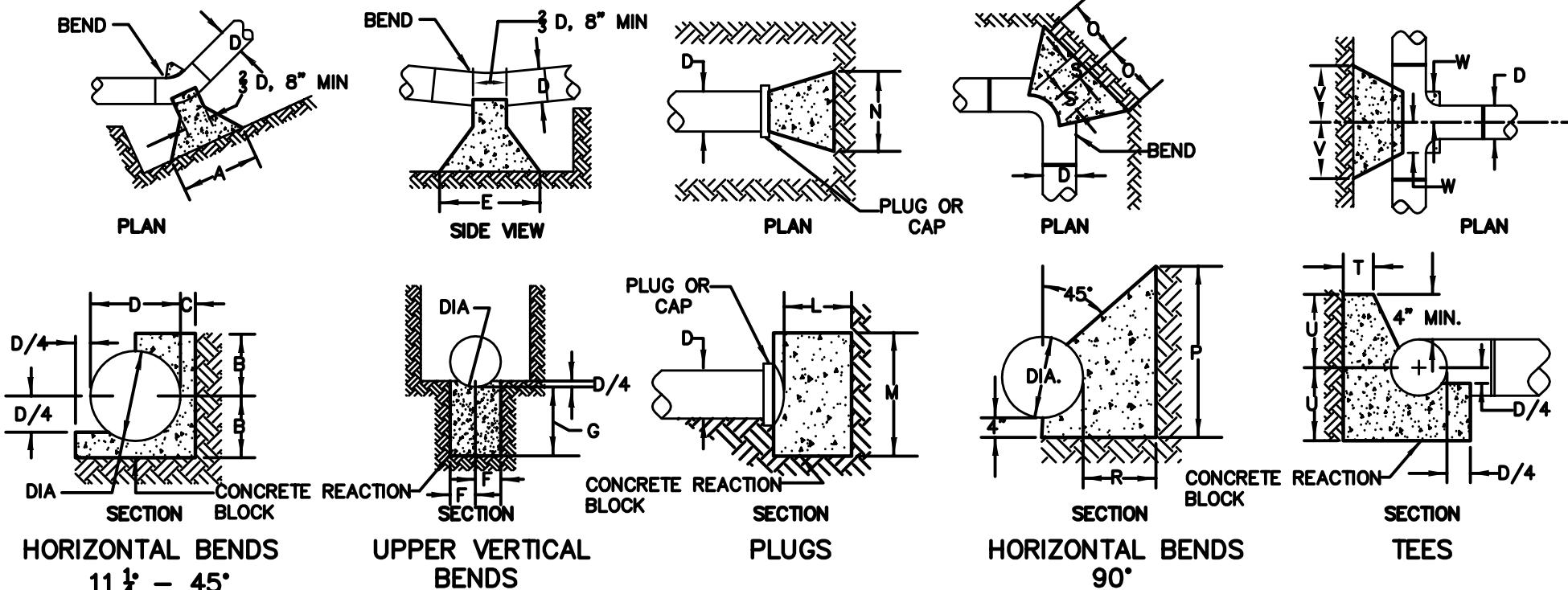
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BACKFLOW PREVENTER
DOUBLE CHECK / DOUBLE GATE
VALVE ASSEMBLY (3" TO 8")

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
BP-2

NOTES:

ALL CONCRETE SHALL BE VDOT CLASS A-3 AND SHALL BE POURED AGAINST UNDISTURBED EARTH
PAINT ALL EXPOSED STEEL WITH 2 COATS OF WATERPROOF BITUMASTIC COMPOUND



DIA	HORIZONTAL BENDS						UPPER VERTICAL BENDS						PLUGS				HORIZ. BENDS				TEE								
	11 1/4	22 1/2	45°	11 1/4	22 1/2	45°	E	F	G	E	F	G	E	F	G	L	M	N	O	P	R	S	T	U	V	W			
4"	.50	.58	.75	.75	.58	.75	1.25	.58	.75	.50	.58	.58	.75	.58	.58	1.25	.58	.58	.50	1.17	1.50	1.17	1.17	1.67	.42	.75	.67	.75	.50
6"	.50	.58	.75	.75	.58	.75	1.25	.58	.75	.50	.58	.58	.75	.58	.58	1.25	.58	.58	.50	1.17	1.50	1.17	1.17	1.67	.42	.75	.67	.75	.50
8"	.67	.67	.75	1.00	.67	.75	2.00	.67	.75	.67	.67	.58	1.00	.67	.67	2.08	.75	.83	.67	1.50	2.25	1.58	1.50	1.75	.50	.75	.83	1.00	.67
10"	.83	.75	.75	1.50	.75	.83	2.50	.75	.92	.83	.75	.67	1.50	.83	.67	2.08	.75	.83	.67	2.00	2.50	1.67	2.08	1.75	.50	.83	1.00	1.25	.67
12"	1.00	.83	.75	1.75	.92	.92	2.92	.92	1.17	1.00	.83	.67	1.75	.83	.67	2.50	.92	.92	.83	2.33	3.25	2.00	2.50	1.92	.58	1.00	1.25	1.42	.67
16"	1.33	1.00	.75	2.33	1.00	1.17	3.67	1.25	1.42	1.33	1.00	.75	2.25	.83	.75	3.33	1.25	1.25	1.00	2.92	4.17	2.08	3.00	2.17	.83	1.17	1.67	1.83	.83
20"	1.67	1.17	1.00	3.17	1.17	1.33	4.75	1.50	1.83	1.67	1.17	.83	3.00	1.17	1.00	4.17	1.50	1.50	1.33	3.75	5.17	3.50	3.83	2.83	1.00	1.33	2.08	2.25	1.17
24"	2.00	1.33	1.00	4.00	1.33	1.50	6.08	1.67	1.92	2.00	1.33	1.00	3.50	1.33	1.00	5.00	1.75	1.75	1.67	4.33	6.25	4.67	4.00	3.00	1.00	1.50	2.50	2.67	1.33
30"	2.50	1.50	1.08	5.00	1.58	1.75	7.95	2.00	3.08	2.50	1.58	1.08	4.17	1.58	1.08	6.25	2.25	2.25	2.00	5.42	7.42	5.75	5.00	3.83	1.17	1.75	3.08	3.92	1.83
36"	3.00	1.92	1.17	5.75	2.00	2.00	8.92	2.50	3.33	3.00	1.58	1.17	5.33	2.00	1.17	7.50	2.50	2.67	2.00	6.50	9.00	6.83	6.00	4.83	1.17	2.00	3.75	3.92	1.83

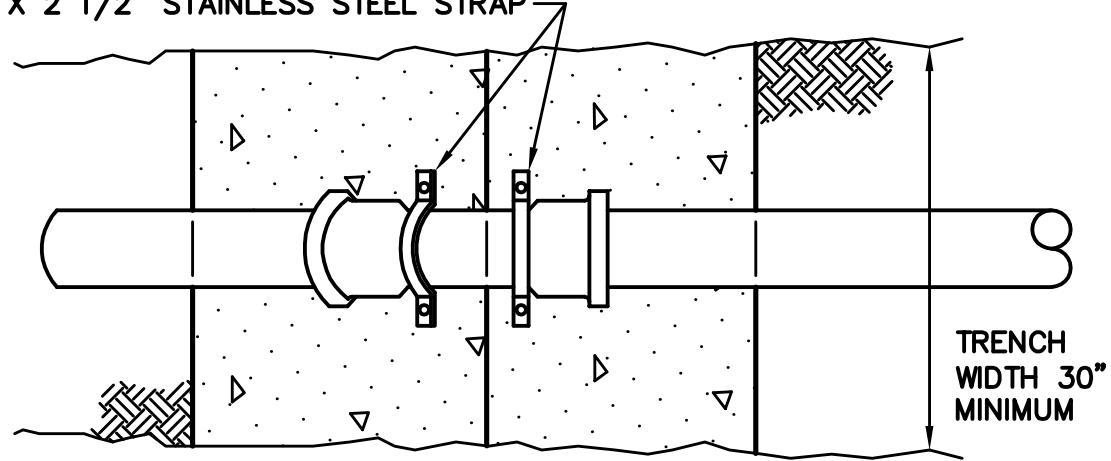


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REACTION BLOCKING
WATER AND SANITARY SEWER
FORCE MAIN FACILITIES

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CA-1

1/2" X 2 1/2" STAINLESS STEEL STRAP



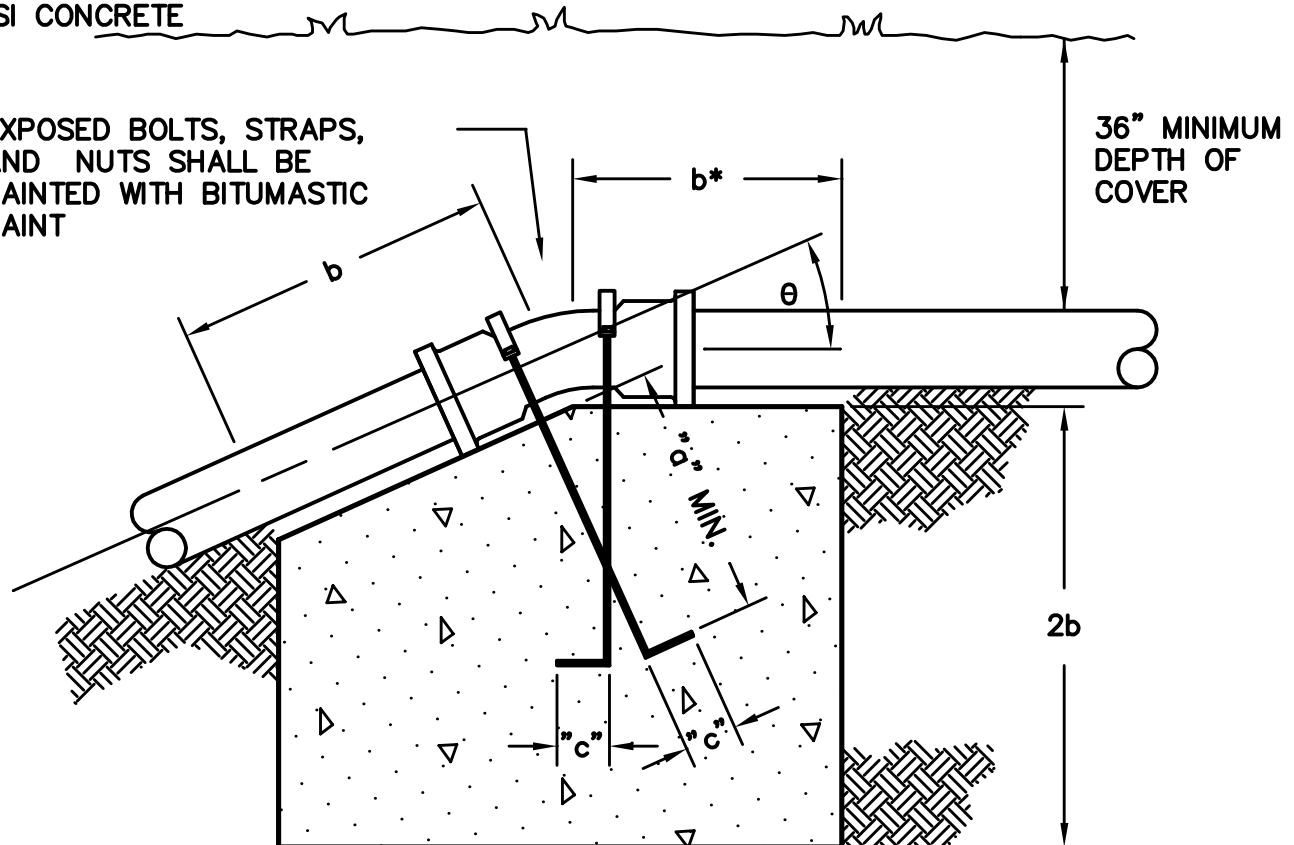
NOTES:

1. FITTING FLANGE BOLTS SHALL REMAIN FREE OF CONCRETE
2. DO NOT BACKFILL UNTIL CONCRETE HAS SET FOR A MINIMUM OF 4 HOURS
3. USE VDOT ST'D A3
3000 PSI CONCRETE

PLAN

REDUCE "b" DIMENSION IN SOLID ROCK AS APPROVED BY TOWN.

EXPOSED BOLTS, STRAPS, AND NUTS SHALL BE PAINTED WITH BITUMASTIC PAINT



STEEL ANCHOR BOLT SIZE

b	dia.	a	c
0 to 1'-0"	5/8"	8"	3 3/4"
1'-1" to 2'-6"	5/8"	12"	3 3/4"
2'-7" to 3'-0"	3/4"	12"	4 1/2"
3'-1" to 3'-5"	7/8"	12"	5 1/4"

PROFILE

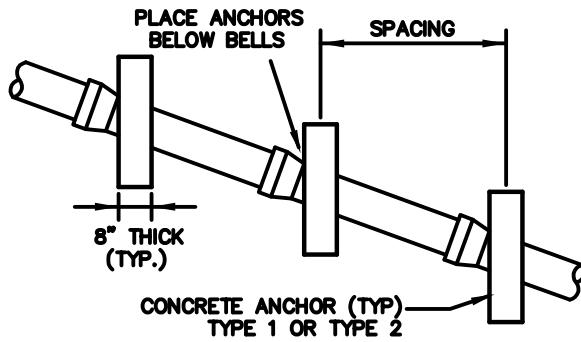
* USE "b" VALUES AS SHOWN ON PLAN



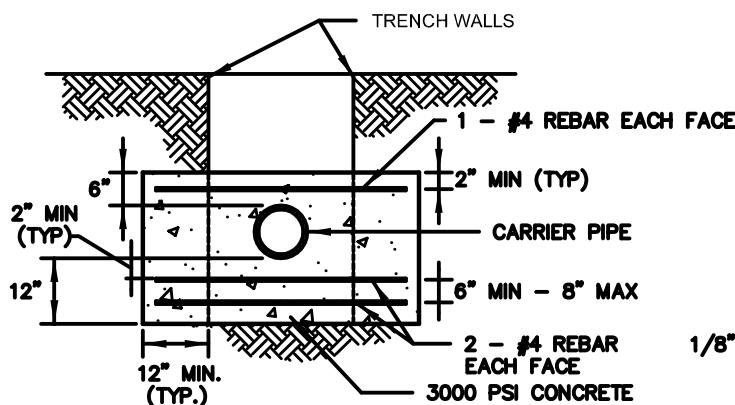
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CONCRETE ANCHORS
(CHREST ANCHORS)

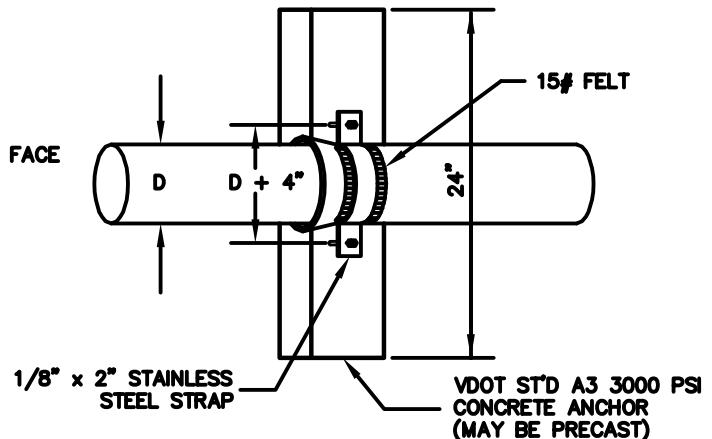
DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CA-2



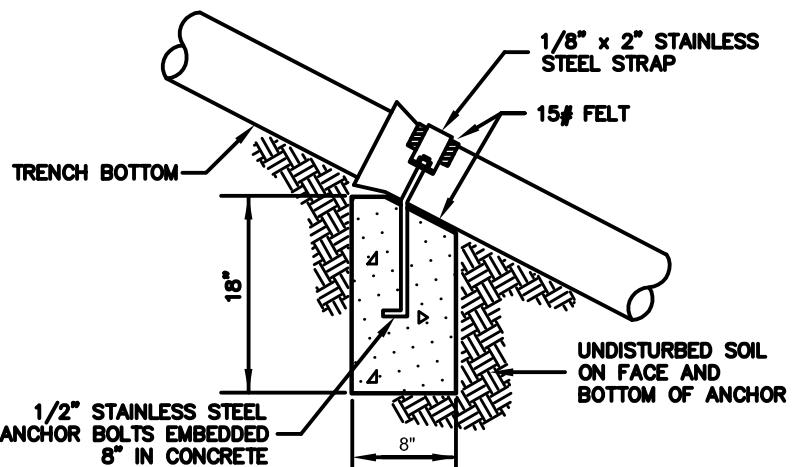
PROFILE – TYPE 1 AND TYPE 2



CROSS SECTION – TYPE 1



PLAN – TYPE 2



ELEVATION – TYPE 2

NOTES:

1. TYPE 1 OR TYPE 2 (CONTRACTOR'S OPTION)
CONCRETE SLOPE ANCHOR REQUIRED FOR ALL
WATER MAINS AND SANITARY SEWER MAINS WITH
SLOPE GREATER THAN OR EQUAL TO 20%.
2. MAXIMUM ANCHOR SPACING SHALL BE AS FOLLOWS:

PIPE SLOPE	MAX. SPACING
20% TO 35%	36'
35% TO 50%	24'
OVER 50%	16'

SEE PLAN FOR ACTUAL SPACING.

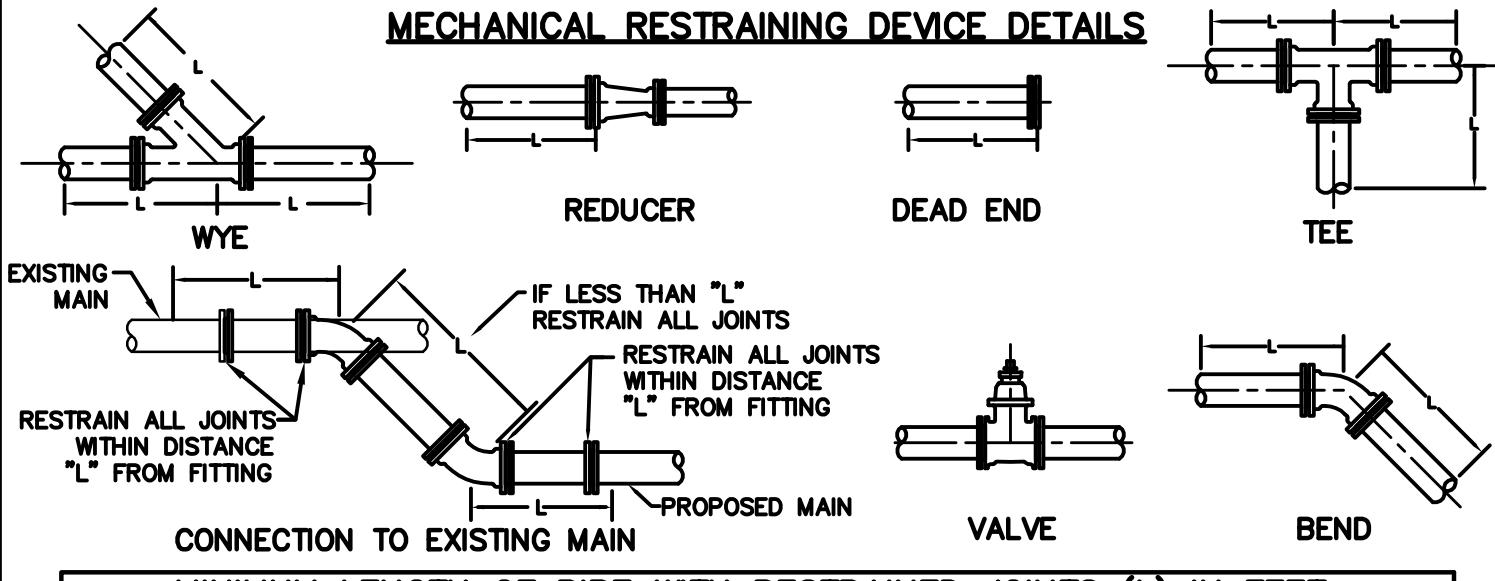


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CONCRETE SLOPE ANCHOR
(FOR SLOPES OVER 20%)

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CA-3

MECHANICAL RESTRAINING DEVICE DETAILS



CONNECTION TO EXISTING MAIN

PIPE SIZE	HORIZONTAL BEND				VERTICAL BEND UP			VERTICAL BEND DOWN			DEAD END OR VALVE	UNIFORM SIZE TEE OR WYE	REDUCER LARGER ♂ TO SMALLER ♂
	11.25°	22.5°	45°	90°	11.25°	22.5°	45°	11.25°	22.5°	45°			
4"	2	5	10	24	2	5	10	4	7	15	18	13	13
6"	3	7	15	35	3	7	15	5	10	21	26	21	14
8"	5	9	19	46	5	9	19	7	14	28	34	29	14
10"	6	11	23	56	6	11	23	8	17	34	42	37	14
12"	7	13	28	67	7	13	28	10	20	41	50	45	15
14"	8	15	32	77	8	15	32	11	23	48	57	52	15
16"	9	17	36	87	9	17	36	13	26	54	65	60	15
18"	10	19	40	97	10	19	40	14	29	61	73	68	15
20"	11	21	45	108	11	21	45	16	32	67	81	76	15
24"	13	25	53	128	13	25	53	19	38	80	97	92	29

NOTES:

1. RESTRAINING DEVICES OR RESTRAINED JOINTS SHALL HAVE A WORKING PRESSURE OF 250 PSI WITH A MINIMUM SAFETY FACTOR OF 2.0.
2. RESTRAINED LENGTH SHOWN IS BASED ON 3' OF COVER, SOIL TYPE CL, TRENCH TYPE 2, 2:1 SAFETY FACTOR, AND DUCTILE IRON PIPE AT A TEST PRESSURE OF 150 PSI. IF FIELD CONDITIONS DIFFER FROM THOSE LISTED, CONTACT ENGINEER TO DETERMINE REQUIRED RESTRAINED LENGTH.
3. RESTRAINED LENGTHS SHOWN IN CHART WERE CALCULATED USING METHODOLOGY DEVELOPED BY THE DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA) AND ARE INTENDED AS A GENERAL GUIDE BASED ON CONDITIONS SHOWN IN NOTE 2. FOR FITTINGS AND/OR FIELD CONDITIONS NOT SHOWN, ENGINEER SHALL SUBMIT CALCULATIONS USING DIPRA METHODOLOGY TO THE TOWN FOR APPROVAL.
4. EXISTING PIPE ADJACENT TO PROPOSED BENDS, WYES, VALVES, TEES, AND PLUGS SHALL BE UNCOVERED AND THE JOINTS RESTRAINED FOR THE LENGTHS INDICATED. IF THE EXISTING PIPE IS UNABLE TO ACCEPT THE MECHANICAL JOINT RESTRAINING MECHANISM, THE EXISTING PIPE SHALL BE REPLACED WITH DUCTILE IRON WATER MAIN IN ACCORDANCE WITH THE SPECIFICATIONS AND RESTRAINED LENGTH INDICATED. IN LIEU OF RESTRAINING JOINTS OF EXISTING PIPE, A BULKHEAD ANCHOR AS SHOWN IN DETAILS CA-1 AND CA-2 MAY BE USED.
5. FIRE HYDRANTS SHALL BE RESTRAINED AT EACH JOINT IN THE ASSEMBLY.
6. ALL JOINTS WITHIN CASING PIPES SHALL BE RESTRAINED.
7. IF A CASING PIPE FALLS WITHIN THE RESTRAINED LENGTH "L", THE REQUIRED RESTRAINED LENGTH SHALL BE INCREASED BY THE LENGTH OF THE CASING.
8. THRUST RESTRAINTS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND SHALL CONFORM TO THE FOLLOWING TABLE OR APPROVED EQUAL. SHOP DRAWINGS FOR ALTERNATE RESTRAINTS SHALL BE SUBMITTED TO THE TOWN FOR APPROVAL PRIOR TO CONSTRUCTION.

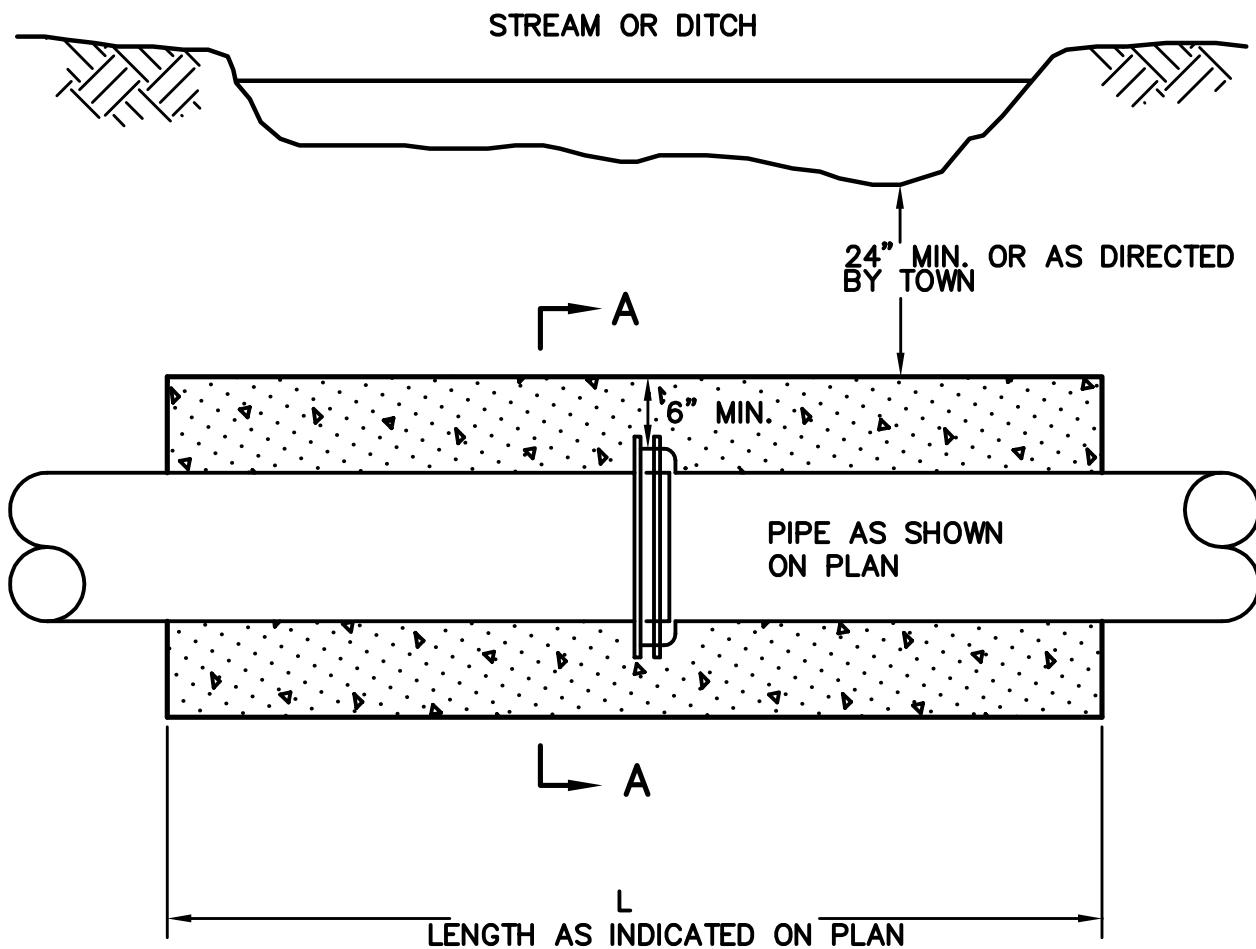
PIPE SIZE	JOINT TYPE	SPECIFICATION
4"-12"	MECHANICAL JOINT	ROMAC INDUSTRIES GRIP RING OR MEGALUG SERIES 1100
14"+	MECHANICAL JOINT	ROMAC INDUSTRIES ROMAGRIP OR MEGALUG SERIES 1100
4"-12"	PUSH-ON OR COUPLING	ROMAC INDUSTRIES 611 OR MEGALUG SERIES 1700
14"+	PUSH-ON OR COUPLING	MEGALUG SERIES 1700



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(540) 381-7238 FAX
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MECHANICAL RESTRAINING DEVICES
FOR DUCTILE IRON PIPE

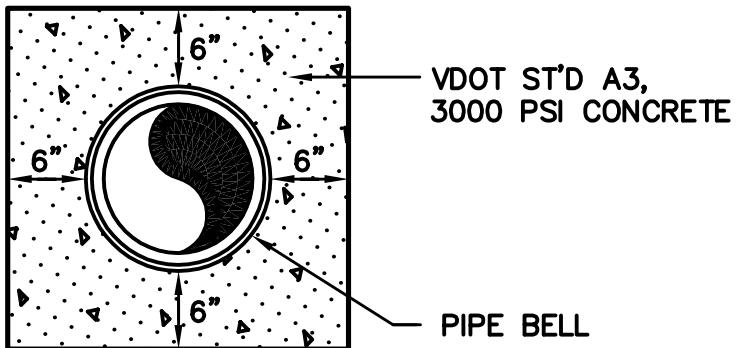
DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CA-4



NOTE:

1. ENCASEMENT SHALL EXTEND A MINIMUM OF 36 INCHES BEYOND 10 YEAR FLOOD PLAIN.
2. FOR CONCRETE ARCH, WHERE CALLED FOR ON PLANS, ELIMINATE CONCRETE BELOW PIPE, USE 12" OF CONCRETE OVER AND AROUND THE PIPE, AND EXTEND CONCRETE TO TRENCH WALLS (FORMS NOT ALLOWED).

PROFILE



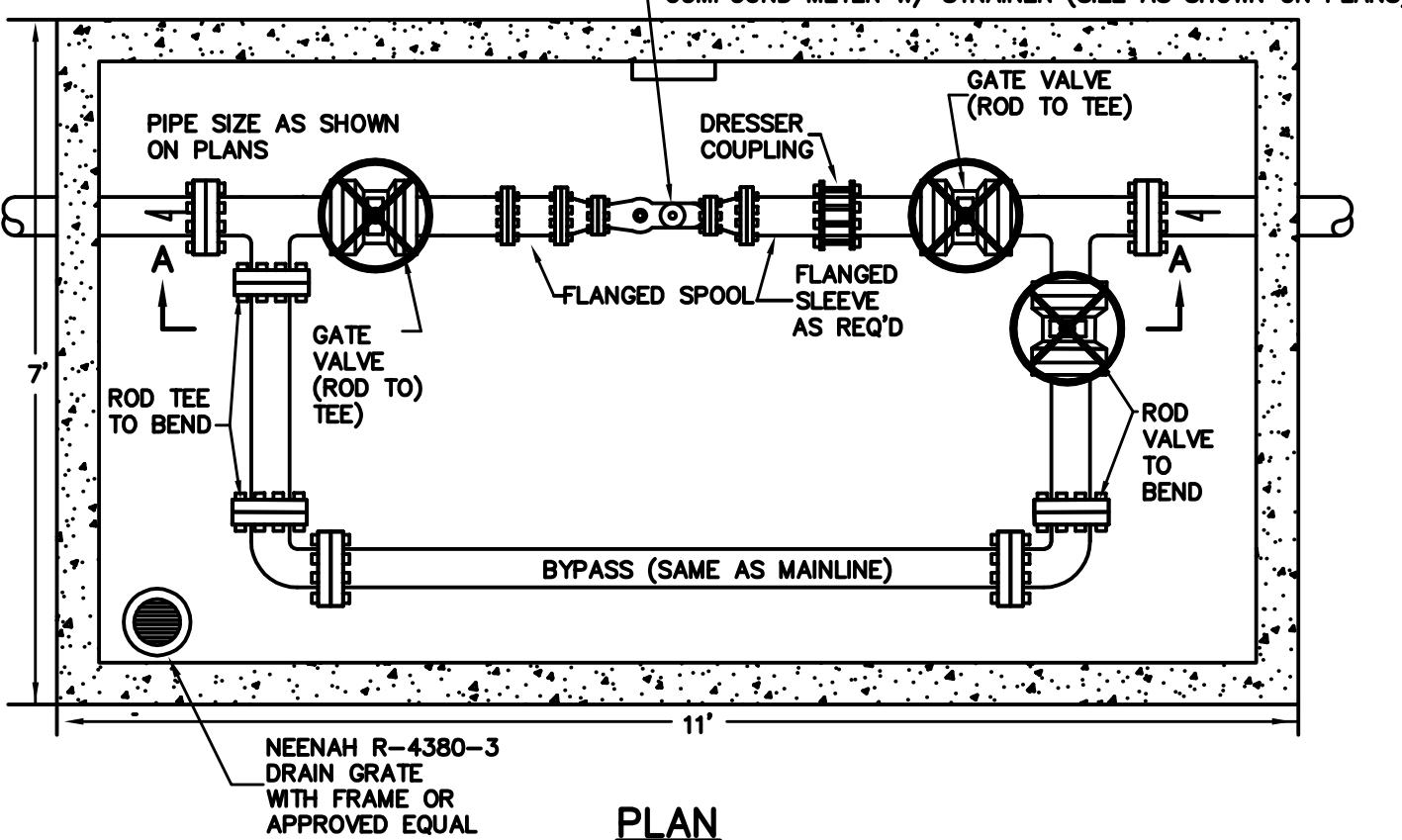
SECTION A-A



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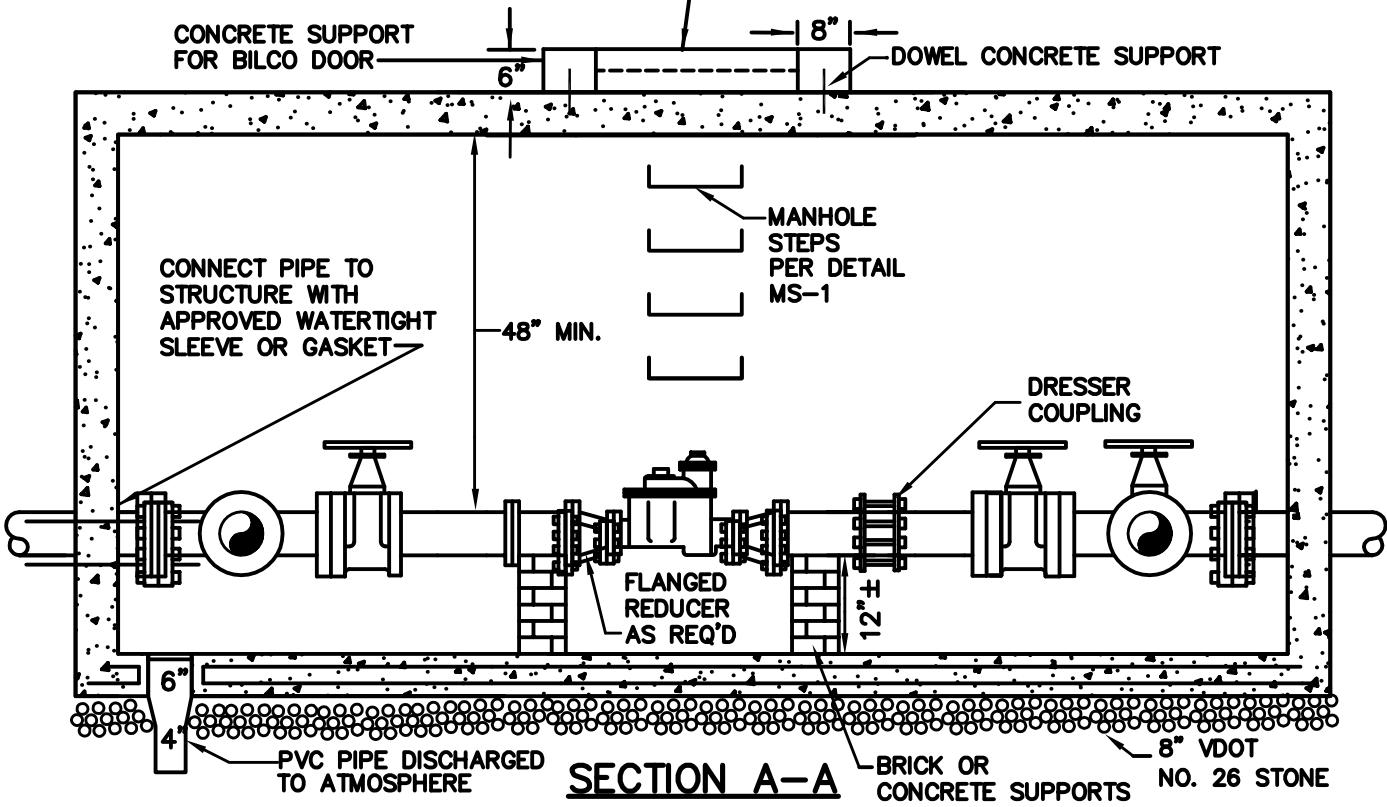
CONCRETE ENCASEMENT

DATE:	11 AUG 2014
SCALE:	N.T.S.
DETAIL NO.	CE-1



PLAN

ACCESS HATCH ALIGNED WITH STEPS; HATCH
SIMILAR TO BILCO Q-4 SERIES OR APPROVED EQUAL



SECTION A-A

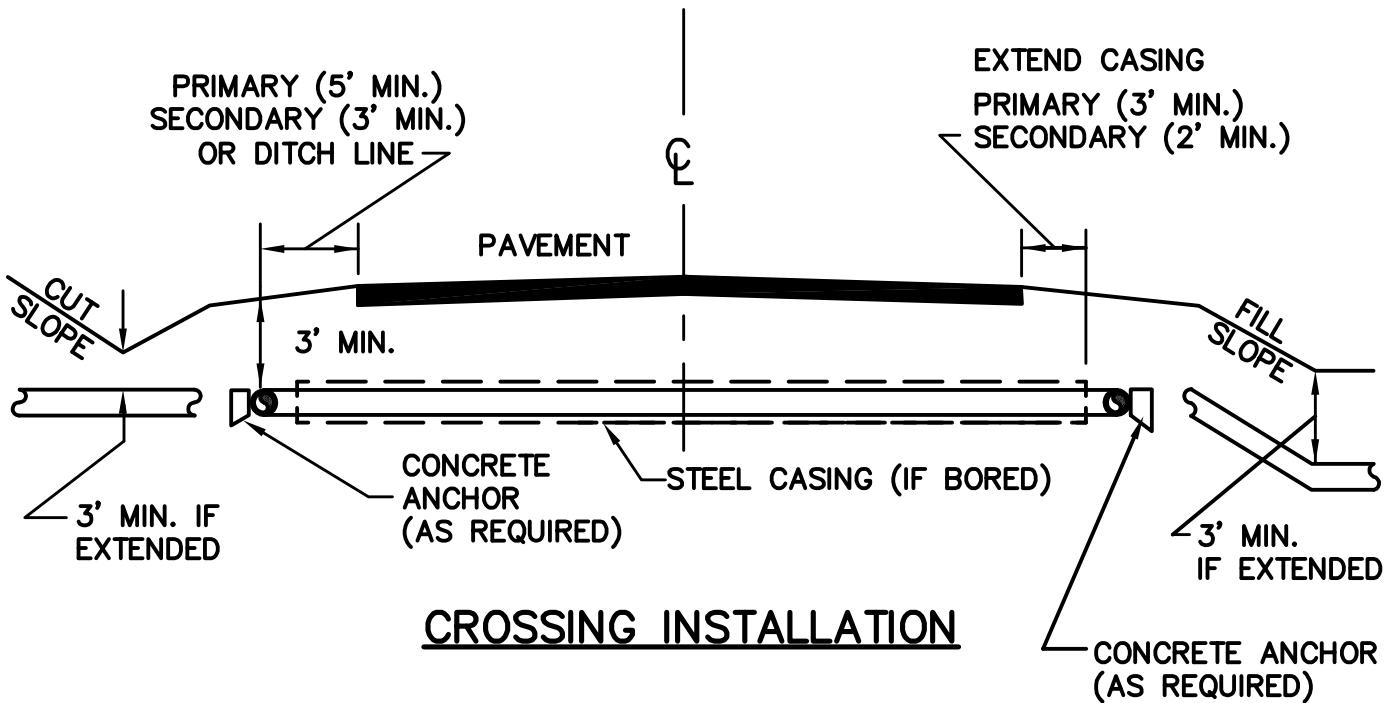
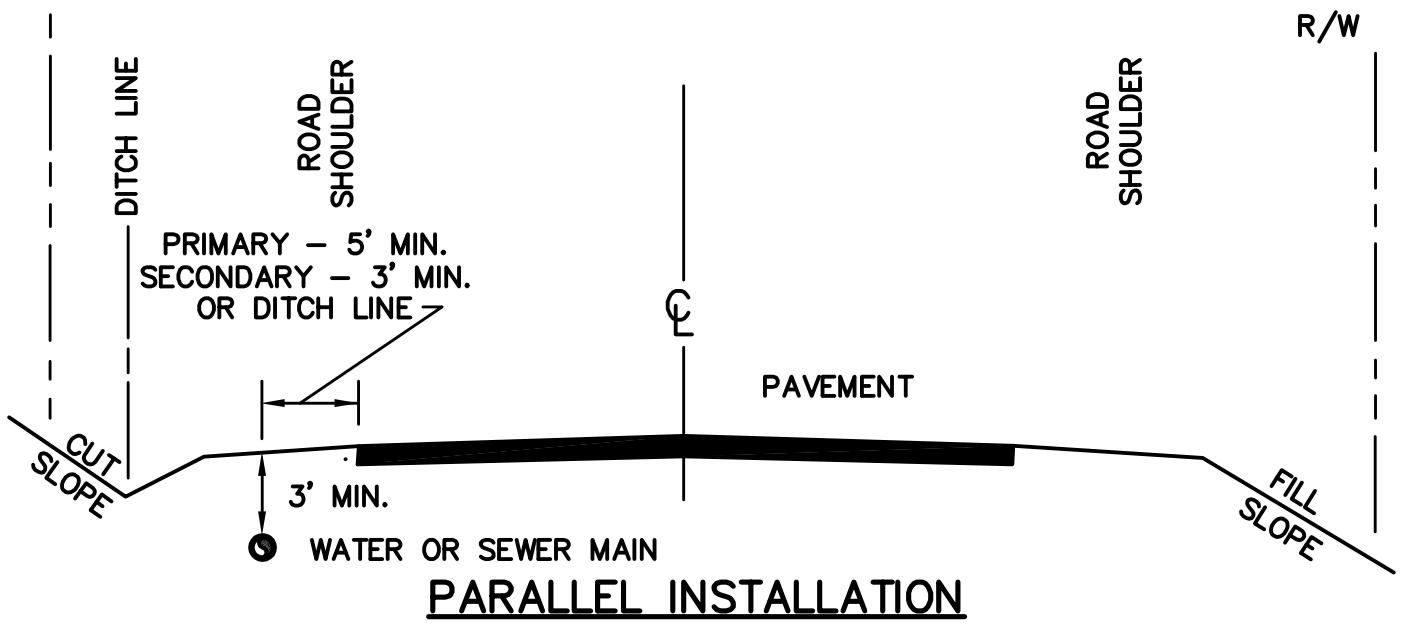


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COMPOUND METER INSTALLATION PRECAST VAULT

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CM-2

R/W AS NOTED ON PLANS



NOTES

1. PLACE VALVES AS NOTED ON PLAN.
2. VERIFY LOCAL REQUIREMENTS WITH TOWN.



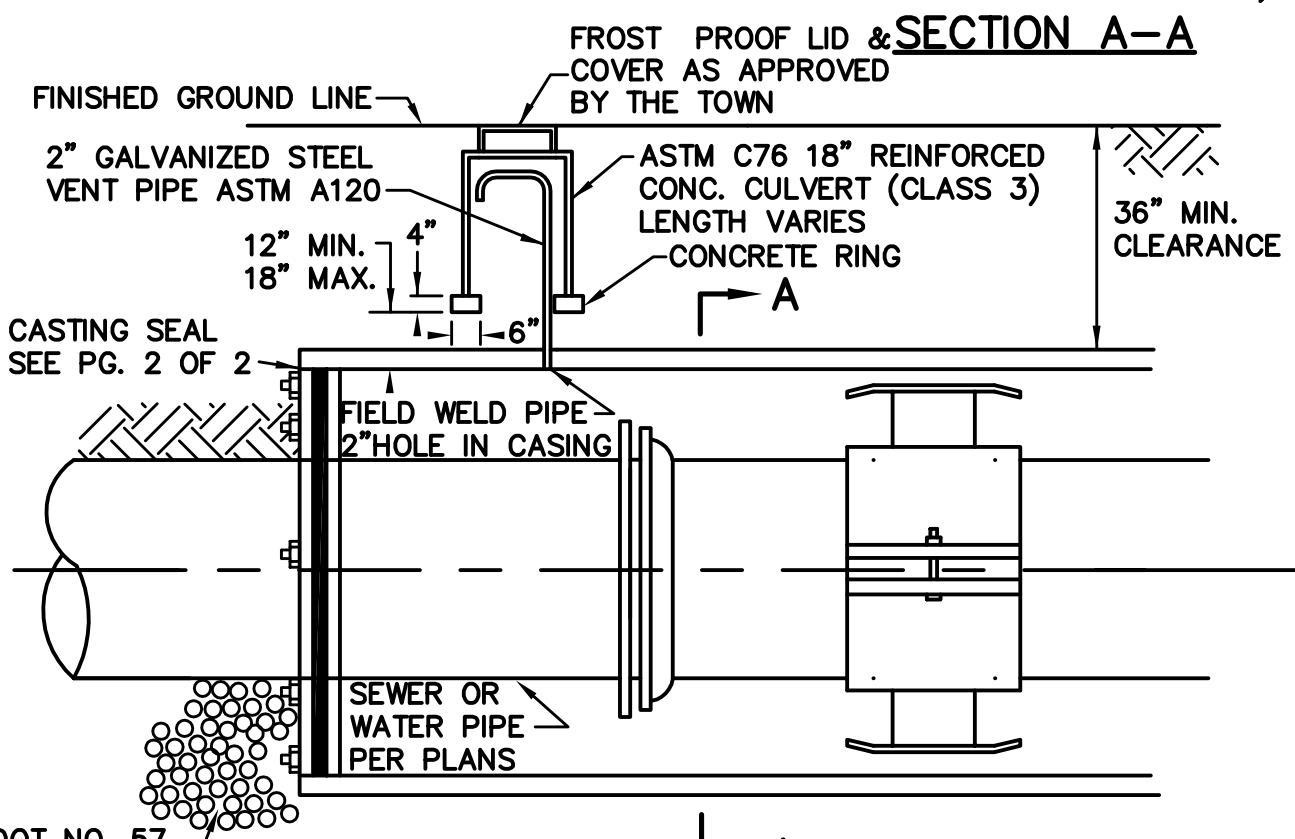
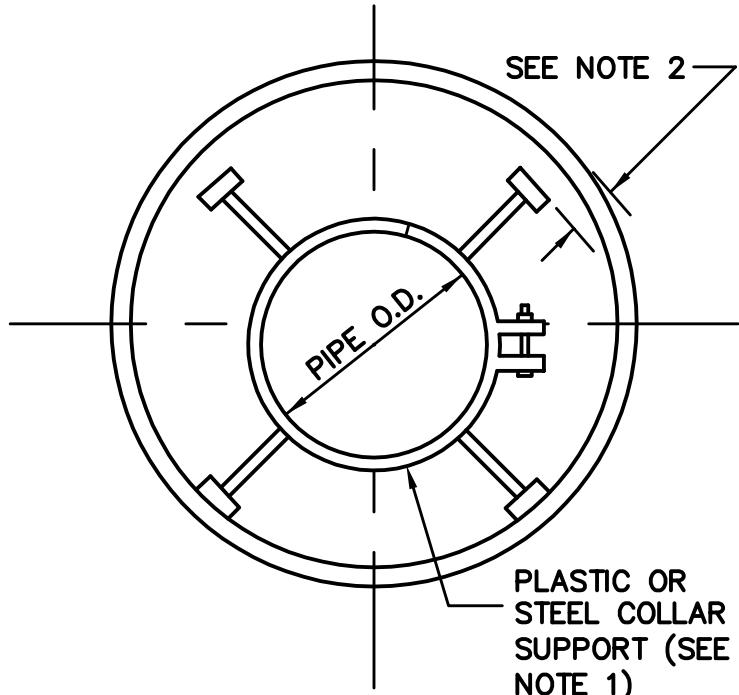
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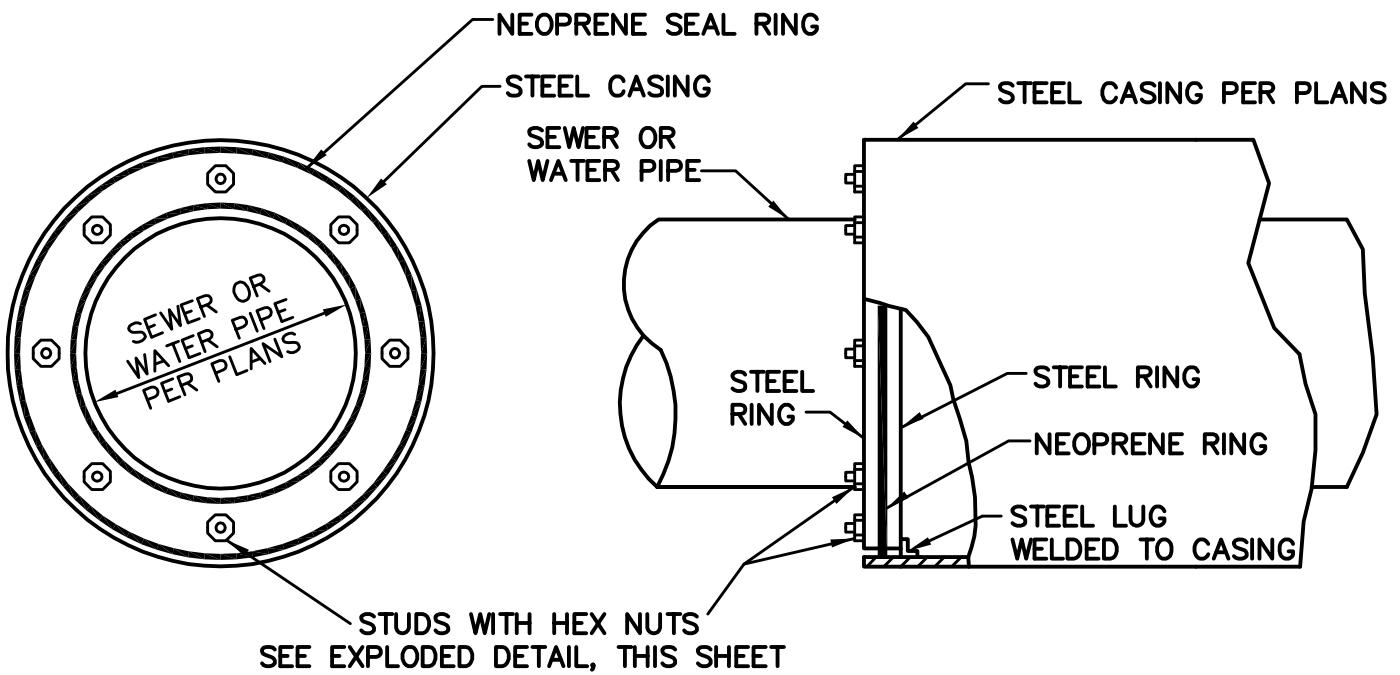
TYPICAL WATER OR SEWER
MAIN LOCATION WITHIN
TOWN RIGHT-OF-WAY

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CS-2

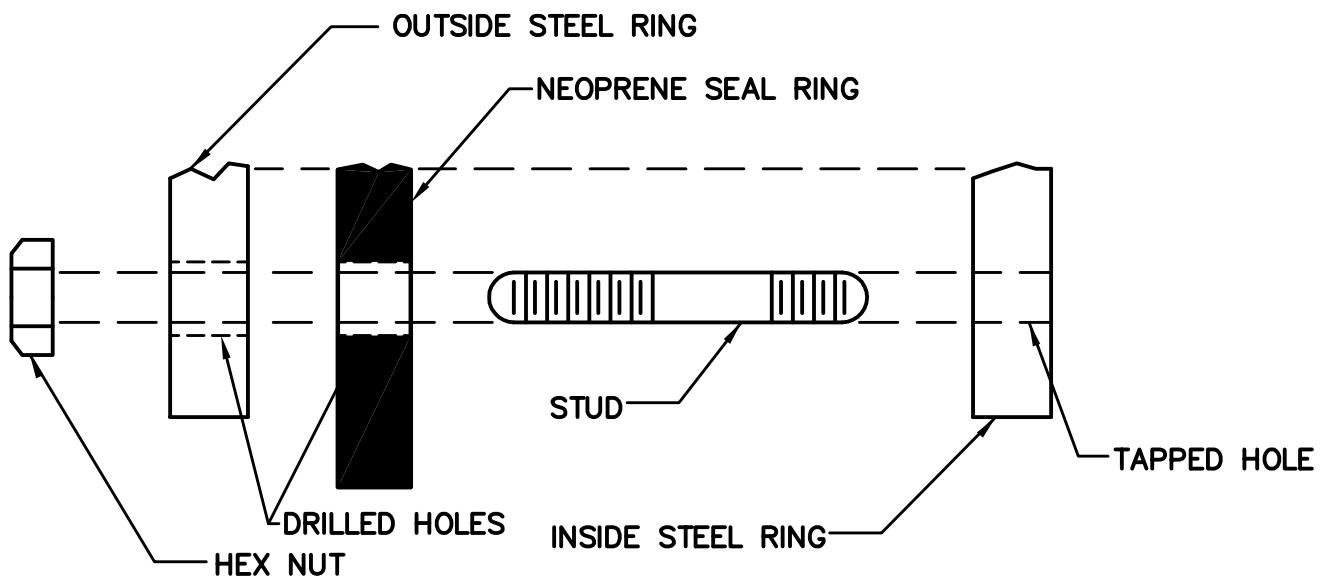
NOTES:

1. SINGLE-PIECE COLLAR SHOWN; 2-PIECE COLLAR USED FOR CARRIER PIPES 18" OR LARGER. DIMENSION AS NECESSARY TO PROVIDE
2. MINIMUM CLEARANCE NEEDED TO SLIDE PIPE THROUGH CASING. THIS STANDARD APPLICABLE FOR 4"
3. DIA. AND LARGER PIPE INSTALLED UNDER PRIMARY AND SECONDARY HIGHWAYS. FOR LINES SMALLER THAN 4", USE DUCTILE IRON PIPE FOR CASING IF OPEN TRENCH METHOD IS UTILIZED FOR INSTALLATION. MODIFY INSTALLATION ACCORDINGLY.
4. CORRUGATED METAL PIPE SHALL NOT BE USED AS CASING.
5. PVC PIPE REQUIRES SKID MIDWAY BETWEEN BELL AND SPIGOT END. TOP BLOCK NOT REQUIRED AT THIS LOCATION. PROVIDE SHIM TO PROTECT PIPE AGAINST STRAP.





CASING SEAL DETAIL



EXPLODED DETAIL



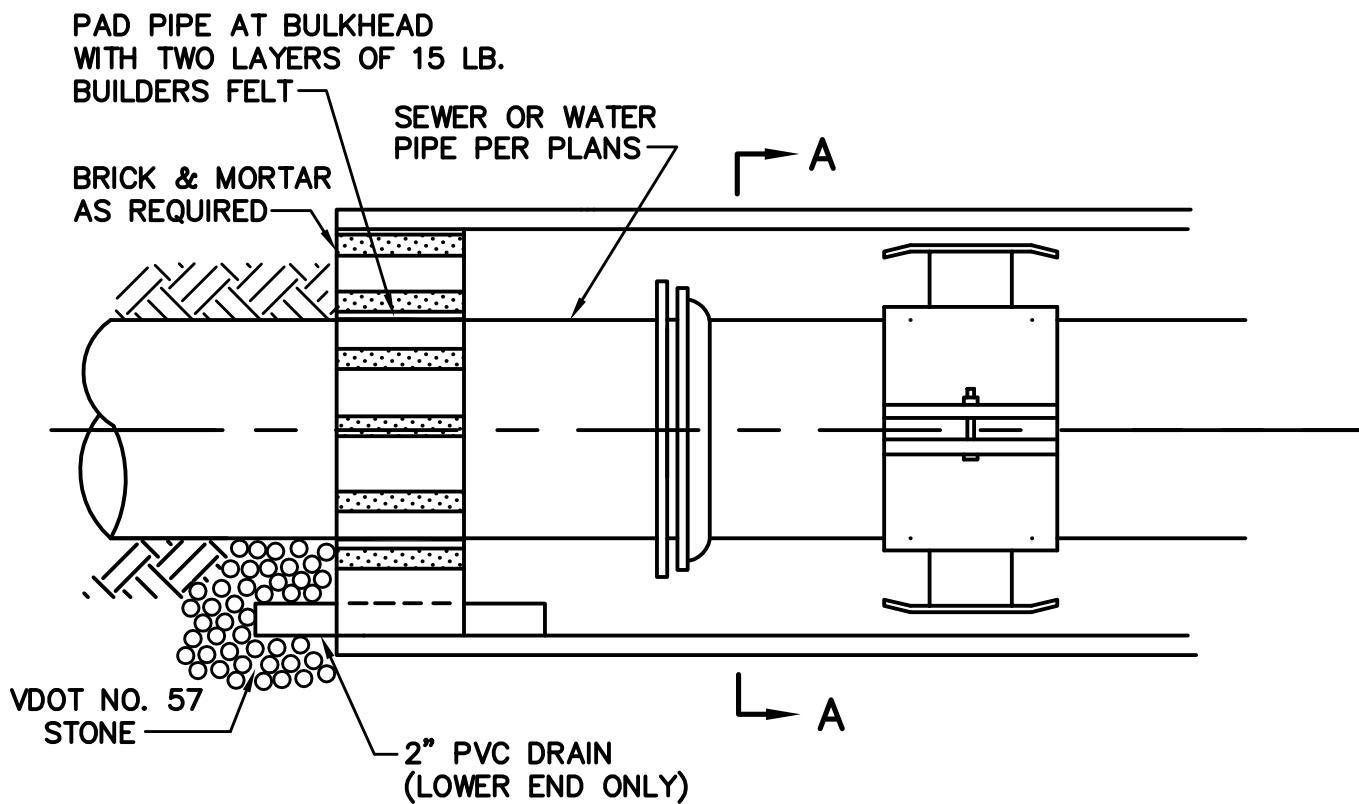
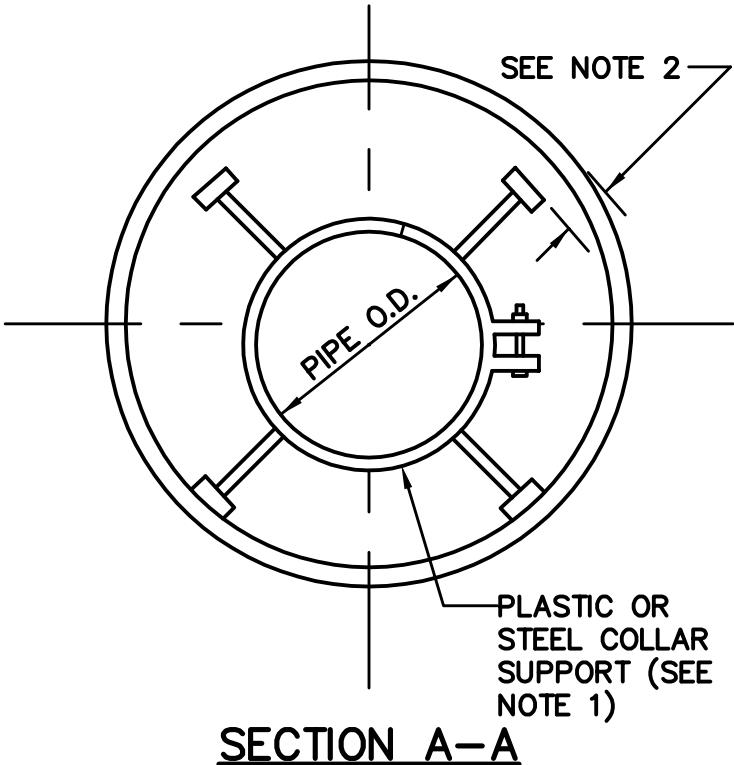
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NEOPRENE SEALED
CASING INSTALLATION
(2 OF 2)

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CS-3B

NOTES

1. SINGLE-PIECE COLLAR SHOWN;
2-PIECE COLLAR USED FOR CARRIER
PIPES 18" OR LARGER.
2. DIMENSION AS NECESSARY TO PROVIDE
MINIMUM CLEARANCE NEEDED TO SLIDE
PIPE THROUGH CASING.
3. THIS STANDARD APPLICABLE FOR 4"
DIA. AND LARGER PIPE INSTALLED
UNDER PRIMARY AND SECONDARY
HIGHWAYS. FOR LINES SMALLER THAN
4", USE DUCTILE IRON PIPE FOR
CASING IF OPEN TRENCH METHOD IS
UTILIZED FOR INSTALLATION. MODIFY
INSTALLATION ACCORDINGLY.
4. CORRUGATED METAL PIPE SHALL NOT
BE USED AS CASING.
5. PVC PIPE REQUIRES SKID MIDWAY
BETWEEN BELL AND SPIGOT END.
TOP BLOCK NOT REQUIRED AT THIS
LOCATION. PROVIDE SHIM TO PROTECT
PIPE AGAINST STRAP.

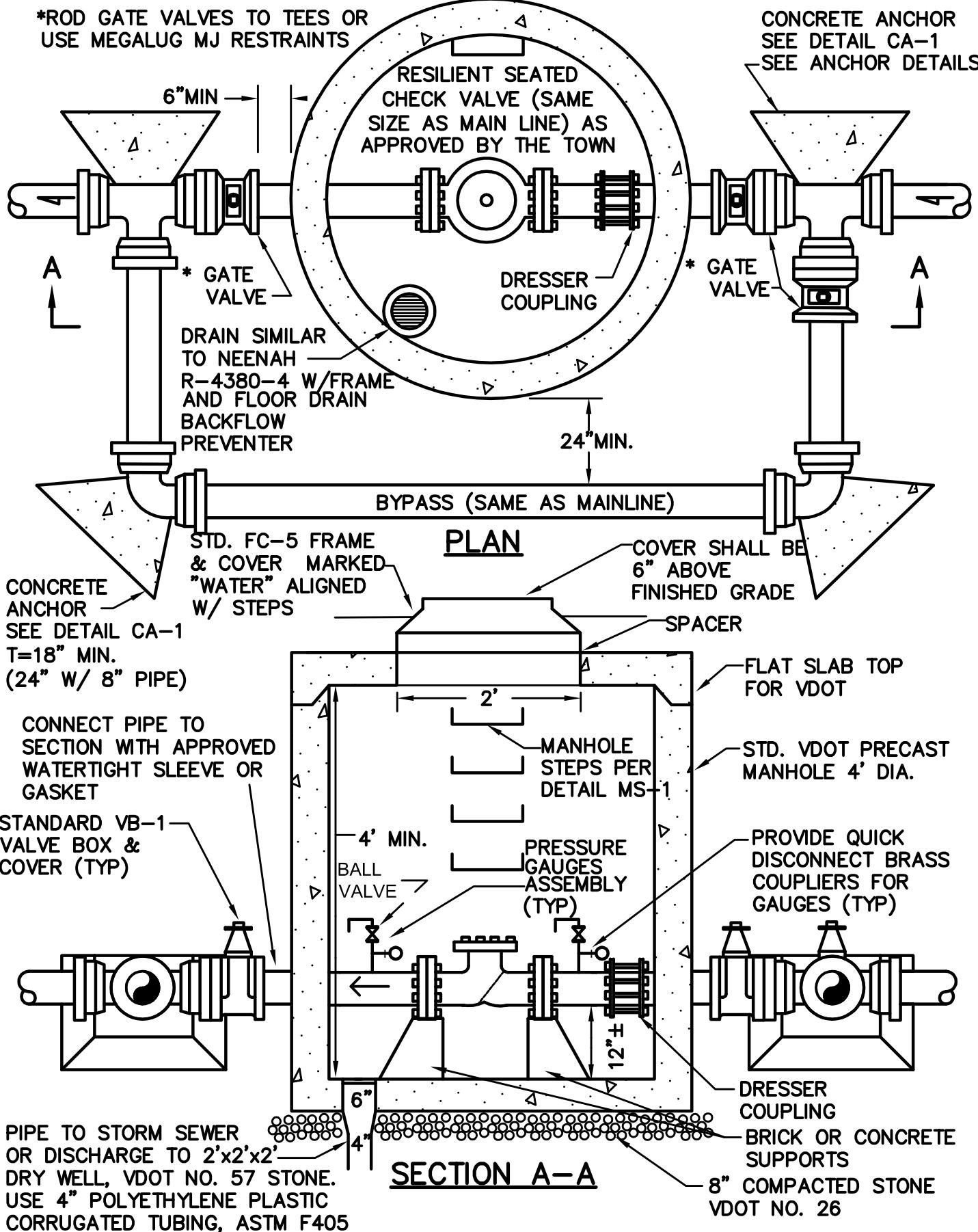


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SEALED CASING INSTALLATION
WITH PLASTIC OR STEEL COLLAR

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CS-4

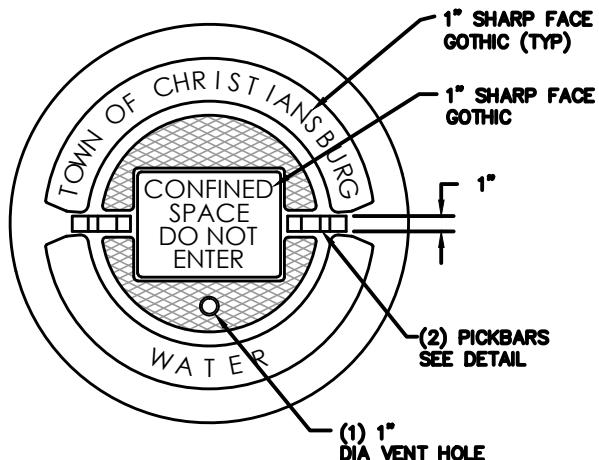
***ROD GATE VALVES TO TEES OR
USE MEGALUG MJ RESTRAINTS**



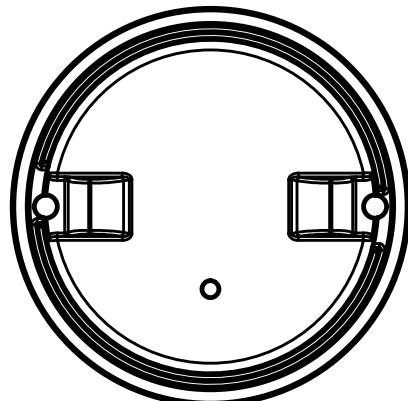
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CHECK VALVE ASSEMBLY AND BYPASS

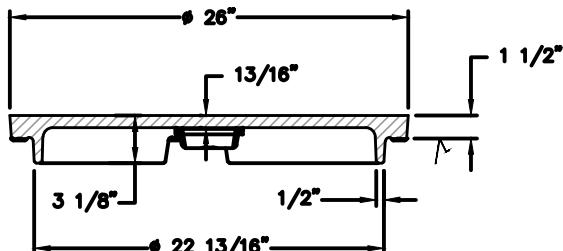
DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
CV-1



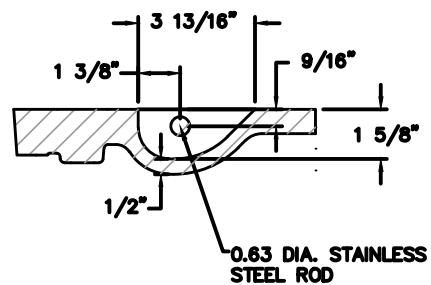
PLAN VIEW



BOTTOM VIEW

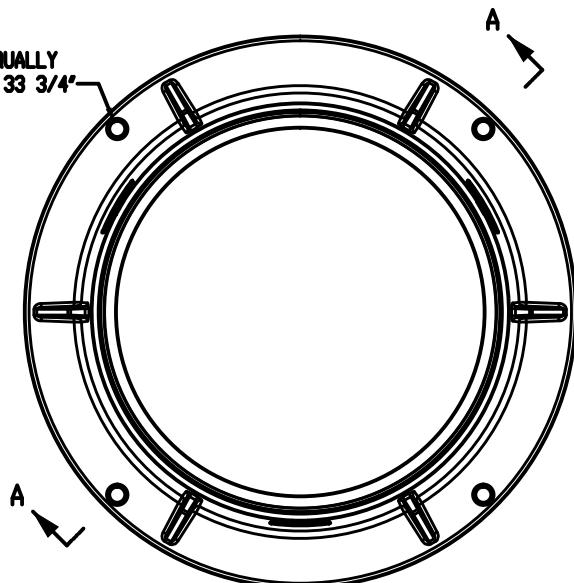
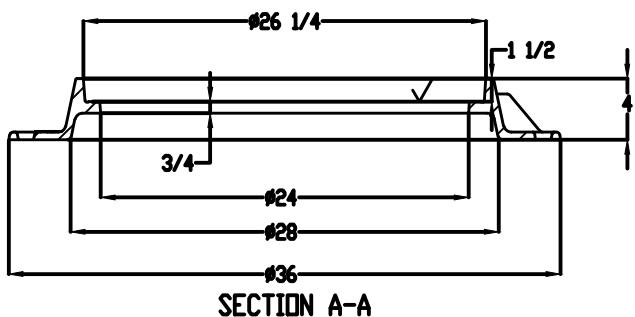


SECTION VIEW



PICKBAR DETAIL

(4) #1 HOLES EQUALLY SPACED ON A # 33 3/4" BOLT CIRCLE



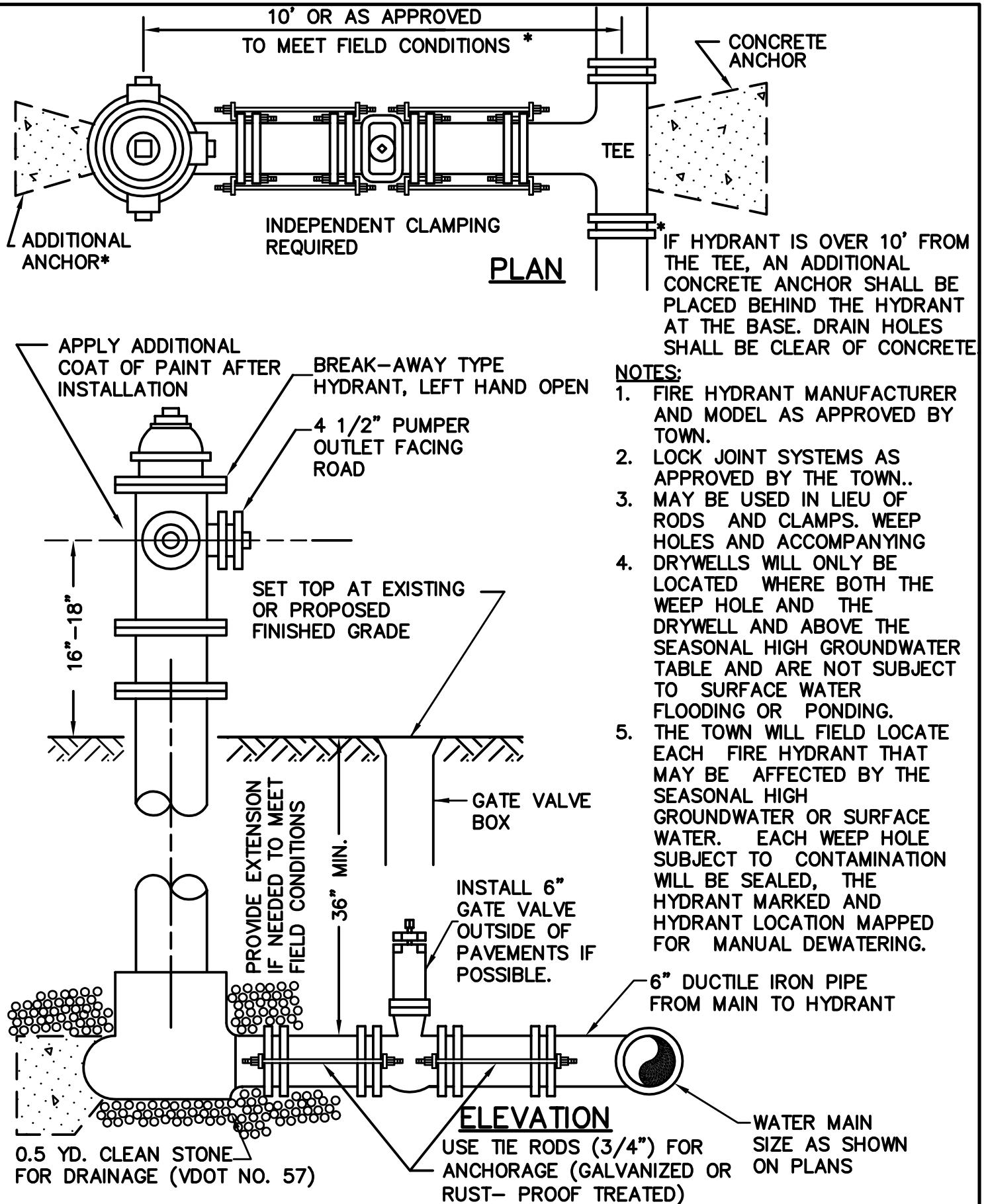
SECTION A-A



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WATER MANHOLE
FRAME AND COVER

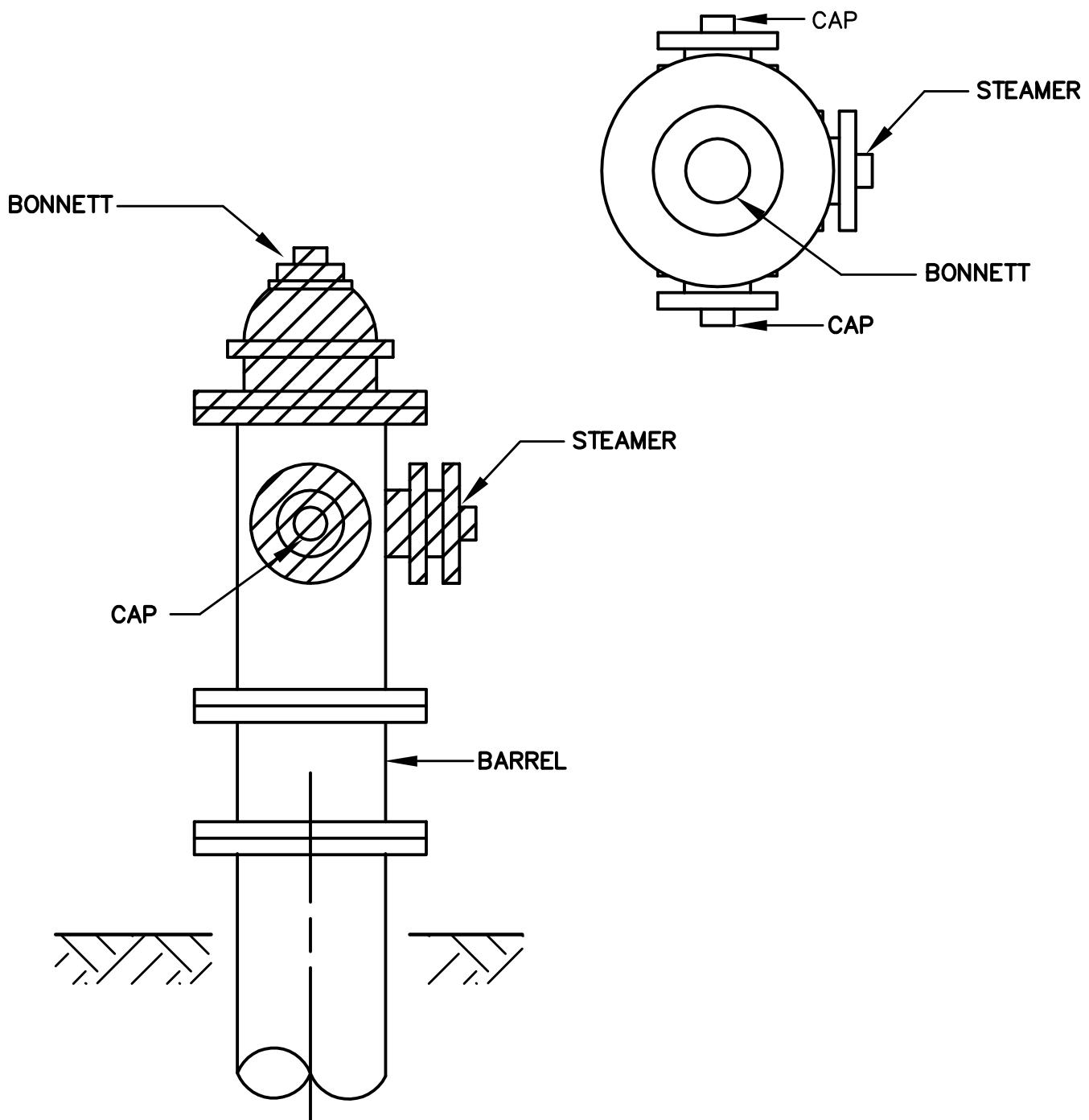
DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
FC-5



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FIRE HYDRANT INSTALLATION

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
FH-I



FLOW	BARREL	BONNETT
499 OR LESS GPM	RED	RED
500-999 GPM	RED	ORANGE
1000-1499 GPM	RED	GREEN
1500 GPM OR MORE	RED	BLUE

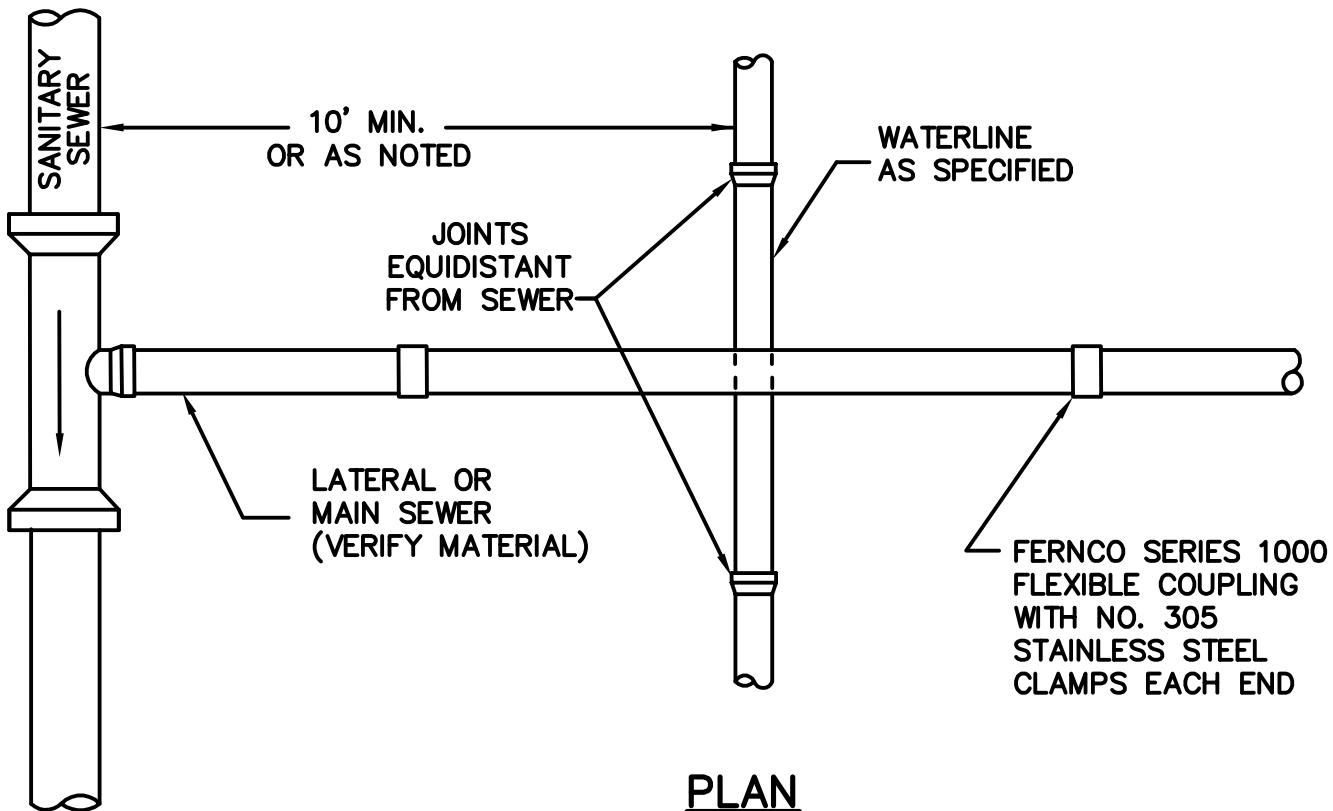
PRESSURE	STEAMER	CAPS
BELow 50 PSI	RED	RED
50-120 PSI	ORANGE	ORANGE
OVER 120 PSI	GREEN	GREEN



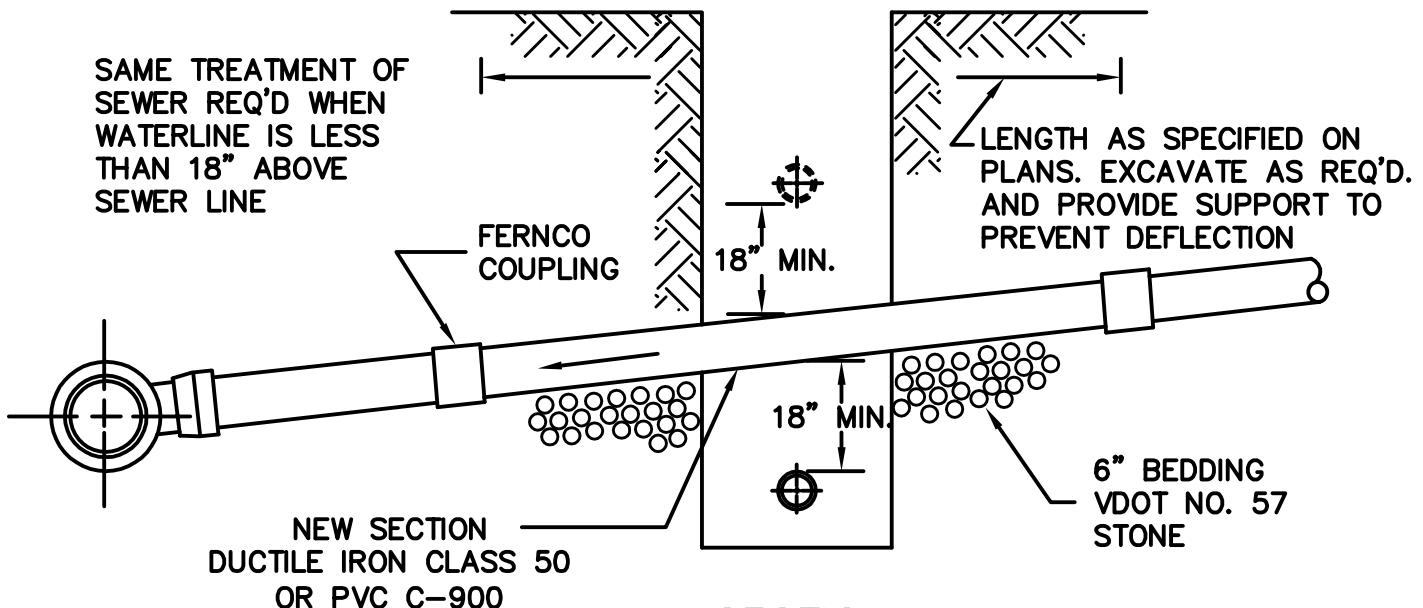
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FIRE HYDRANT
PAINTING SCHEDULE

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
FH-2

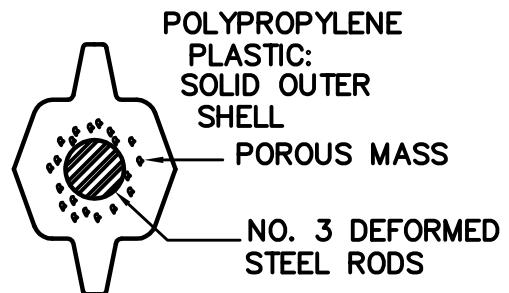
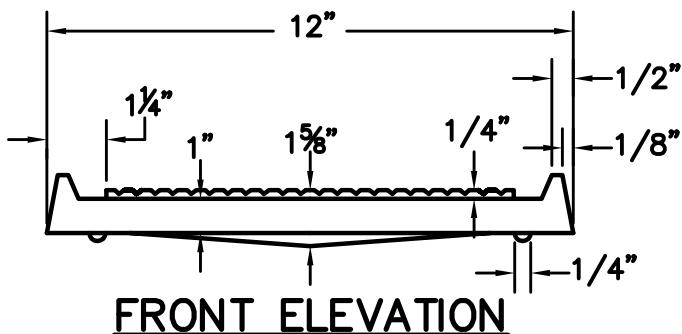
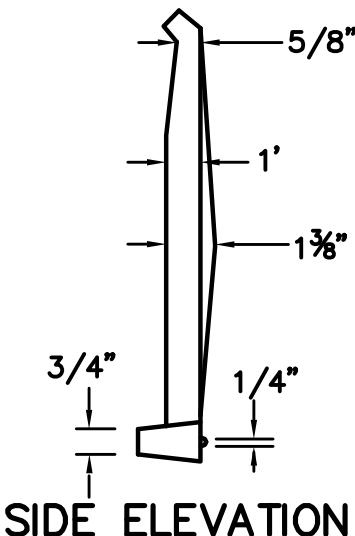
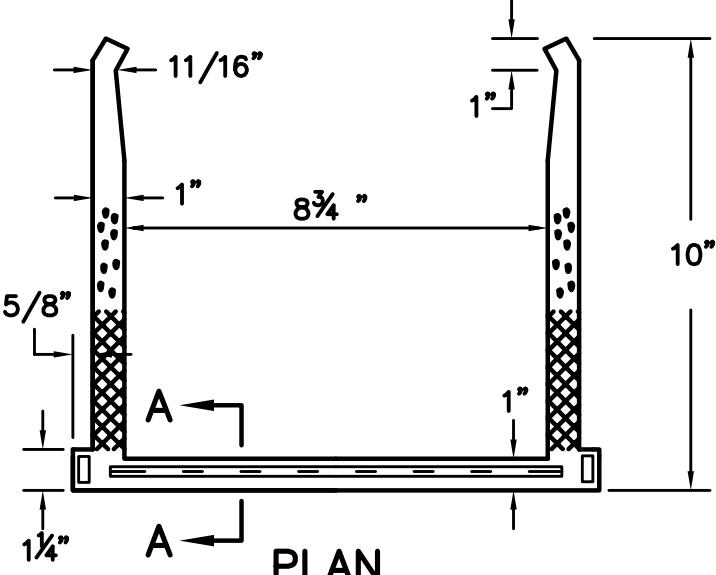


PLAN

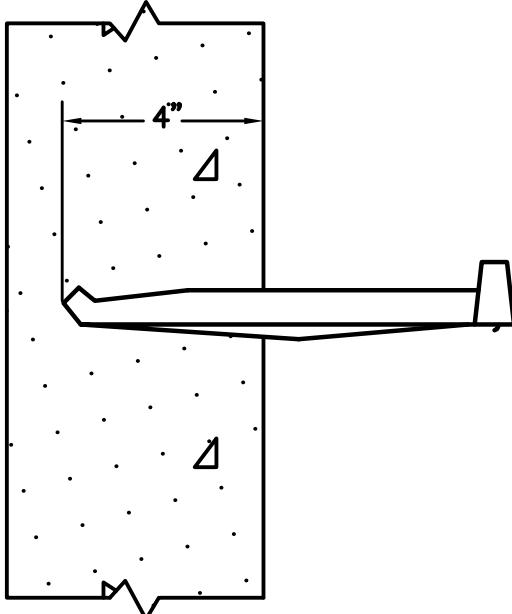


SECTION





SECTION A-A



MATERIALS:

POLYPROPYLENE PLASTIC - GRADE 10-1014 "AVISUN CORP."

STEEL REINFORCING BAR - CONFORMS TO A.S.T.M. STD A-615

INSTALLATION

STEPS SHALL BE POURED INTEGRALLY WITH THE MANHOLE SECTION AND NOT MORTARED OR GROUTED LATER



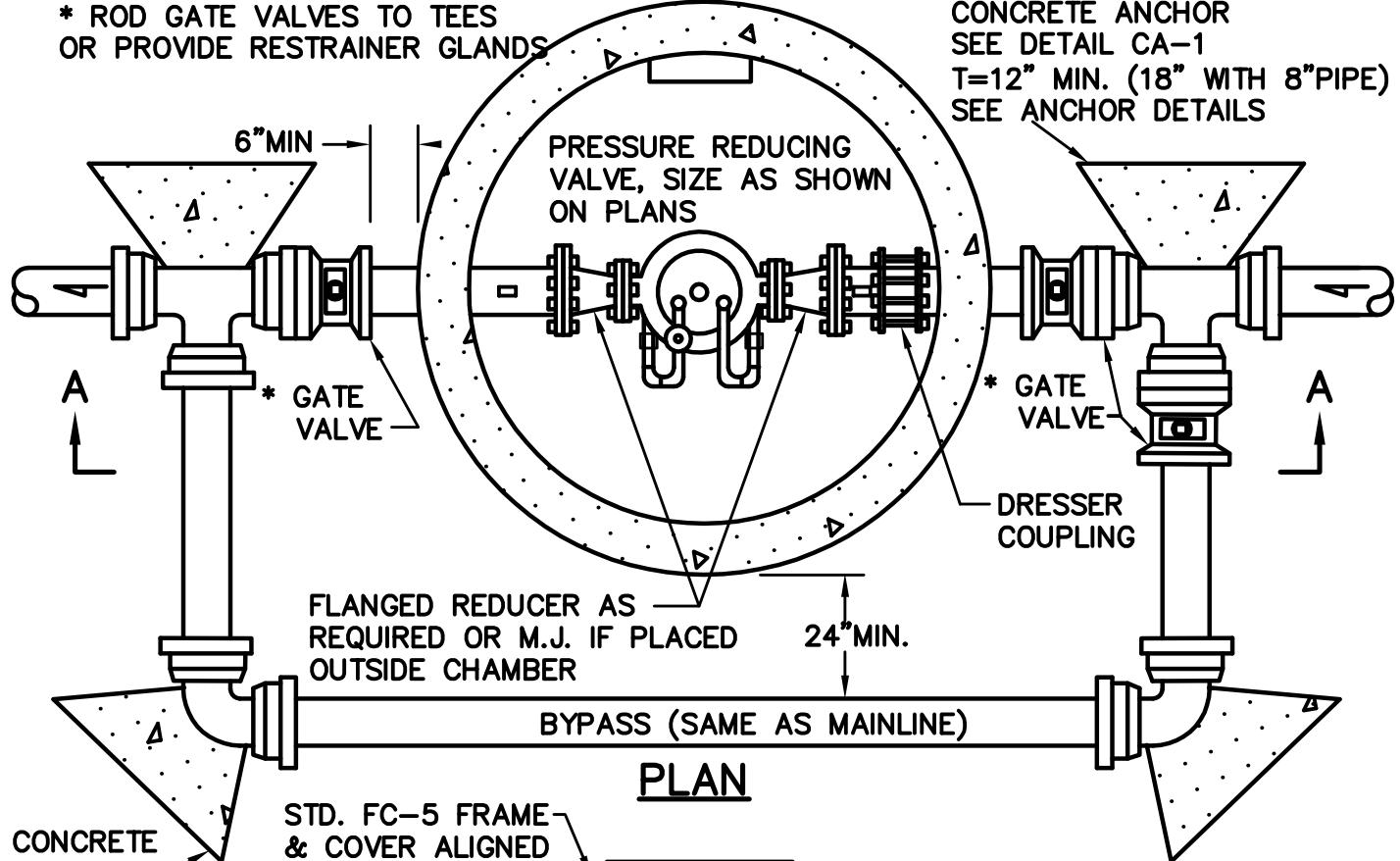
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STANDARD
MANHOLE STEP

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
MS-I

* ROD GATE VALVES TO TEES
OR PROVIDE RESTRAINER GLANDS

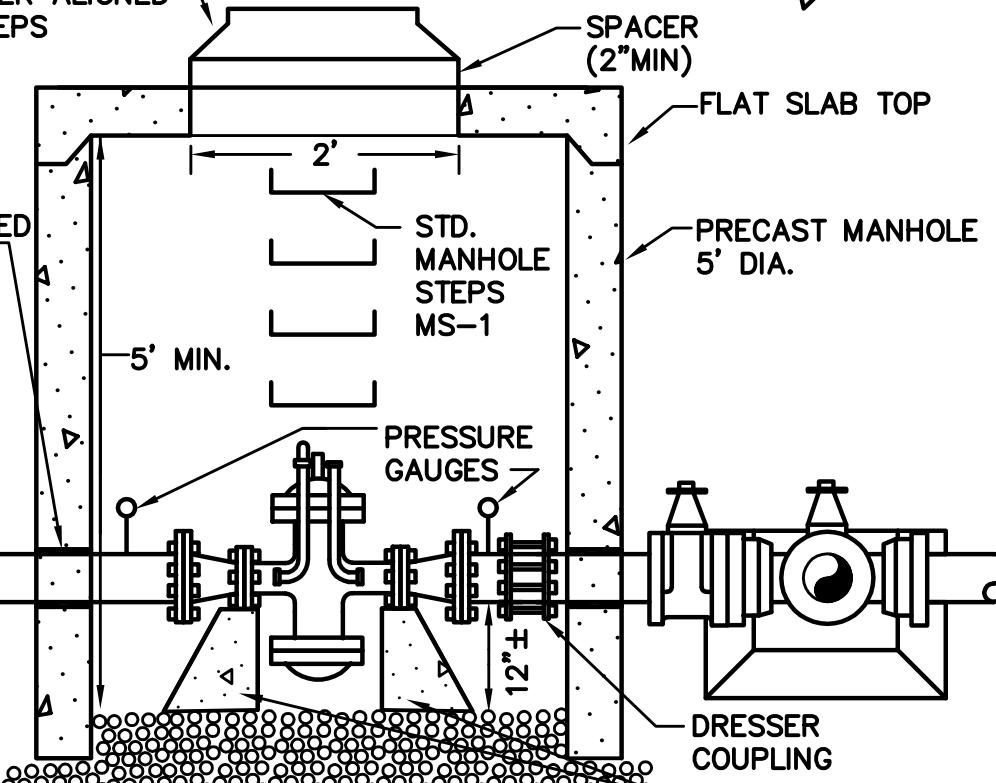
CONCRETE ANCHOR
SEE DETAIL CA-1
T=12" MIN. (18" WITH 8"PIPE)
SEE ANCHOR DETAILS



CONCRETE ANCHOR
SEE DETAIL CA-1
T=18" MIN.
(24" W/ 8" PIPE)

STD. FC-5 FRAME & COVER ALIGNED W/ STEPS

CONNECT PIPE TO STRUCTURE WITH APPROVED WATERTIGHT SLEEVE OR GASKET



NOTE:

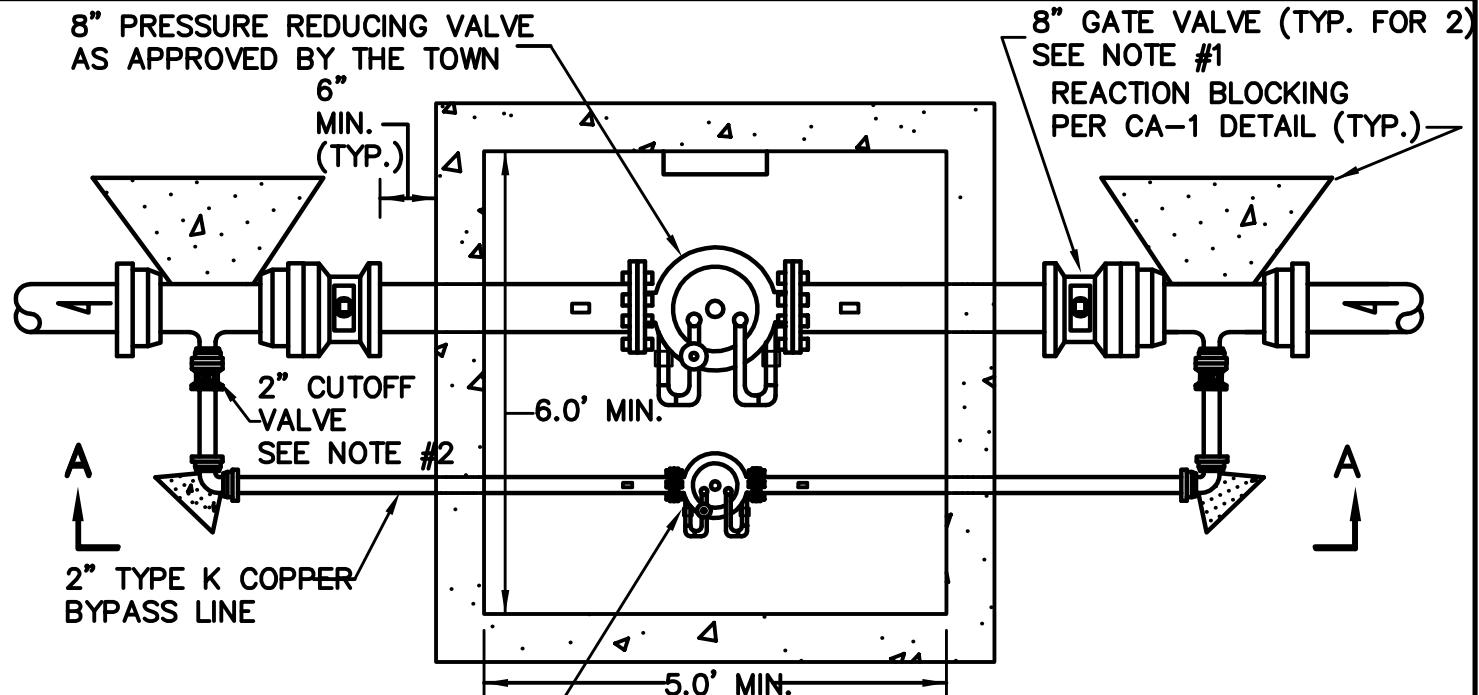
A PLACARD SHOWING THE DESIGN DISCHARGE PRESSURE AND THE ANTICIPATED RANGE OF INLET PRESSURE SHOULD BE INSTALLED INSIDE THE VAULT.



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PRESSURE REDUCING
VALVE INSTALLATION

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
RV-1

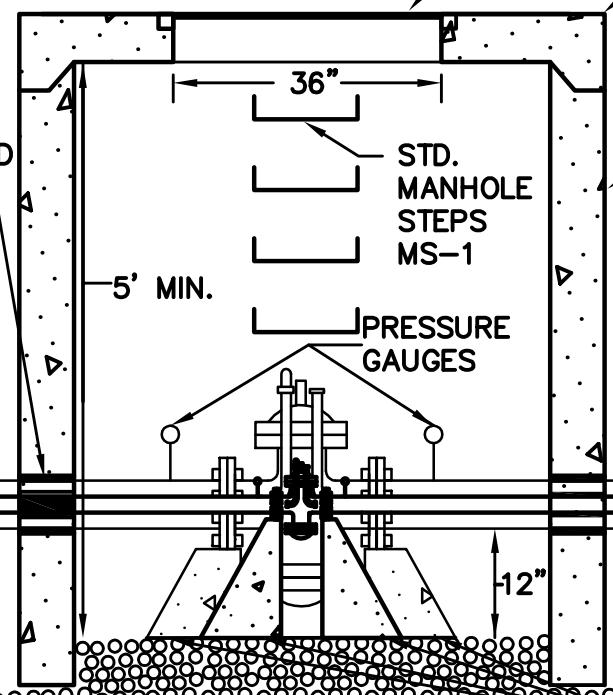


2" PRESSURE REDUCING VALVE
ROSS VALVE MODEL MOD 98EP

ACCESS DOOR
(HALLIDAY H1W3636 OR EQUAL)

FLAT SLAB TOP RATED
FOR H-20 TRAFFIC
LOADING

CONNECT PIPE TO
STRUCTURE WITH APPROVED
WATERTIGHT SLEEVE OR
GASKET



8" COMPACTED
STONE VDOT NO. 57

BRICK OR CONCRETE
SUPPORTS

SECTION A-A

NOTES:

1. ROD GATE VALVES TO TEES OR PROVIDE RESTRAINER GLANDS
2. CONTRACTOR MAY UTILIZE 2" TAPPING SLEEVE AND VALVE TO CONNECT TO 8" MAIN IN LIEU OF TEE AND 2" VALVE
3. A PLACARD SHOWING THE DESIGN DISCHARGE PRESSURE AND THE ANTICIPATED RANGE OF INLET PRESSURE SHOULD BE INSTALLED INSIDE THE VAULT.

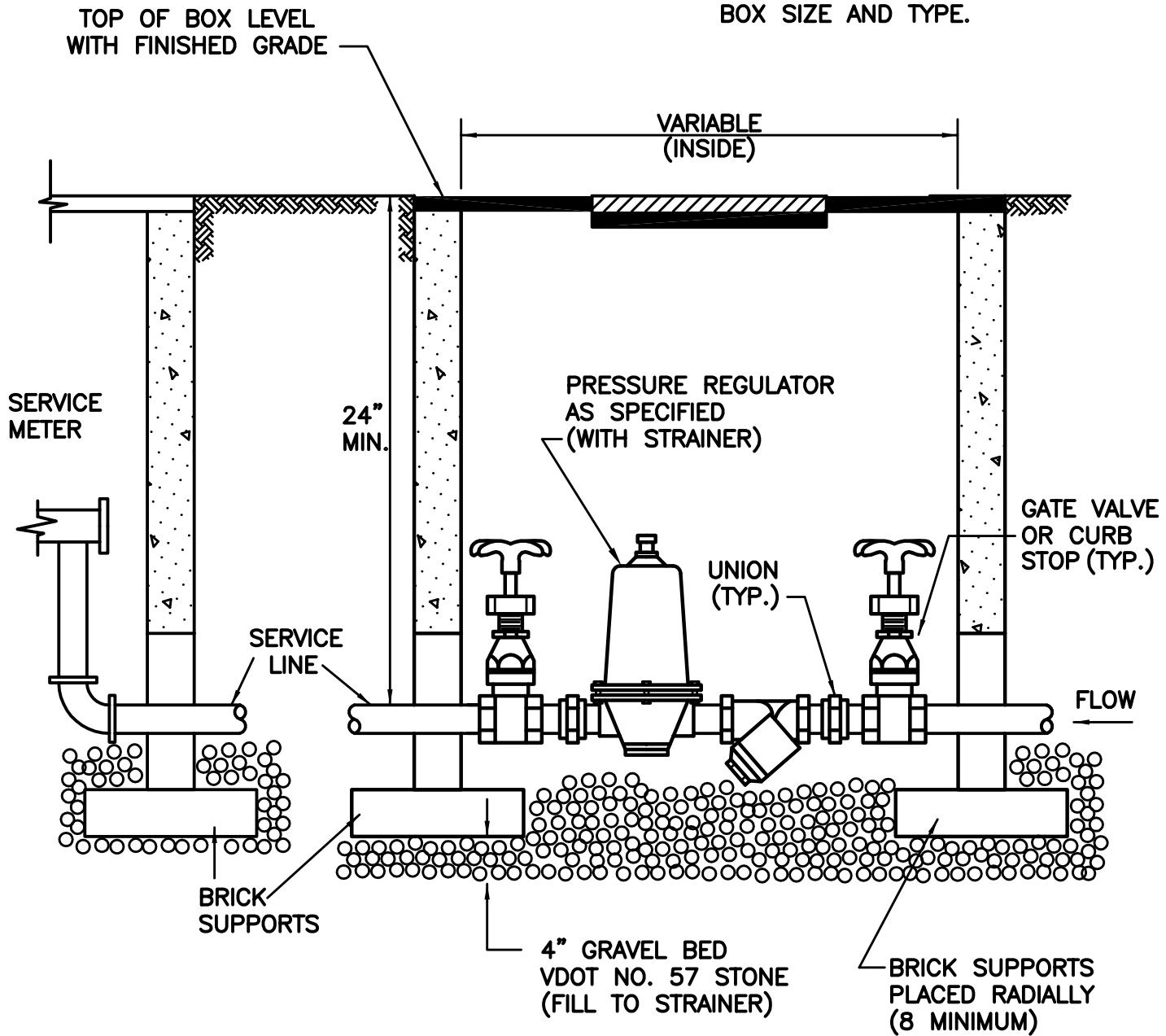


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8-INCH PRESSURE REDUCING
VALVE ASSEMBLY WITH
2-INCH BYPASS

DATE:	11 AUG 2014
SCALE:	N.T.S.
DETAIL NO.	RV-2

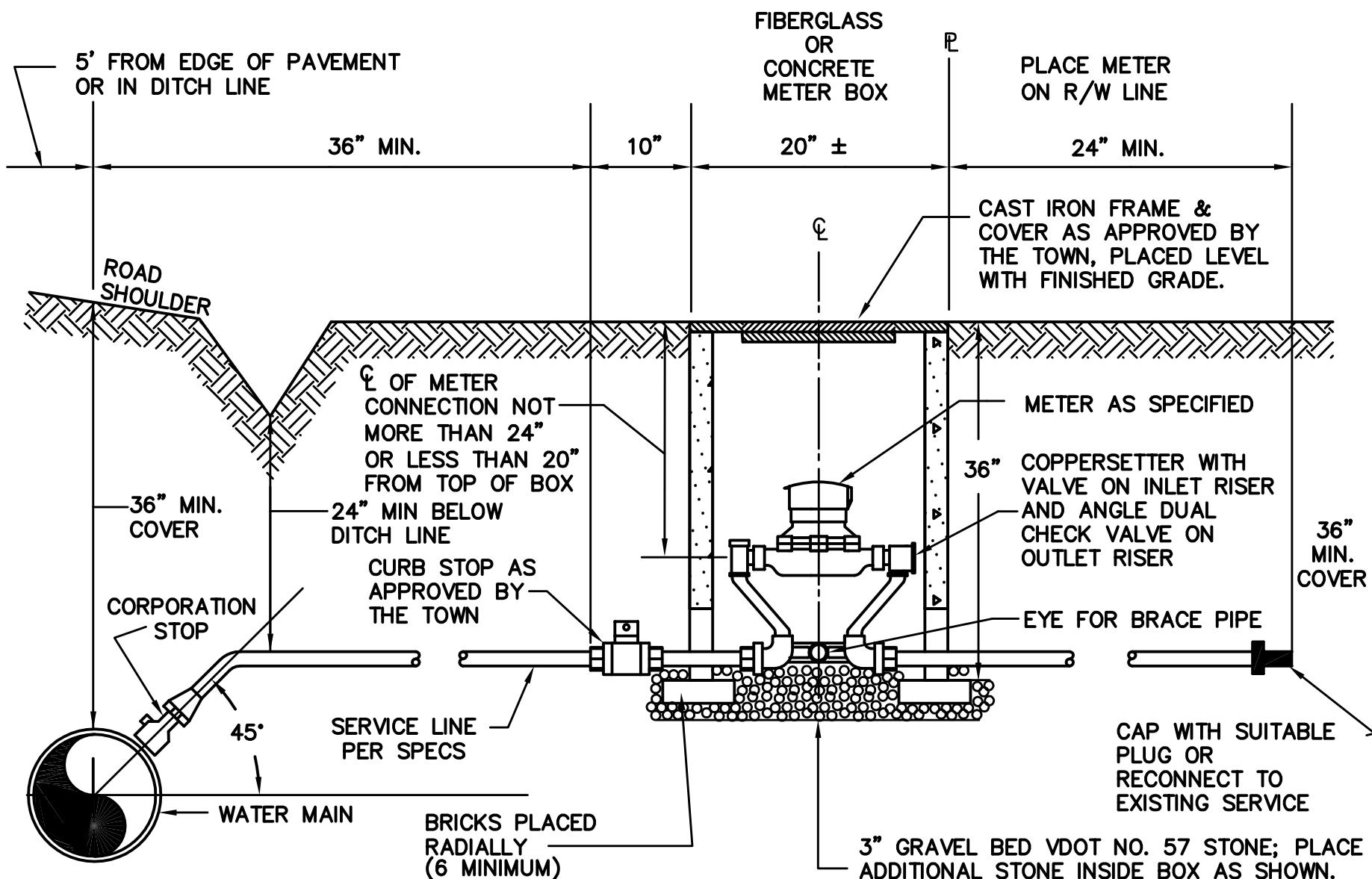
NOTE:
CONTRACTOR SHALL SUPPLY
SHOP DRAWINGS INDICATING
BOX SIZE AND TYPE.



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PRESSURE REDUCING VALVE
INDIVIDUAL SERVICE

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
RV-3



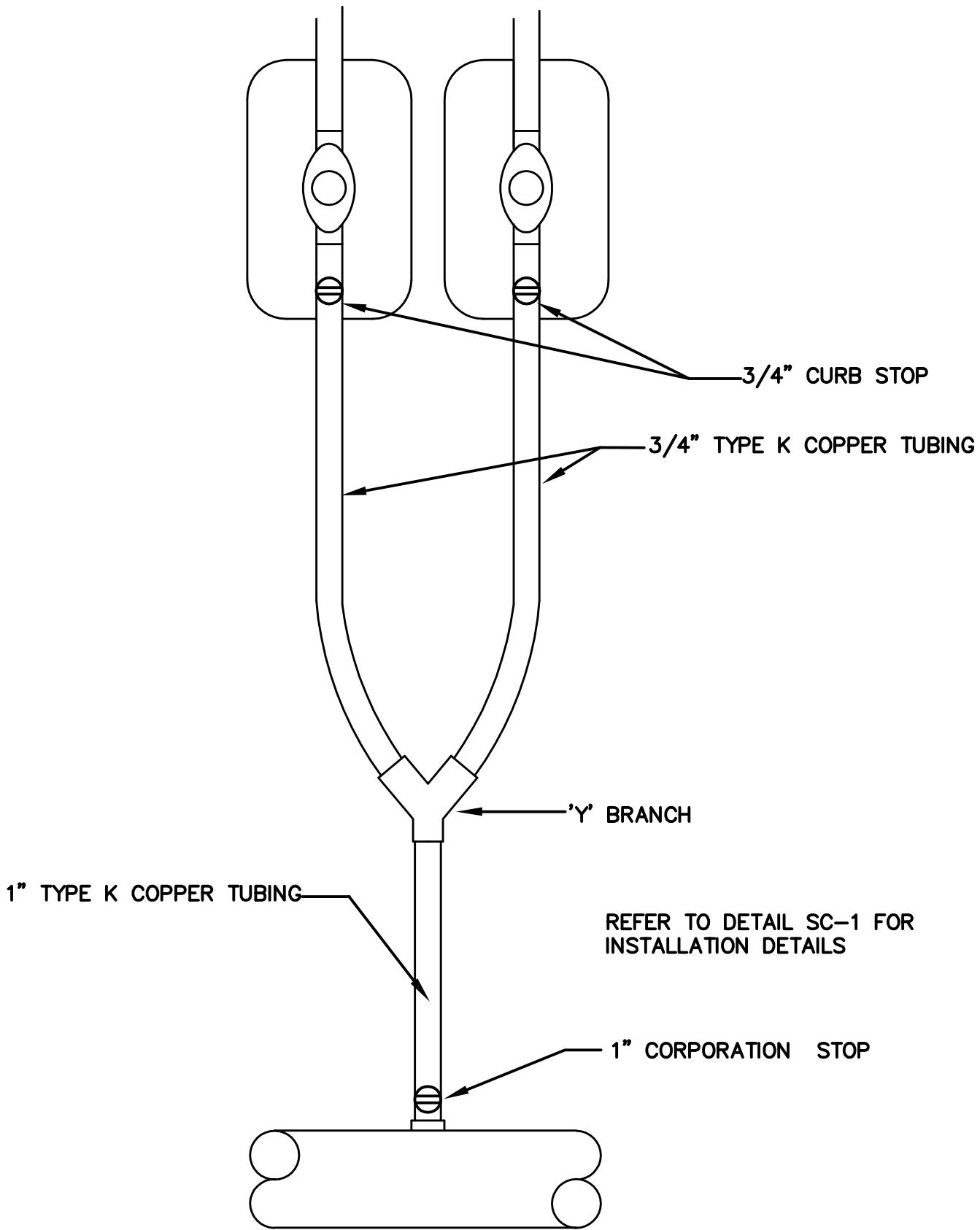
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STANDARD WATER SERVICE CONNECTION

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
SC-1

NOTE:

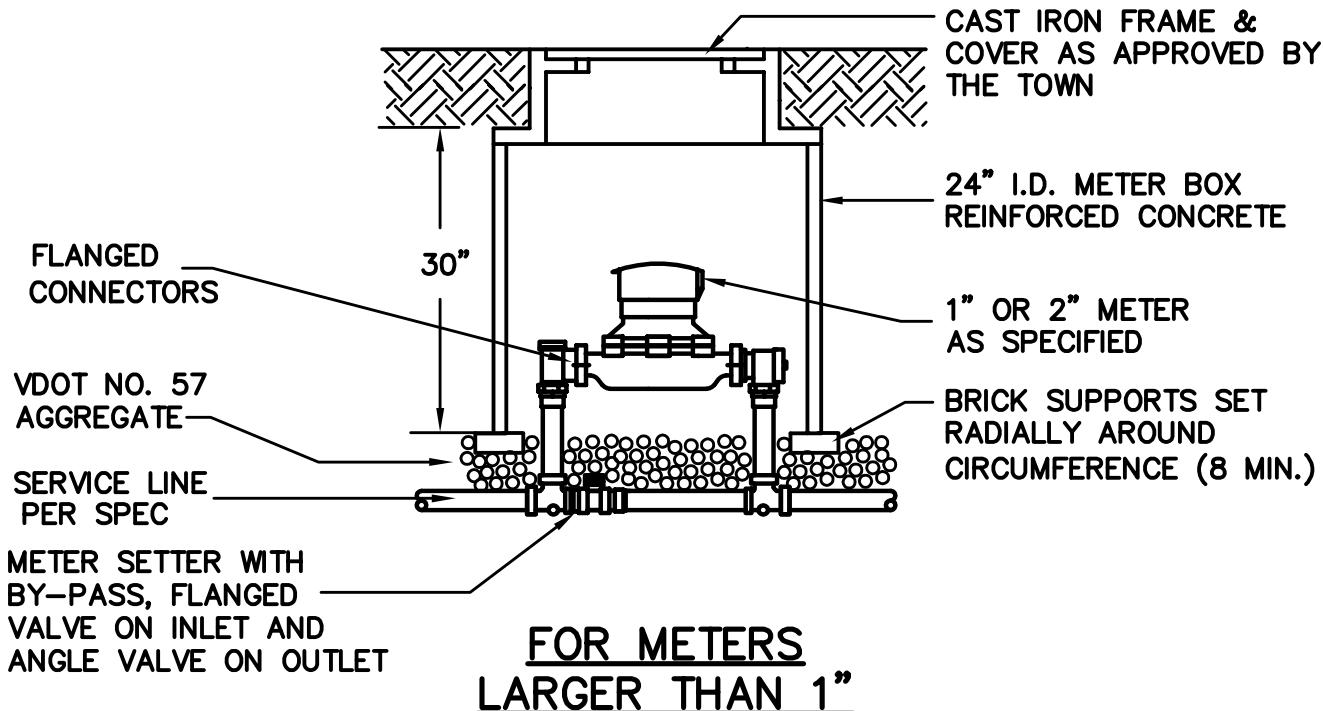
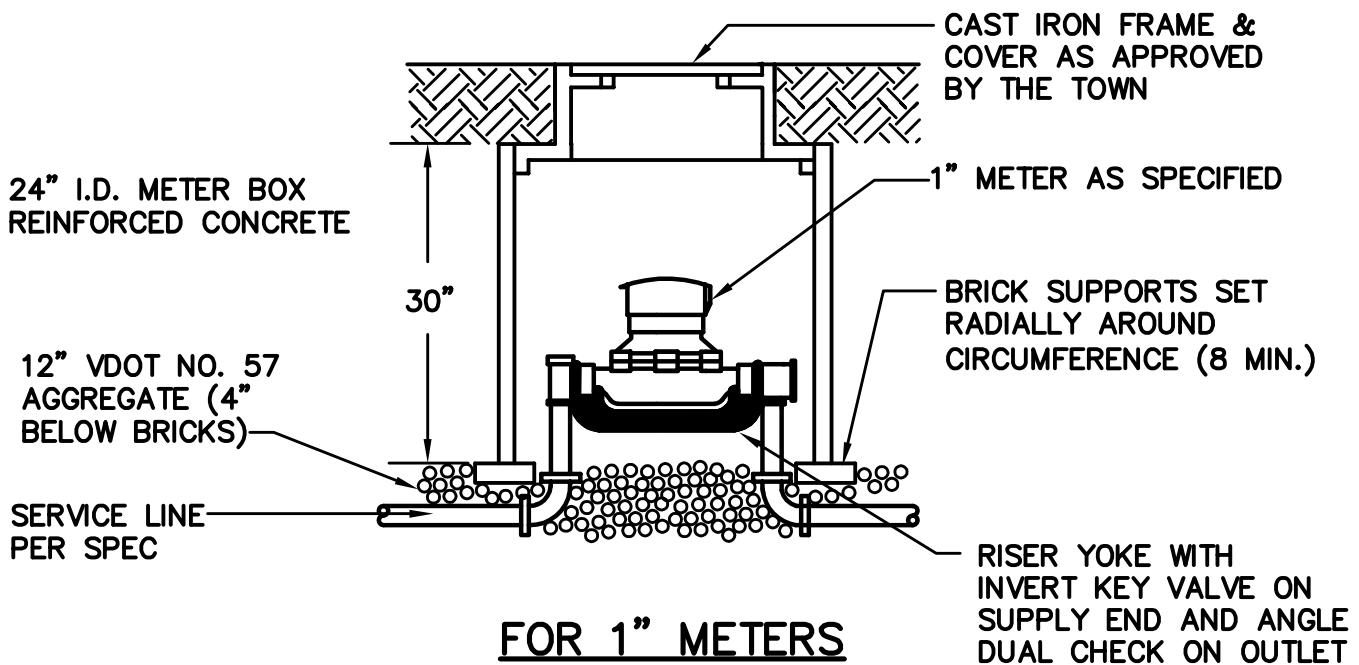
THE USE AND INSTALLATION OF DUAL WATER METERS SHALL BE AS DETERMINED BY THE TOWN ENGINEER AT THE PRE-DESIGN MEETING.



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DUAL WATER METER
INSTALLATION

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
SC-2



NOTES:

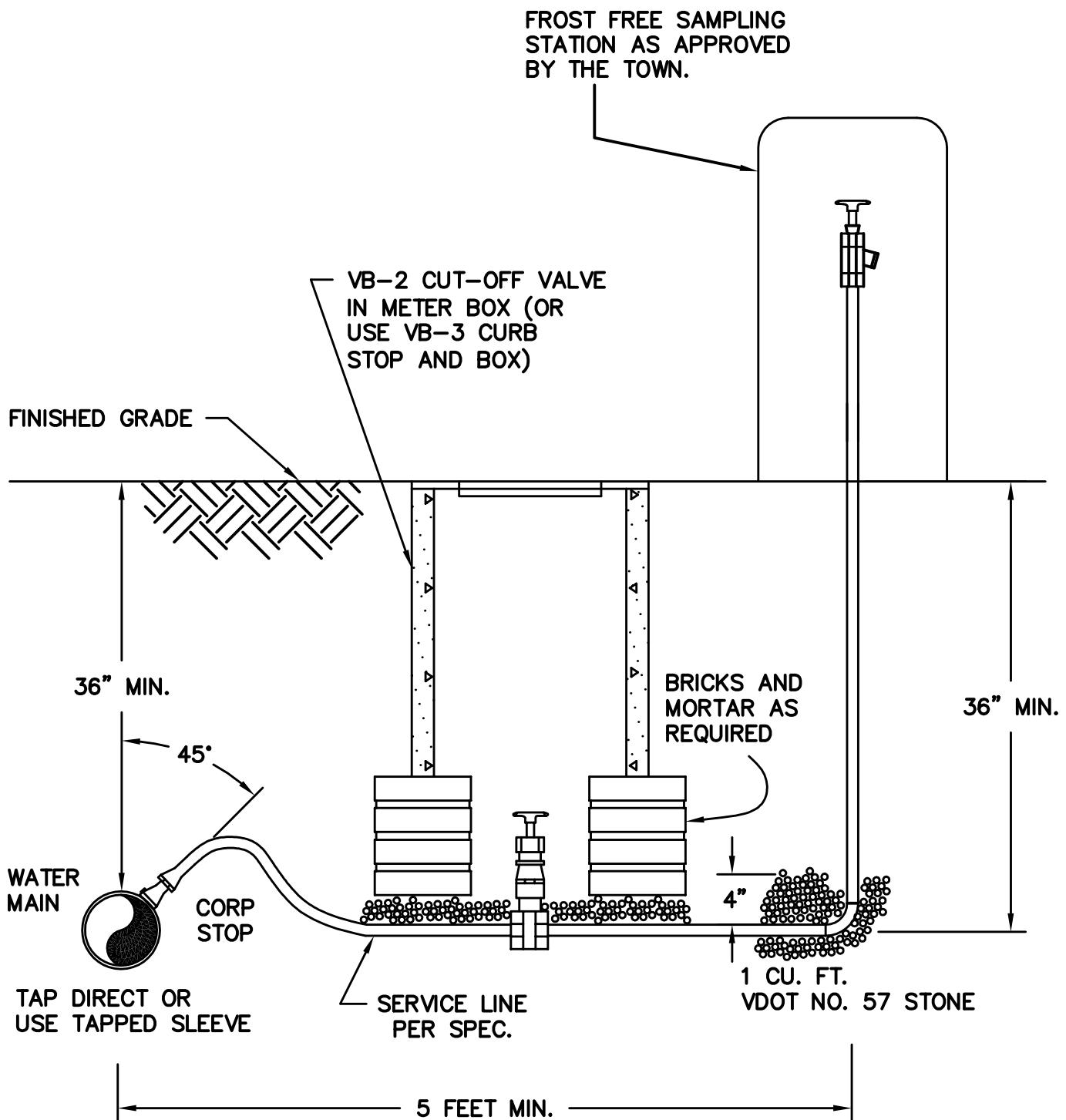
1. CENTERLINE OF METER CONNECTIONS NOT MORE THAN 24" OR LESS THAN 20" FROM TOP OF BOX
2. MINIMUM DEPTH TO SERVICE LINE IS 36"
3. DO NOT INSTALL BRICKS OVER WATER LINE



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**WATER METER INSTALLATION
(FOR 1" TO 2" METERS)**

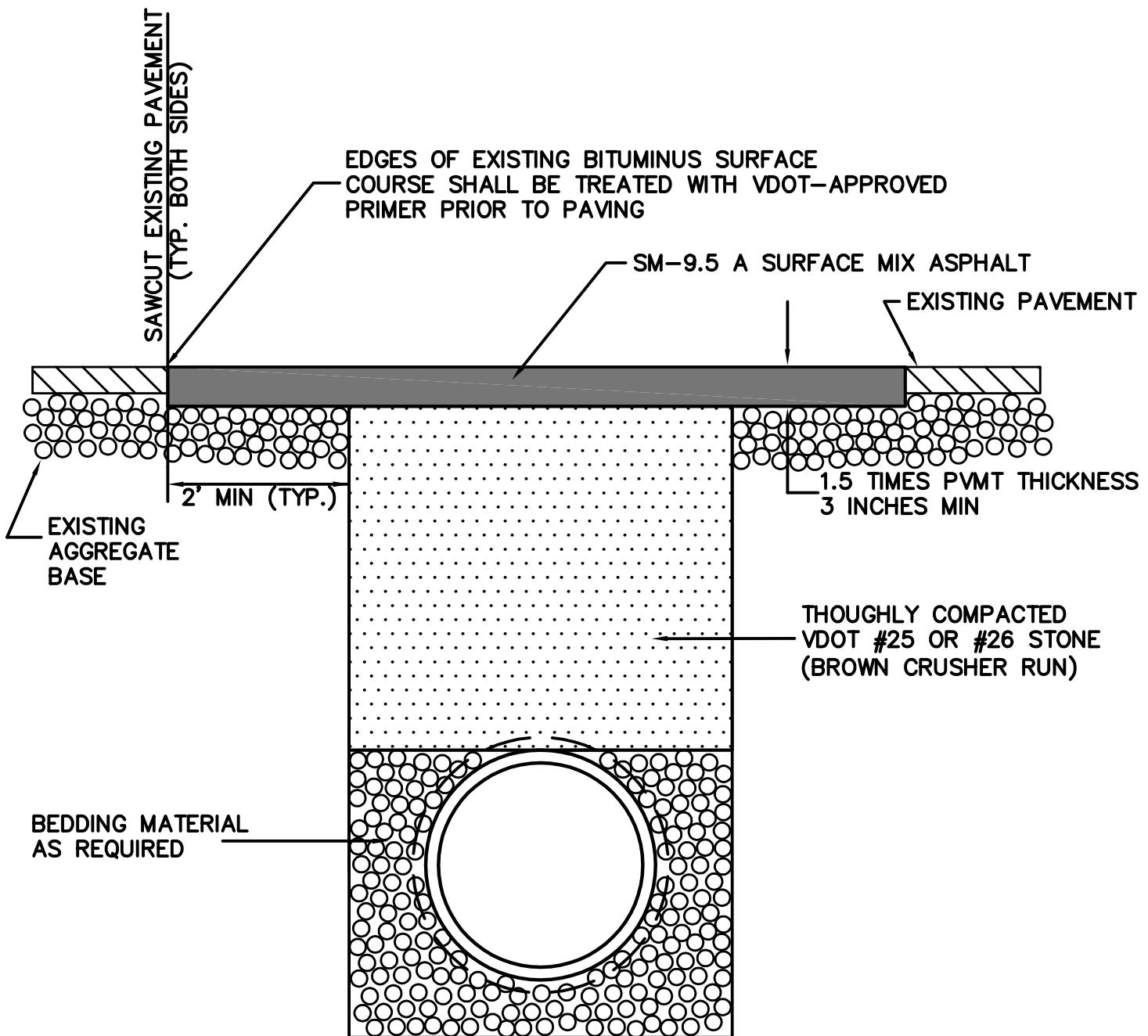
DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
SC-3



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SAMPLE TAP
INSTALLATION

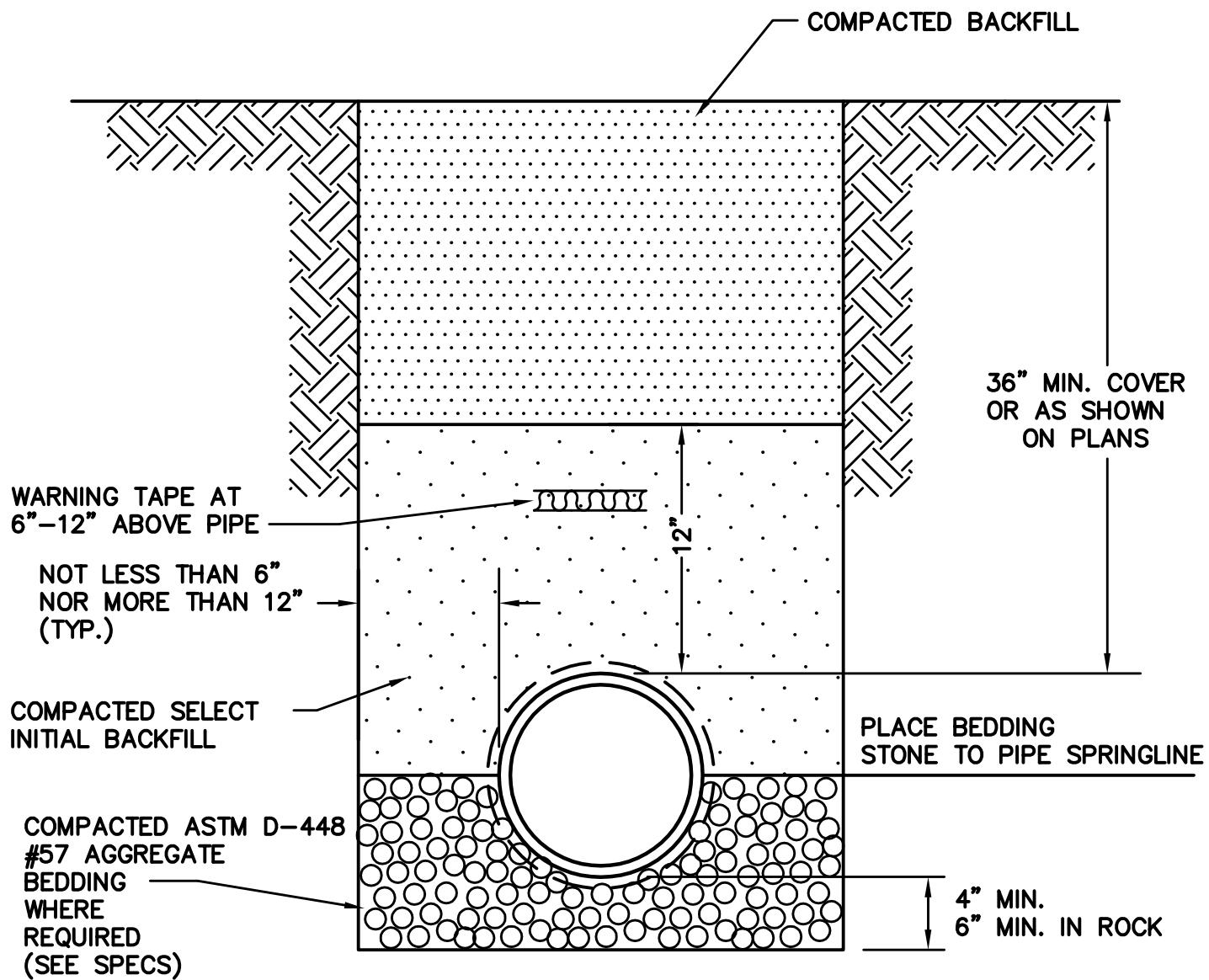
DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
SP-1



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PAVEMENT REPAIR
FOR UTILITY TRENCH

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
TB-2



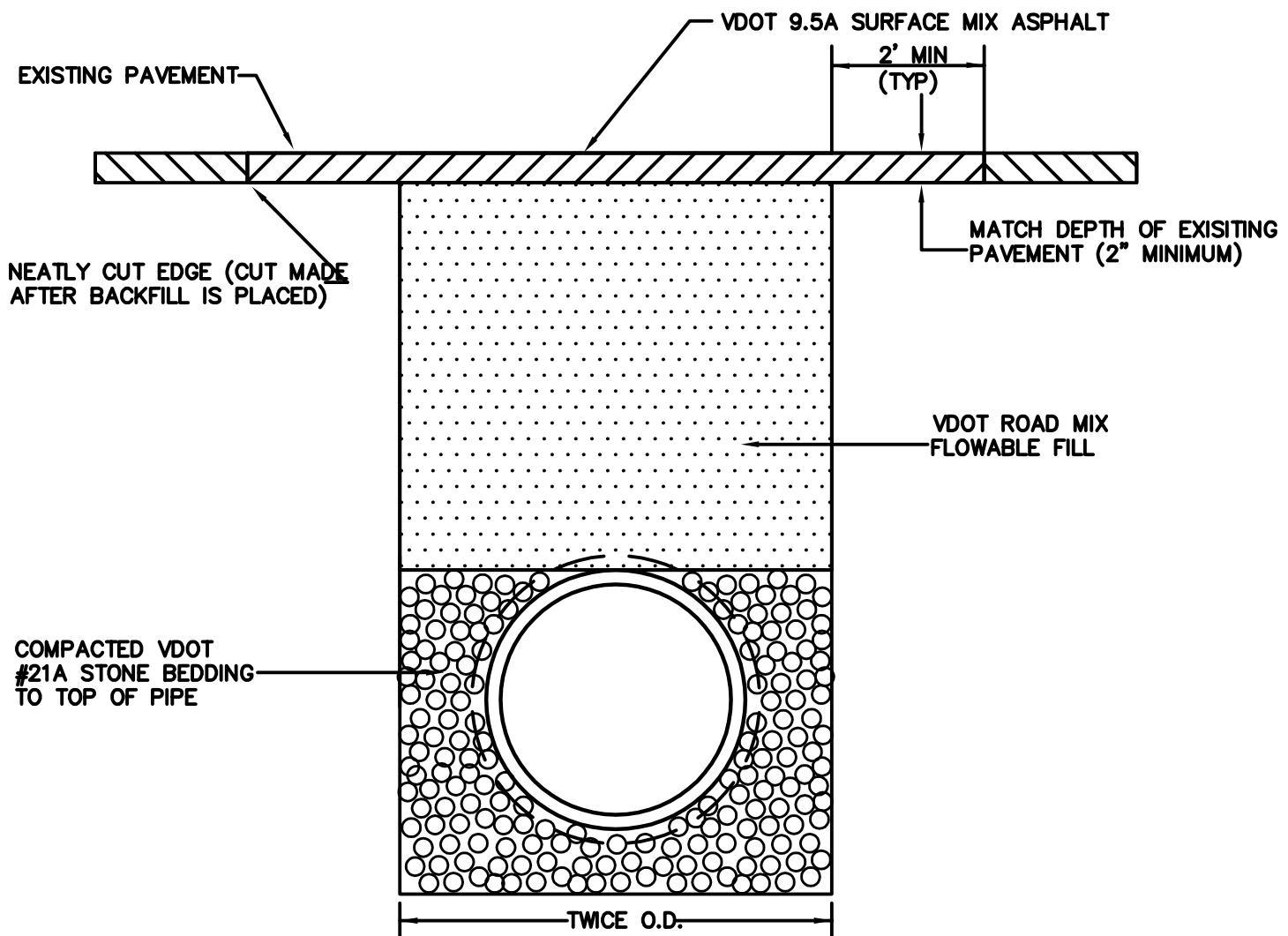
THIS DETAIL APPLICABLE
FOR DEPTHS LESS THAN 14 FEET.
SEE PLANS FOR MODIFICATIONS
IN DEEPER TRENCHES.



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PRESSURE PIPE
TRENCH BEDDING

DATE:	11 AUG 2014
SCALE:	N.T.S.
DETAIL NO.	TB-3



NOTES:

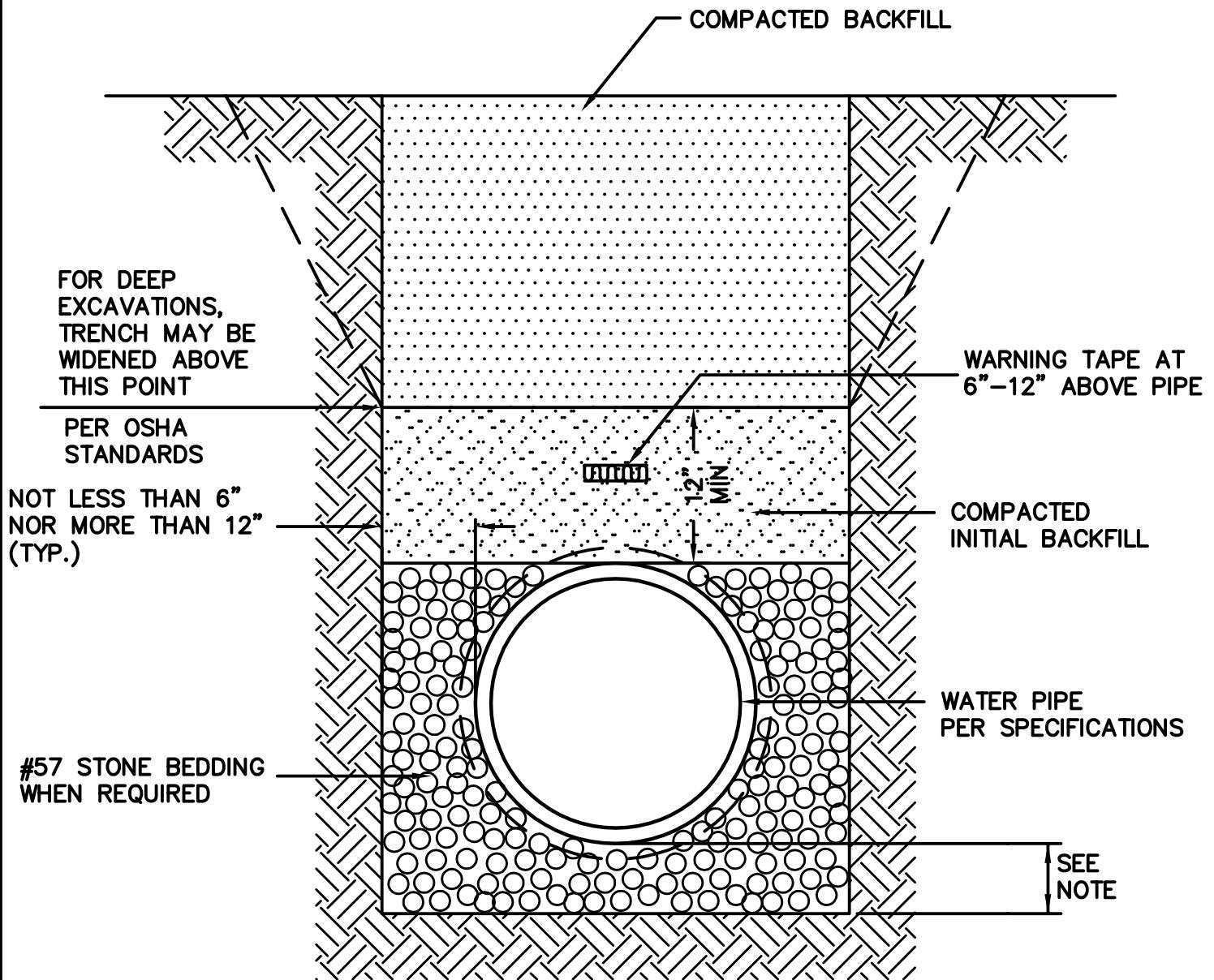
1. PAVING TO BE PLACED WITHIN 5 WORKING DAYS OF UTILITY REPAIR. FLOWABLE FILL TO BE BROUGHT UP TO BOTTOM OF ASPHALT WITH 7/8" COLD ROLLED STEEL PLATES TO COVER TRENCH 24 HOURS MINIMUM PRIOR TO PLACEMENT OF SURFACE MIX ASPHALT.
2. DURING COLD WEATHER, COLD MIX TO BE USED AS A TEMPORARY MEASURE. PERMANENT SM-2A PAVING TO BE PLACED WITHIN 3 WEEKS OF STARTUP OF HOT MIX PLANTS. CHECK STONE OR PLATES AT LEAST DAILY UNTIL RESURFACED.
3. SAFETY MEASURES ARE REQUIRED; FOR EXAMPLE, FLAGMEN AT ALL TIMES THE STREET IS OBSTRUCTED, BARRICADES AT NIGHT, BRACING, ETC.
4. CONTACT THE TOWN OF CHRISTIANSBURG PRIOR TO STARTING WORK.
5. 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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FLOWABLE FILL
UTILITY CUT REPAIR

DATE:	11 AUG 2014
SCALE:	N.T.S.
DETAIL NO.	
TB-5	



NOTE:

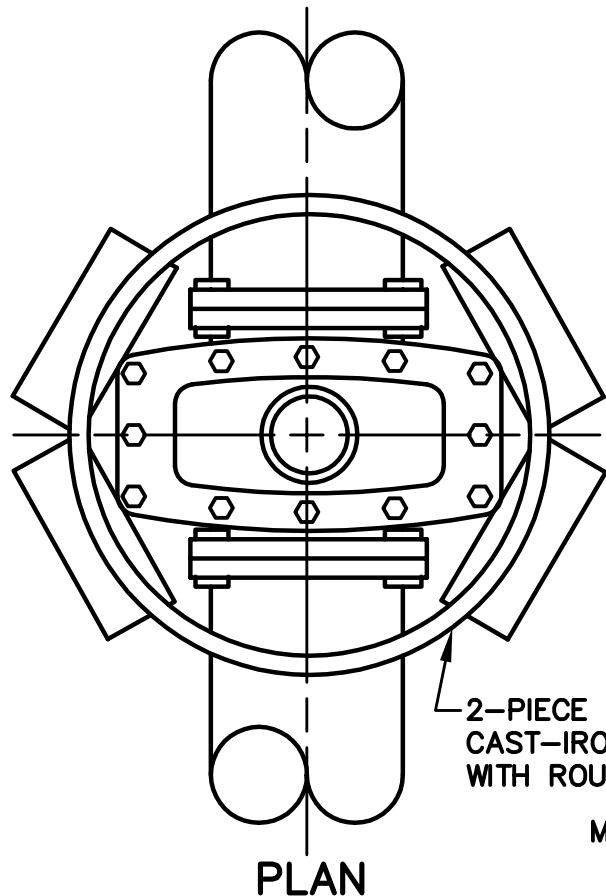
BEDDING MATERIAL DEPTH SHALL BE 4" ON SOFT, YIELDING OR UNSUITABLE FOUNDATION MATERIAL, AND SHALL BE 6" IN ROCK. BEDDING MATERIAL MAY BE ELIMINATED WHEN BOTTOM OF TRENCH IS IN STABLE CLAY CONDITIONS. CARE SHOULD BE TAKEN TO CREATE HOLES FOR PIPE BELLS TO ENSURE THAT PIPE IS NOT RESTING ON THE BELLS AND IS SUPPORTED BY THE FULL LENGTH OF THE PIPE BARREL.



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**WATERLINE
TRENCH BEDDING**

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
TB-7



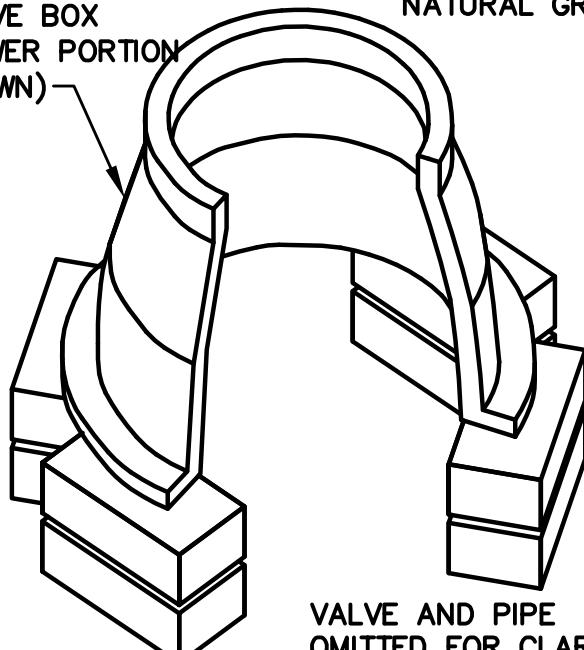
PLAN

BOTTOM OF TOP BRICK SHALL BE EVEN WITH TOP OF BONNET BOLT FLANGE (BASE SIZE SHALL BE SUFFICIENT TO PERMIT INSTALLATION AS SHOWN)

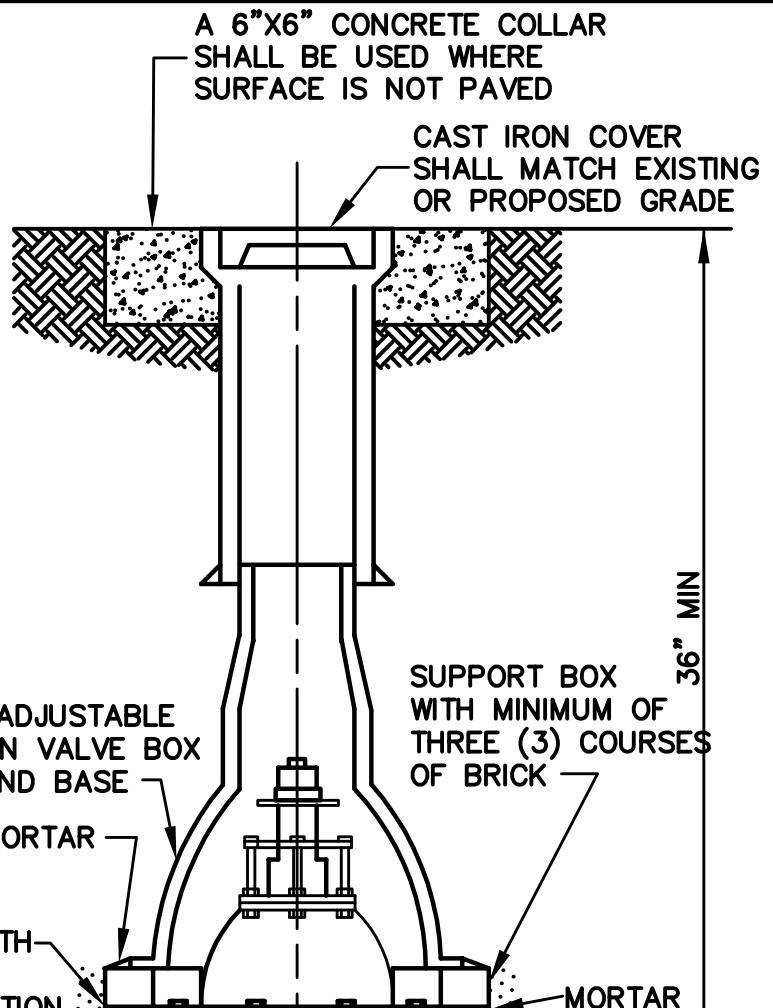
MORTAR

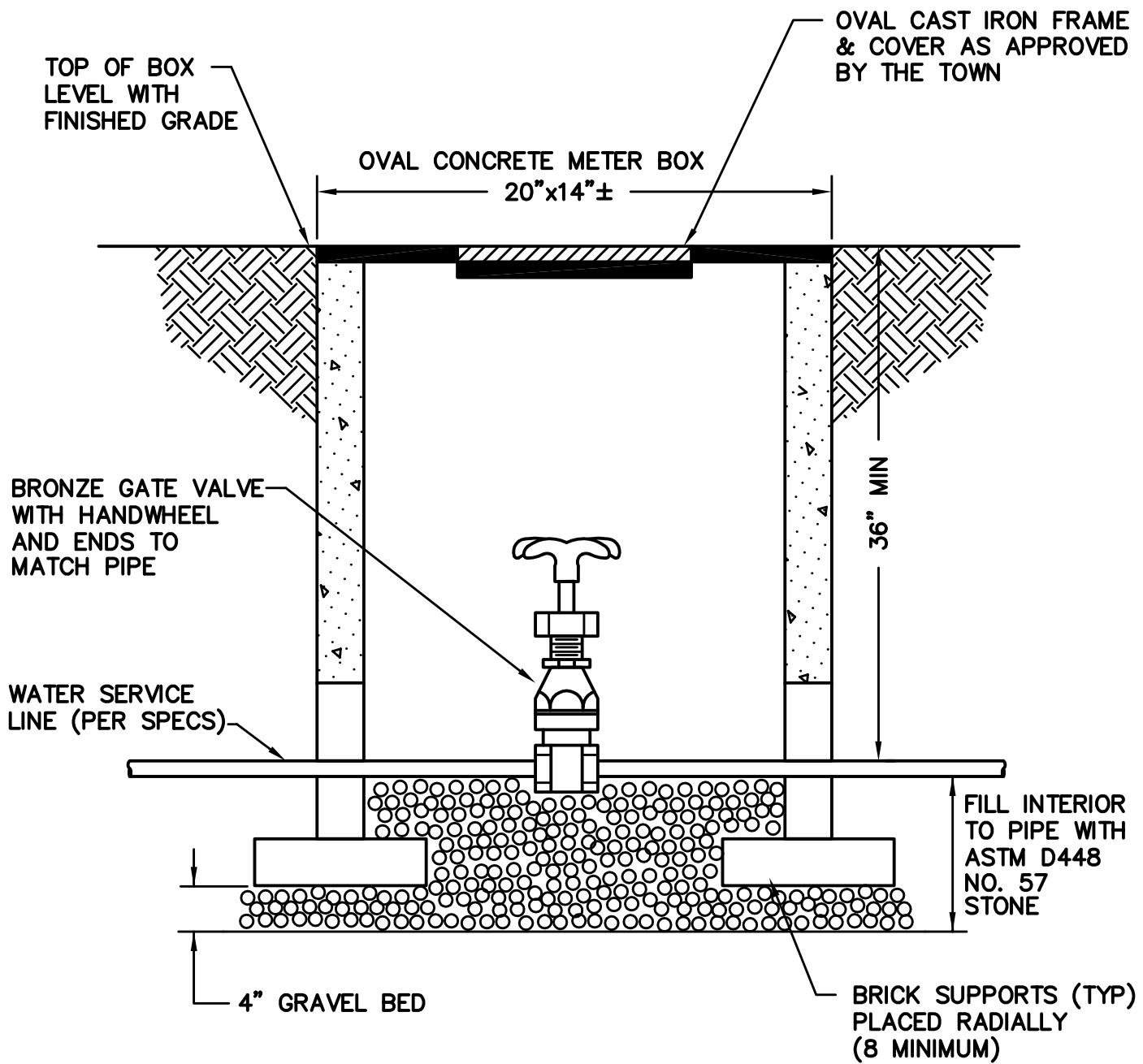
VALVE BOX
(LOWER PORTION SHOWN)

COMPACTED BACKFILL TO NATURAL GROUND



ISOMETRIC VIEW

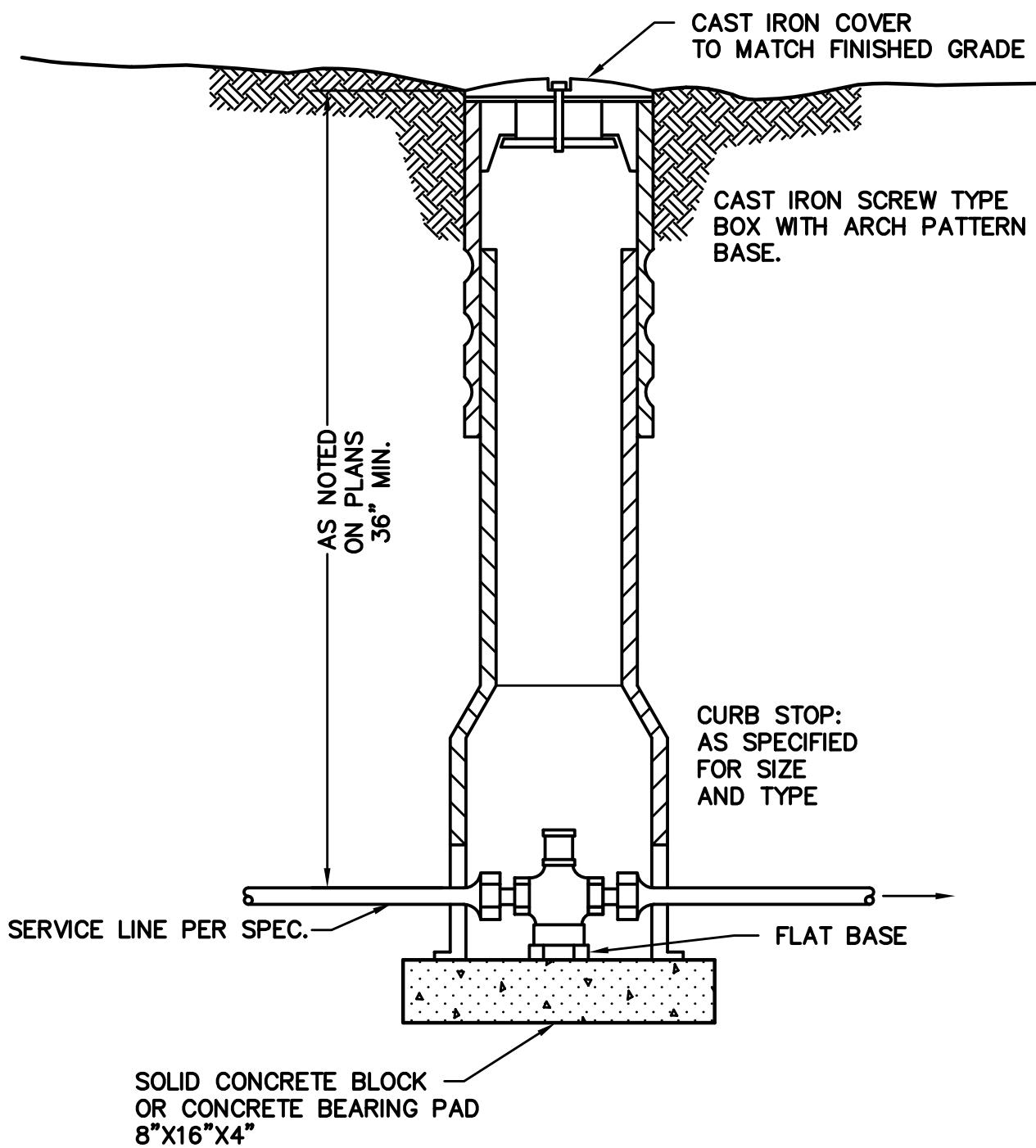




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100 EAST MAIN STREET
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engineering@christiansburg.org

SMALL VALVE
INSTALLATION
(LESS THAN 2" OR AS SPECIFIED)

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
VB-2



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CURB STOP
AND BOX

DATE: 11 AUG 2014
SCALE: N.T.S.
DETAIL NO.
VB-3