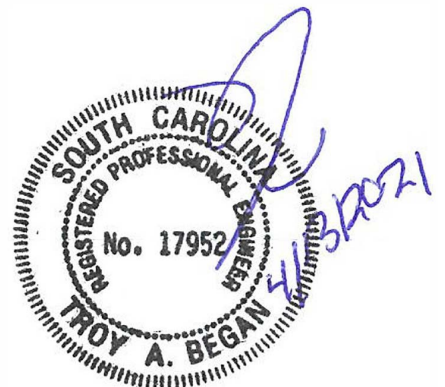
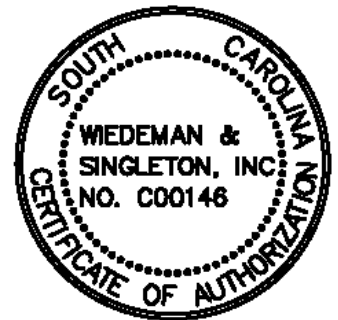


**STANDARD
WATER MAIN
SPECIFICATIONS
for the
CITY of YORK
SOUTH CAROLINA**



April 13, 2021
DHEC
REVIEW

Water Mains and Appurtenances

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Water Mains and Appurtenances

W-I WATER MAIN PIPING

W-I.1. GENERAL

The guidelines and standards apply to all potable water system projects in the City of York (City). The specifications are not a substitute for engineering design but serve as a guide to establish the minimum requirements for new water infrastructure in the City of York. In addition to the information contained herein, rules and regulations set forth by the South Carolina Department of Health and Environmental Control (SCDHEC) and the US Environmental Protection Agency (EPA) apply to the permitting and construction of these facilities. This information applies to both existing and new facilities construction.

Work included under this section shall also include specific installation precautions as specified herein for a particular kind of pipe and surge blocking required for water main installation.

All materials or products used that will come into contact with drinking water during its distribution shall be new and unused and shall not adversely affect drinking water quality and the public health and must be certified for conformance with American National Standards Institute/National Sanitation Foundation Standard 61(ANSI/NSF Standard 61), Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute (ANSI).

Metallic pipe, fittings and appurtenances shall be lead free. Lead-free pipes, plumbing fittings/fixtures, and solder/flux shall meet the Reduction of Lead in Drinking Water Act (P.L. 111-380). Any pipe, solder, or flux which is used in the installation or repair of any public water system or used in any plumbing which provides water through connection to a public water system for human consumption, shall be lead-free. Lead-free for solder and flux means those containing not more than 0.2 percent lead. Lead-free for pipes and pipe fittings means those containing not more than 8.0 percent lead.

All pipe, fittings, packing, jointing materials, valves and fire hydrants shall conform to the applicable Section C of the AWWA Standards. Installation of water mains and appurtenances shall be conducted in accordance with Section C of the AWWA Standards as applicable and as modified herein.

Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water.

1.1 DESIGN STANDARDS

Water distribution system additions shall be designed to conform to, or exceed, the requirements set forth in SCDHEC R.61-58 ¹. This specifically includes:

- 1) Sizing and design of blow-offs, fire flows for water lines and fire hydrants. A blow-off assembly is required to flush all water mains under 6-inches in diameter. Lines 6-inches in size and larger will require a standards fire hydrant or other approved blow-off, for flushing.
- 2) When fire flows or flushing flows are provided in excess of maximum peak hourly flow a minimum of twenty (20) pounds per square inch will be acceptable at any tap. Minimum flushing velocities of 2.5 feet per second shall be provided. Fire Flows requirements shall be in accordance with the requirements of the City of York Fire Department with a minimum fire flow of 1,000 gpm provide at all fire hydrants.
- 3) An average residual line pressure of a minimum of 50 pounds per square inch shall be supplied at the meter to every customer service under conditions of maximum instantaneous demand.
- 4) Unless otherwise approved by the City, the minimum size for all water lines is 6-inch diameter. Smaller diameter water lines may be considered by the City for a service on a cul-de-sac or other dead-end line.
- 5) Separation of water mains and existing or proposed sewers.
 - a. Parallel Installation: Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located

State Primary Drinking Water Regulation: R.61-58 of South Carolina, October 2014 (or most recent revision)

- on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.
- b. Crossings: Water mains crossing sewers shall be laid to provide a minimum vertical separation of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case whether the water main is either above or below the sewer line. Whenever possible, the water main shall be located above the sewer line. Where a new water main crosses a new sewer line, a full length of pipe shall be used for both the water main and sewer line and the crossing shall be arranged so that the joints of each line will be as far as possible from the point of crossing and each other. Where a new water main crosses an existing sewer line, one full length of water pipe shall be located so both joints will be as far from the sewer line as possible. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the water main.
 - c. Special Conditions: When it is impossible to obtain the distances specified in R.61-58.4(D)(12)(a) and (b) the Department may allow an alternative design. Any alternative design shall:
 - i. maximize the distances between the water main and sewer line and the joints of each;
 - ii. use materials which meet the requirements R.61-58.4(D)(1) for the sewer line; and,
 - iii. allow enough distance to make repairs to one of the lines without damaging the other.
 - d. Force Mains: There shall be at least a 10-foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossing as required in R.61-58.4(D)(12)(a) and (b).
 - e. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole.
 - f. Drain-fields and Spray-fields: Potable water lines shall not be laid less than 25 feet horizontally from any portion of a waste-water tile-field or

spray-field or shall be otherwise protected by an acceptable method approved by the Department.

- g. Stormwater: Water mains shall be laid at least 10-feet horizontally from any existing or proposed storm sewer. The distance shall be measured edge-to-edge. Separation to stormwater shall be 10-feet. This separation may be reduced if approved by the City if there is no other practical alternative. No water pipe shall pass through or come into contact with any storm sewer or catch basin.

Whenever the requirements of this document conflict with SCDHEC R.61-58, the higher standard shall prevail.

1.1.a. Water Lines Installed Within Subdivisions

- 1) The overall distribution plan adhered to by the City utilizes extensive looping of water lines. This looping allows the use of relatively small lines in most cases and provides adequate fire flow protection while eliminating dead ends and stagnated water.
- 2) It is the City's policy to require 20-ft. wide (minimum) utility easements between lots on any new subdivision where a loop could be installed to connect to another subdivision or main line in the future. The design engineer should determine the location of possible future development around the proposed subdivision, consider the ease of construction of a loop to the future development, and discuss with the City. All easements must be shown on the plans and on the final recorded plat as 20 ft. utility easements dedicated to the City of York.
- 3) The Developer must lay the water line along the entire length of each required easement to the adjoining property with a dead-end gate valve and blow-off at the end.
- 4) Water lines are to be installed only on dedicated rights-of-way. In general, easements dedicated to the City will be entered by the City personnel for maintenance purposes only. Non-permanent structures, such as fences, shrubs, and small trees, which will impact access or maintenance of the water lines, will be allowed within water line easements.
- 5) Water lines within subdivisions shall be located on the north side of east-west streets, and on the west side of north-south streets, unless otherwise agreed to by the City and its location shall remain consistent from the back of the curb

throughout the subdivision. The water lines shall not be located beneath sidewalks, streetscape or other obstructions that would restrict access to the water line and the location and elevation of other utilities shall be coordinated to avoid conflicts between the water line and services. For new subdivision construction, a utility plan showing the location of all proposed utility systems shall be submitted for staff review and approval.

- 6) Subdivision water lines shall have a minimum cover of 3 feet to the top of the pipe.
- 7) Piping shall be minimum Class 250 ductile iron pipe (D.I.P.), or PVC C-900 DR-18 PC 235 pipe, within the subdivision. Ductile iron pipe shall be used for all water mains larger than 12" in diameter. Higher rated pressure class pipe may be required to accommodate system requirements or may be required by the City on a case-by-case basis.
- 8) All water lines over cross-drains, sewers, roadways which are open cut, at stream crossings, and anywhere else specifically requested by the City shall be pressure Class 350 D.I.P. and may require installation in steel casings as per the City of York.
- 9) At underwater stream crossings and wet weather ditch crossings, water lines shall be protected from erosion by concrete encasement around the pipe. Water lines shall be installed with the top of the encasement a minimum of three feet below the deepest part of the bottom of the stream bed or ditch. At streams which are greater than fifteen (15) feet in width, valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair. The valves shall be easily accessible, and not subject to flooding. A blow-off shall be provided on the side opposite the supply service, sized in accordance with SCDHEC R.61-58. Blow-off shall not be directed toward creeks or other water bodies without proper precaution being taken to dechlorinate prior to discharge.
- 10) Water lines in cul-de-sacs shall conform to the configuration shown in Drawing **WD-01**.
- 11) A ¾-inch service tap and corporation stop for chlorination shall be indicated on the plans within 3 to 5 feet from the beginning point of the water line installation.
- 12) All services crossing streets inside the subdivision shall be installed inside 1-1/2" or 2" Class 160 PVC conduit casing (for 3/4" service line and 1" service lines,

respectively). Conduit shall extend to a minimum of 5 feet on each side of the curb/pavement as shown on Drawing **WD-02**.

- 13) At least one water sampling station shall be included in the first phase of each subdivision. The station shall be shown on plans for location approval by the City. A sample station detail is shown on Drawing **WD-03**.
- 14) No flushing device shall be directly connected to any sewer and blow-offs shall not be directed towards roads so that the water will flow into creeks, etc.

1.1.b. Water Lines Installed Outside the Subdivision Site

- 1) Water lines shall generally be located within 5 ft. of the right-of-way limits with a minimum of 3 ft. of cover and 4 ft. of cover on SCDOT and County Roads. Where 3 ft. of cover cannot be provided, the City will consider installation of the pipe with less cover provided the pipe is Class 350 ductile iron, properly bedded and the pipe is protected from traffic/impact.
- 2) All bores shall have steel casing, with the minimum casing length equal to the width of the pavement plus 5 ft. on each side. All pipe within the casing shall be restrained joint ductile iron. See Drawing **WD-04**.
- 3) Piping shall be minimum Class 250 D.I.P. or PVC C-900 DR-18 PC 235 pipe. Higher rated pressure class pipe may be required to accommodate system requirements or may be required by the City on a case-by-case basis.
- 4) All water lines over cross-drains, sewers, roadways which are open cut, at stream crossings, and anywhere else specifically requested by the City shall be pressure Class 350 D.I.P
- 5) No flushing device shall be directly connected to any sewer and blow-offs shall not be directed towards roads so that the water will flow into creeks, etc.

1.1.c. Fire Hydrants

Drawing: **WD-05**

- 1) Fire hydrants are to be spaced a maximum distance of 500 feet apart whether inside or outside a subdivision, as measured from hydrant to hydrant along the roadway.
- 2) Hydrants are to be set within one foot of the right-of-way limits on any street or road and are to be set on property lines where possible.

- 3) Fire hydrants shall be required at the end of all dead-end lines such as those installed in cul-de-sacs.
- 4) Each fire hydrant shall have a 6-inch gate valve located with 3 feet of the hydrant. The location of valves shall be adjusted to avoid the installation in roads or sidewalks.

1.1.d. Valves

- 1) All water valves 12-inches and smaller shall be resilient-seated gate valves. Larger valves shall be butterfly valves.
- 2) Every tee shall have two valves away from the source, and every cross shall have three valves away from the source.
- 3) An in-line valve shall be installed every 1,000 feet of water line within a subdivision, and every 2,000 feet outside the subdivision.
- 4) Air release valves shall be provided in accordance with sound engineering practice at high points in water mains as required. See detail on Drawing **WD-06**.
- 5) All connections to existing water mains shall be made with tapping sleeves and tapping valves and shall be properly restrained. See Drawing **WD-07**.
- 6) All back-taps shall be shown on the plans and labeled as such. Back taps shall not be installed by the Contractor unless specifically shown on the water line drawings approved for construction. A back tap detail is shown on Drawing **WD-08**.
- 7) All stub-out valves and dead-end valves shall be shown to have a restrained joint cap on the plans. These devices shall be properly restrained to allow for future connections as shown in Drawings **WD-09A, WD-09B and WD-09C**.

1.1.e. Services

The Developer shall install single or double meter sets for all lots depending on the need of the development. Meters shall be installed by City personnel only, at the expense of others. Prior to setting any meter, all required fees must be paid in full, a Permit to Operate for the new water system issued by SCDHEC, and any, if any, unresolved item resolved. All other accessories and appurtenances shall be installed by the Developer. See Drawing **WD-10**.

1.1.f. Vaults

Chambers, pits or manholes containing valves, blow-offs, meters, air relief valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.

1.2 MATERIALS HANDLING

The Contractor shall unload, haul, distribute and store pipe and related materials as outlined in the following paragraphs.

1.2.a. Unloading

Equipment and facilities for unloading, hauling, distributing and storing materials shall be furnished by the Contractor and shall at all times be available for use in unloading materials. Delays in unloading railroad cars, unloading trucks, or hauling from freight terminal which incur demurrage, truck waiting charges or terminal charges shall be at the expense of the Contractor.

1.2.b. Handling

Pipe, fittings and other material shall be carefully handled so as to prevent breaking and/or damage. Pipe may be unloaded individually by hand but shall not be unloaded by rolling or dropping off of trucks or cars. Preferred unloading is in units using mechanical equipment, such as forklifts, cherry pickers or front-end loaders with forks. If forklift equipment is not available, units may be unloaded with use of spreader bar on top and nylon strips or cables (cushioned with rubber hose sleeve) looped under the unit.

1.2.c. Distributing

Materials shall be distributed and placed so as to least interfere with traffic. No street or roadway may be closed without first obtaining permission of the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets, and roadways upon which material is distributed. No distributed materials shall be placed in drainage ditches.

1.2.d. Storage

- 1) All pipe fittings and other materials which cannot be distributed along the route of the work shall be stored for subsequent use when needed. The Contractor shall make his own arrangements for the use of storage areas.
- 2) PVC pipe must be stockpiled on level ground. If pipe is unloaded individually by hand, timbers must be used under the pipe for a base, spaced the same as

factory load, with stop blocks nailed at either end. Stockpile must be built up the same manner as it was stocked for shipment, transferring dunnage and chock blocks from load to stockpile. Individual lengths of pipe shall not be stacked in piles any higher than five feet (5').

- 3) If pipe is unloaded in units, the units must be placed on level ground and shall not be stacked more than two (2) units high. Units must be protected by dunnage in the same way they were protected while loaded on the truck or car. The dunnage must support the weight of all units so that pipe lengths do not carry the weight of the unit loaded above.
- 4) If PVC pipe is to be stored outside and exposed to sunlight for a number of months, the pipe must be protected from ultraviolet light (UV) by covering with canvas or other opaque material. The cover shall be loose enough to allow for air circulation around the pipe to prevent heat build-up. The use of clear plastic sheets will not be permitted.

1.3 ORDER OF WORK

The City reserves the right to require certain line segments to be constructed before others and to accept and use portions of the work when it is considered to be in the public's interest to do so.

1.4 INSPECTION

All work done and material furnished shall be subject to inspection by the City's authorized representative. Improper work shall be reconstructed and materials which do not conform to the requirements of this section shall not be used in the work and shall be removed from the site upon notice from the City of the rejection of those materials. The City shall have the right to mark rejected materials and/or the Contractor shall segregate said materials to distinguish them as such.

1.5 ORGANIZATION OF WORK

- 1) The Contractor shall so organize his work such that back-filling and cleanup shall closely follow pipe laying operations.
- 2) In general, not more than one block of a street or roadway shall be closed for construction at any one time. Before proceeding with trenching operations in a succeeding block, the proceeding section shall be back-filled, cleanup completed, and the street opened to traffic.

- 3) The Contractor shall perform compaction testing to verify the compaction effort has been applied to all excavations (including trenching, bore pits, etc.) in roads, streets, parking areas, commercial drives and other areas indicated. Compact backfill underlying pavement and sidewalks, to a minimum 95 percent of the maximum dry density. The top 12-inches shall be compacted to a minimum of 98 percent of the maximum dry density. At a minimum, field density tests shall be performed at all open excavation and at a maximum of 500' intervals along pipeline construction. Field tests shall be performed for every 2' of fill placement. All soils testing shall be arranged and paid for by the Contractor. Failure of a compaction test will result in the entire area represented by the test being uniformly reworked and tested at random locations selected by the City.
- 4) For work outside the streets and roadways, back-filling, and windrowing, in accordance with the provisions of "General Back-filling" paragraph shall be performed in such manner that not more than two hundred (200') feet of trench shall remain open at any one time.
- 5) Failure on the part of the Contractor to comply with the above provisions in a reasonable manner, in the opinion of the City, shall be sufficient cause for the City to order a temporary shut-down of further trenching and pipe laying operations until the provisions have been met.

1.6 ACCEPTANCE OF WORK

Water lines and appurtenances will not be considered ready for acceptance until all provisions of the specifications have been complied with, until all tests have been satisfactorily completed, and until inspection of the work has been made.

1.6.a. Construction Plans As-Builts

All entities who construct any public water line to be maintained by the City of York must submit an "As-built" set of construction drawings for approval as a part of the City's acceptance process. The As-built drawings shall clearly and legibly show any changes or variations from the approved drawings and record actual construction including:

- 1) Measured station number and horizontal and vertical locations of fittings, valves and other appurtenances, referenced to a minimum of two permanent aboveground features of the Work.

- 2) Measured locations of internal utilities and appurtenances concealed in construction, referenced to a minimum of two permanent aboveground features of the Work.
- 3) Reference all pipelines from the center of the parallel roadway at least every 100 feet or where changes occur in the direction of the pipeline.
- 4) Reference all bores from the center of the roadway to the beginning and end of the casing. Depths of bury must also be provided.
- 5) Field changes of dimension and detail.
- 6) Details not on original Construction drawings.

1.6.b. GIS Shapefile As-builts

GIS shapefiles with applicable attributes for As-built drawings must be submitted for approval as a part of the City's acceptance process. GIS data of water assets submitted in shapefile (.shp) format shall meet the following requirements:

- 1) Shapefile formatting shall be delivered on sub-foot accuracy and in NAD_1983_StatePlane_South_Carolina_FIPS_3900_Feet_Intl coordinate system.
- 2) Required GIS data features, if applicable:
 - a. Fittings
 - i. Point Feature
 - ii. Attributes:
 - a. Type: Cap, Cross, Tee, Tapping Sleeve, Bend (with degree), Sleeve, Reducer, Plug, etc.
 - b. Material: PVC, DI, etc.
 - c. Restrained: Yes / No
 - d. Installation Date: MM/DD/YYYY
 - b. Valves & Hydrant Valves
 - i. Point Feature
 - ii. Attributes:
 - a. Valve ID: Identifier per as-built
 - b. Type: Gate, Tapping, Blow Off, etc.
 - c. Diameter
 - d. Position: Open / Closed Open
 - e. Installation Date: MM/DD/YYYY

- c. Hydrants & Blow-offs
 - i. Point Feature
 - ii. Attributes:
 - a. Hydrant ID: Identifier per as-built
 - b. Manufacturer: Muller, Kennedy, etc.
 - c. Billing Type: Private or Public
 - d. Hydrant Type: Fire, Flushing, or Pit
 - e. Hydrant Valve Identifier: Identifier per as-built
 - f. Installation Date: MM/DD/YYYY
- d. Main, Hydrant Lateral & Service Lateral
 - i. Line Feature
 - ii. Attributes:
 - a. Diameter
 - b. Material and if applicable pressure class: PVC, DI, etc. (ex. PVC C-900)
 - c. Restrained: Yes / No
 - d. Installation Date: MM/DD/YYYY
- e. Meters (If Applicable)
 - i. Point Feature
 - ii. Attributes:
 - a. Meter ID: Identifier per as-built
 - b. Meter size: 3/4, 1, etc.
 - c. Service Address: Address
 - d. Installation Date: MM/DD/YYYY
- f. Easement (If Applicable)
 - i. Polygon Feature
 - ii. Attributes: Easement Type: Utility, Water, Drainage, etc.
 - iii. Duration: Temporary or Permanent

The As-built drawings shall be submitted to the City in paper (blue line copy and mylar copy), electronic format (CD-ROM) in AutoCad DWG format and electronic format (.shp) in GIS shapefile format, prior to final acceptance. Additional requirements may be required in the future or as specific projects dictate.

1.7 WARRANTY

For a period of at least one year after final acceptance of the Project by the City of York, the Contractor and/or Developer shall warrant the fitness and soundness of all work done and materials and equipment put in place. Neither the partial nor the entire occupancy of the premises by the City of York shall constitute an acceptance of work that is not done in accordance with the approved development plans or relieve the Contractor and/or Developer of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor and/or Developer shall guarantee the equipment to be free from defects in workmanship, design, and material for a period of one year from final acceptance and shall replace without charge any part or parts of any equipment defective or showing undue wear in that time. This Contractor further warrants all work incorporated in this project to remain leak-proof and water-tight at all points for a period of 24 months from the effective date of this Warranty. The Contractor and/or Developer shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within the warranty period. The City will give notice of observed defects with reasonable promptness. All work performed under warranty shall include all materials, parts, labor, and any additional costs necessary to perform the work and shall be done at no expense to the City of York.

W-1.2. PIPE MATERIALS, VALVES AND SPECIALTIES

2.1 POLYVINYL CHLORIDE (PVC) PIPE

Polyvinyl chloride (PVC) plastic pipe supplied for water main installations shall meet the requirements of AWWA C900 Standards for potable water transmission mains. Pipe shall be in accordance with the applicable ASTM and/or ANSI/AWWA Specifications, as amended to date, and the following requirements:

- 1) Pipe shall be supplied in 20 ft. nominal laying lengths.
- 2) The pipe shall include an integral bell with factory-installed gaskets meeting the requirements of ASTM F-477 and the gasketed joints shall meet the requirements of ASTM D-3139. Lubricants which will support microbial growth shall not be used for slip-on joints. The use of vegetable shortening is expressly prohibited. The use of solvent-weld PVC pipe and fittings in water main 4-inches and larger is not acceptable.
- 3) Must bear the National Sanitation Foundation (NSF) seal of approval for potable water use. All service lines must bear the NSF seal for potable water use.

- 4) Meet the approval of the American Water Works Association, meet the minimum standards of AWWA C900 DR-18 PC 235 PVC pipe.
- 5) Be marked at intervals of not more than five feet with the above-mentioned ratings.
- 6) PVC pipe used for water lines shall be blue in color.
- 7) Fittings for PVC pipe shall be mechanical joint ductile iron fittings conforming to ANSI/AWWA A21.53/C-153 or ANSI/AWWA A21.10/C-110, with the joint meeting the requirements of ANSI/AWWA A21.11/C-111. Ductile iron fittings shall have a working pressure of 350 psi.
- 8) PVC pipe shall be installed in accordance with AWWA C605 and manufacturer's written instructions.
- 9) PVC pipe may not be installed above grade or in contaminated areas. If contamination is anticipated along the pipe route, the water line shall be re-routed or the use of protective pipe materials (i.e. DIP with chemical-resistant gaskets) may be considered by the City if the pipe cannot be re-routed.
- 10) Smaller diameter water lines less than 4" diameter, when considered by the City for a service on a cul-de-sac or other dead-end line, shall be Endot Endopure IPS CTS water pipe. PE4710 SDR 7 or equal.

2.2 DUCTILE IRON PIPE AND FITTINGS

Ductile iron pipe, where called for on the drawings, shall:

- 1) Pipe shall be domestically manufactured in the United States and conform to ANSI/AWWA C151/A21.51
- 2) All pipe and fittings shall be NSF approved (ANSI/NSF Standard 61) for potable water use.
- 3) Ductile Iron pipe shall be designed in accordance with the requirements of ANSI/AWWA C150 as applicable and as modified in this Section and shall be Pressure Class 250 D.I.P., minimum.
- 4) Be cement lined with a bituminous seal coat in accordance with ANSI/AWWA C104/A21.4.
- 5) Ductile iron pipe and fittings shall be coated on the exterior with a bituminous coating in accordance with AWWA C151/ANSI A21.51 and AWWA C110/ANSI A21.10 or AWWA C153/ ANSI 21.53

- 6) Have rubber gasket joints conforming to ANSI/AWWA C111/A21.11. Lubricants which will support microbial growth shall not be used for slip-on joints. The use of vegetable shortening is expressly prohibited.
- 7) Fittings shall be cast from ductile iron and shall conform to ANSI Specifications A 21.53 (AWWA C-153) or ANSI/AWWA A21.10/C-110 as amended to date. All fittings shall have standard mechanical joints. Fittings for pipe sizes through 24 inch shall be Pressure Class 350 and for fittings above 24-inch through 48-inch shall be Pressure Class 250.

2.3 RESTRAINED JOINT PIPE AND FITTINGS

Restrained joint pipe and fittings, where called for on the drawings shall be ductile iron meeting the requirements for ductile iron pipe and ductile iron fittings specified elsewhere and shall:

- 1) Restrained joint pipe having a diameter of 4-inch to 18-inch may be restrained using US Pipe Field Lok Gaskets (red), American Fast Grip Gaskets (yellow) or approved equal. Restrained joint pipe having a diameter of 20-inch to 36-inch shall be Flex Ring by American Cast Iron Pipe Company, TR. Flex by US Pipe, or approved equal. Joint restraint for pipe must be the product of the pipe manufacturer.
- 2) Mechanical joint restraint device shall have a working pressure of at least 250 psi. with a minimum safety factor of 2:1 and shall be EBAA Iron, Inc., MEGALUG or approved equal.

2.4 STEEL PIPE CASING

REFERENCE DRAWINGS: WD-04

The Contractor shall furnish steel pipe casing and related materials (see Drawing **WD-04**) as follows:

- 1) All existing improved roads, railroad and highway crossings shall be cased in steel pipe. The minimum diameter of the casing shall be the nominal diameter of the bell of the carrier pipe plus 6 inches. Casing shall be new and unused pipe. The steel plate shall also meet the chemical requirements of ASTM A-36. Casing pipe shall be plain, uncoated steel, having a yield strength of not less than 36,000 psi, and manufactured in conformance with the following specifications: AWWA C201 "Fabricated Elect. Welded Steel Water Pipe"

AWWA C202 "Mill-Type Steel Water Pipe"

ASTM A53 "Welded and Seamless Steel Pipe"

- 2) Casing installation shall be coordinated with the City and shall meet the requirements of the SCDOT and/or the railroad. Pipe used for casing shall be of wall thickness to accommodate the required forces to be exerted on the casing when jacking and to meet the anticipated service conditions and loads that will be imposed on the casing.

2.5 PORTLAND CEMENT CONCRETE

Concrete shall be composed of cement, fly ash (if required), admixtures (if required), fine aggregate, coarse aggregate, and water proportioned and mixed to produce a plastic workable mix and shall be suitable for the specific conditions of placement. Concrete shall be classified as "A", "B", and "C"; shall have normal setting characteristics (unless the use of high early strength cement is approved by the City); shall be used in the locations identified herein; and shall have 28-day compressive strengths not less than those listed below, except that concrete containing high early strength cement shall have 7-day compressive strengths not less than those listed below.

- 1) Class "A" Concrete: Class "A" concrete shall have a compressive strength of not less than 4,500 psi, and shall be used for reinforced concrete work, and for unreinforced footings not thicker than 8-inches.
- 2) Class "B" Concrete: Class "B" concrete shall have a compressive strength of not less than 3,000 psi, and shall be used for blocking, gravity type walls, and unreinforced footings and slabs thicker than 8-inches.
- 3) Class "C" Concrete: Class "C" concrete shall have a compressive strength of not less than 2,500 psi, and shall be used for concrete sub foundations, pipe encasement, and concrete backfill where required.
- 4) Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.6 VALVES AND SPECIALTIES, GENERAL

REFERENCE DRAWINGS: WD-05

The work included in this section consists of the installation of valves, fire hydrants, and service connections.

Surge blocking at fire hydrants and valves shall be installed according to details and dimensions given in Drawing **WD-05**.

Excavation for all specialties shall be stabilized with gravel or sand cushion, if necessary due to unsuitable foundation conditions and tamped. Surge blocking shall be provided after the item is placed and backfill shall be hand or mechanically tamped in no more than 6" lifts.

Depth adjustment shall be provided for valve boxes, and valves to be set in roadways or paved areas shall be adjusted to finished surfaces.

Detection wire shall be installed along the length of PVC pipe as shown on the plans (not required if D.I.P. is used). It shall be THHN 12 gauge (minimum) solid copper wire and shall form a single electrical conductor along the entire length of the pipe. Each splice shall be made with copper split bolt wire connectors and completely wrapped in electrical tape. Wire shall be wrapped around each hydrant barrel and main line valve box, accessible for direct connection of locating equipment to the wire (see valve and hydrant details, Drawing **WD-05**). If the connections or wire is broken during installation of the pipe, the Contractor will be required to excavate and make the repairs. Metallic detection tape shall not be acceptable as an alternative to the detection wire. Underground water main marking tape shall be installed in addition to the detection wire for both PVC and DIP water mains. The marking tape shall be 3" wide aluminum foil core tape. The tape shall be blue printed with a repeating warning message – "Caution Buried Water Line Below". The tape shall be installed 1'-6" directly above the continuous length of the pipe during backfilling operations.

2.7 GATE VALVES

Gate valves shall be located as shown on the drawings and installed as detailed on the drawings complete with cast iron valve boxes and concrete pad. Any valve which is installed on pipe having a depth of cover of more than 5 feet shall be provided with a permanently installed valve stem extension and guide that extends the operating nut to within 6 inches of the valve box lid.

Gate valves shall:

- 1) Conform to the latest revision of AWWA-C509.
- 2) Be resilient seated valves.
- 3) Have non-rising stem with "O"-ring seals.
- 4) Have cast iron, bronze mounted bodies.
- 5) Have rubber-covered gates.
- 6) Open to the left.

- 7) Have mechanical-joint type connections.

Contractor shall locate each valve by measurements to two prominent terrain features or structures (i.e., center of road, fire hydrant, power pole). Each measurement should be taken, as perpendicular to the other as possible and a record of these location distances shall be submitted to the Owner on the as-built drawings at the conclusion of the work. A sketch of each valve location with the points of reference shown shall also be neatly drawn on a separate 5" x 7" card and provided to the Owner along with the as-built drawings.

Valves shall be manufactured by Clow, Mueller, M & H, or approved equal.

2.8 BUTTERFLY VALVES

Butterfly valves shall be located as shown on the drawings and installed as detailed on the drawings complete with cast iron valve boxes and concrete pad. Any valve which is installed on pipe having a depth of cover of more than 5 feet shall be provided with a permanently installed valve stem extension and guide that extends the operating nut to within 6 inches of the valve box lid.

Butterfly valves shall:

- 1) Shall be rubber seated (rubber compounds which support microbial growth may not be used for seats) with rubber seats securely fastened to the body and shall confirm to the latest revision of AWWA C504.
- 2) Designed for 150 psig operating pressure, unless noted otherwise on the Contract Drawings and shall be bubble tight at rated pressures.
- 3) Hydrostatic and leakage tested in accordance with AWWA C504.
- 4) Have cast iron bodies with mechanical-joint type connections.
- 5) Open to the left.
- 6) Valve and actuator shall be suitable for buried service.
- 7) Operators shall be of the traveling nut type, totally enclosed, permanently lubricated.

Contractor shall locate each valve by measurements to two prominent terrain features or structures (i.e., center of road, fire hydrant, power pole). Each measurement should be taken, as perpendicular to the other as possible and a record of these location distances shall be submitted to the Owner on the as-built drawings at the conclusion of the work. A sketch of each valve location with the points of reference shown shall also be neatly drawn on a separate 5" x 7" card and provided to the Owner along with the as-built drawings.

Valves shall be manufactured by Henry Pratt or approved equal.

2.9 TAPPING SLEEVES AND VALVES

REFERENCE DRAWINGS: WD-07

The Contractor will furnish and install tapping sleeves and valves suitable for connection to the existing water mains at locations indicated in the drawings. Tapping sleeves shall be Smith-Blair #665 (stainless steel), or equal. See Drawing **WD-07**.

Tapping valves shall be furnished in accordance with the specifications for Gate Valves where applicable, except for any modifications required to permit the use of full-size shell cutters. The valve shall have a flanged connection to the tapping sleeve and a mechanical joint connection to the branch pipe. The mating valve flange to the tapping sleeve outlet must have a raised male face, conforming to MSS SP-60, to ensure true alignment of the valve and tapping sleeve.

2.10 VALVE BOXES

REFERENCE DRAWINGS: WD-07

Valve boxes shall be of close-grained gray cast iron. The valve boxes shall be the two-piece screw type and the cover or cap shall have cast on the upper surface in raised letters the word "WATER". Valve boxes shall be made with an integral base which measures 8 $\frac{3}{4}$ " in diameter by 9" high. The base will cover only the stuffing box for valves 10" and smaller. Valve boxes shall be painted with a coat of protective bituminous paint before being shipped from the factory. See Drawing **WD-07**.

2.11 PVC VALVE MARKERS

PVC marker poles shall be installed for all valves, air release valves and buried blow-off valves which shall indicate the direction to the valve. Markers shall be in the style and numbers as determined by the City. Markers shall indicate: "MV" for main line valves, "ARV" for air release valves, and "BO" for blow-off valves. During the placement of new concrete curb, utility markings shall be embossed into the top of the curb for all water valves and all water services. The marking shall be 2-inch-tall letters and shall be "MV" for main line valves, "ARV" for air release valves, "BO" for blow-off valves and "WS" for water services. The stamp shall be placed into the concrete before it sets up. The letters shall be located perpendicular from the utility feature that is being marked.

2.12 AIR RELEASE VALVES

REFERENCE DRAWINGS: WD-06

Air release valves shall be installed where shown on the plans and as shown in Drawing **WD-06**. It shall be designed to permit automatic escape of large quantities of air from a pipeline when the line is being filled. It also shall allow accumulating air to escape while the line is in operation and under pressure. This shall be accomplished with a float and compound lever system functioning in conjunction with a large and small orifice in one integral body casting.

The body of the valve shall be gray cast iron meeting ASTM specification A126.CL.B. Valve levers, float, float rod, valve plunger and other internal metal parts shall be stainless steel. Air and vacuum seats shall be Buna-N rubber.

Valve shall be UL (universal) series model manufactured by Crispin Valve or equal, meeting AWWA Specification C-512. Valve shall be sized appropriately for the length and diameter of the water main into which it is to be installed and shall be designed for a minimum working pressure of 200 psi.

2.13 BACKFLOW PREVENTION DEVICES

Backflow prevention devices shall be provided and installed, as required by the City of York, SCDHEC (R61-58.4.D.14 and R61-58.7.F) and as set forth in these Standards. There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination may be discharged or drawn in the City's water supply system. All water services for industrial, office, commercial, schools, sprinkler systems, dedicated fire lines and other locations as determined by the City of York shall require a minimum of a double-check backflow prevention assembly as shown on Drawing WD-11 herein. In addition, based on the degree of hazard present a reduced pressure (RPZ) backflow prevention assembly may be required on the customer side of the service lines. High hazard category cross connections shall require an approved RPZ backflow preventer. RPZ backflow prevention assemblies shall not be installed in any area location subject to possible flooding or below grade in pits or vaults. Dedicated commercial fire lines shall also include a spring-loaded detector check valve with bypass meter assembly (including shut off valve, swing check valve and 5/8" x 3/4" meter- Sensus model SR-2 or Ipearl equipped with touch read) that will accurately measure leakage or use of the fire line. Detector check valve shall be Mueller Model EDC IV or equal. No bypasses shall be allowed unless the bypass is equipped with an equal, approved back-flow prevention device. All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.

Backflow prevention devices assemblies shall be the latest approved product and shall be products as outlined on the SCDHEC list of approved backflow prevention devices. All backflow prevention devices shall be tested at the time of installation by the Contractor. Testing must be completed, at the Contractors expense, by a third-party that is SCDHEC certified and included on the current DHEC list of certified Inspectors and Testers of Backflow Prevention Equipment. See Section 2.15 for requirements for Residential Service Connection requirements.

2.14 FIRE HYDRANTS

Fire hydrants shall meet or exceed the requirements of the latest revision of AWWA Specification C-502 and shall be factory painted white.

Fire hydrants shall Super Centurion 250, or equal, 3-Way hydrants, with 5-1/4" main valve, as manufactured by Mueller Co. LTD, or equal. All new hydrants shall be furnished with "Storz" nozzles having 1/4-turn cap and hose connection fittings at the streamer nozzle location. New hydrants should be fitted with the HIHS nozzle already built into the hydrant in place of the threaded nozzle. Each Storz nozzle shall include a Storz blind cap with suction seal and aircraft cable. A Storz wrench shall be provided for every 25 hydrants installed, minimum one wrench per installation. Storz nozzles are manufactured by Harrington, Inc. 2630 West 21st Street Erie, PA 16506 (www.hydrantstorz.com).

2.15 RESIDENTIAL SERVICE CONNECTIONS

REFERENCE DRAWINGS: WD-02, WD-10

The work covered by this Section includes furnishing all materials and equipment, providing all required labor and installing water service connections and all appurtenant work according to these Specifications and/or to the Water Meter Service Detail as shown schematically on Drawing **WD-10** herein.

Water meters are not to be furnished nor installed. However, the water meter connection must be compatible with the water meters currently used by the City.

Residential irrigation systems shall be installed with a separate SCDHEC approved field-testable double check valve backflow preventer. The backflow preventer must be installed before an irrigation meter will be set by the City. A list of approved double check valve backflow preventers is available from SCDHEC.

No galvanized pipe or fittings shall be used on water services. The City prefers non-metallic tubing, however, if copper pipe is to be used, it shall be as specified herein.

Water meter boxes, service lines and associated appurtenances may not be located in any concreted encasements, driveways or other inaccessible areas which restrict maintenance by the City.

2.15.a. Service Lines

- 1) Non-metallic Tubing: Non-metallic tubing used for services shall be IPS Tubing PE 3408-C-3-SDR-9-200-PSI @ 73 Fahrenheit conforming to ASTM D 2737, AWWA C901, and as manufactured by Charter Plastics, Inc. Tubing shall be blue in color or black with blue stripes.
- 2) Copper tubing shall be ASTM B 88, Type K, rolled type. Fittings shall be brass with flare connection inlets and outlets, ANSI B16.26. Where required, adapters shall be brass. Unions shall be cast bronze. Joints shall be flare type. All fittings shall be of bronze construction with flare type connections.
- 3) Any pipe, solder, or flux which is used in the installation or repair of any public water system, used in any plumbing which provides water through connection to a public water system, for human consumption, shall be lead free. Lead Free, for solder and flux, means those containing not more than 0.2% lead. Lead free, for pipes and fittings, mean those containing no more than 0.8% lead.
- 4) Provide detection wire over all service lines. Detection wire shall be installed along the length of the pipe as shown on the plans. It shall be THHN 12-gauge solid copper wire and shall form a single electrical conductor along the entire length of the pipe. Each splice shall be made with split bolt wire connectors and completely wrapped in electrical tape. If the connections or wire is broken during installation of the pipe, the Contractor will be required to excavate and make the repairs. Metallic detection tape shall not be acceptable.
- 5) Copper or polyethylene tubing between tap and water meter shall be one continuous length of pipe with no intermediate joints or connections. The service line shall be placed without sharp turns or bends from the water main to the meter box.
- 6) When meters are located on the opposite side of the street from the water main, new service lines shall be extended through a common bore, Schedule 160 PVC conduit to the service side, as shown on **WD-02**. Replacement of existing services may be by free bore without a casing.

- 7) Water services (meter box installation only) shall be made in accordance to Drawing **WD-10**. Meter boxes must be set to grade. The City will not install the water meter if the meter box is found not set to grade.

2.15.b. Service Saddle

The Contractor will furnish and install service saddles for residential services for connection to water mains. Service saddles shall be Smith-Blair #317 (ductile iron body with double stainless steel straps), or equal. See Drawing **WD-10**.

2.15.c. Valves and Accessories

Ball valves shall be full port bronze, heavy duty type. Valve ends shall be threaded. Valves shall have a minimum 200 psi working pressure for water. Valves shall have stainless steel nut and handle. Valves shall be made in the U.S.A.

2.15.d. Corporation Cocks

Corporation cocks shall be ground key type, shall be made of bronze conforming to ASTM B61 or B62 and shall be suitable for the working pressure of the system. Ends shall be suitable for flare type joint. Coupling nut for connection to flared copper tubing shall conform to ANSI B16.26.

Corporation cocks shall be Ford FB-600-4.

2.15.e. Meter Boxes

Unless otherwise directed by the City, residential meter boxes shall be either Ford Long Double Gulfbox having 1" female NPT inlet fitting and 3/4" male NPT outlet fittings with an integral ASSE 1024 approved - 3/4" Ford cartridge dual check valve. The meter housing box is to hold two (2) 5/8" or two (2) 5/8"x3/4" modern magnetic or multi-jet meters measuring not over 5" above center line nor more than 2-1/4" below center line. Or a Ford Long Meter box having 3/4" female NPT inlet fitting and 3/4" male NPT outlet fittings with an integral ASSE 1024 approved - 3/4" Ford cartridge dual check valve. The meter housing box is to hold one (1) 5/8" or one (1) 5/8"x3/4" modern magnetic or multi-jet meter measuring not over 5" above center line nor more than 2-1/4" below center line. Valves, expansion connections and outlet pieces are to be waterworks brass meeting AWWA Specification C800 and latest revisions. The valves shall be Ball type and installed in the box on the inlet side. The iron box and lid shall meet ASTM A48, Class 25.

2.16 WATER QUALITY SAMPLING STATIONS

REFERENCE DRAWINGS: WD-03

Sampling Stations shall be buried 3 ft. with a ¾" FIP inlet, and a ¾" unthreaded nozzle. All stations shall be enclosed in a lockable, non-removable, aluminum-cast housing. When opened, the station shall require no key for operation, and the water flow in an all brass waterway. All working parts will also be of brass and be removable from above ground with no digging.

A copper vent tube will enable each station to be pumped free of standing water to prevent freezing and to minimize bacteria growth. The exterior piping shall be galvanized, and exterior cover shall be painted green. The unit shall be an Eclipse No. 88 sampling station as manufactured by Kupferle Foundry (800-231-3990), or approved equal. See Drawing **WD-03**.

W-I.3. INSTALLATION

3.1 EROSION CONTROL

Siltation and soil erosion shall be controlled by the Contractor using permanent erosion control measures, temporary erosion control measures and supplemental measures such as, mulches and quick growing grasses, slope drains and other pollution control devices as necessary. All projects which will involve land-disturbing activities are required to comply with the requirements of South Carolina Department of Transportation and the South Carolina Department of Health and Environmental Control and all permits must be secured before any construction begins. Additional information regarding the erosion control requirements can be obtained at SCDOT and SCDHEC websites under Stormwater Erosion Control and Prevention.

All materials shall be first class quality and approved by SCDOT and the South Carolina Department of Health and Environmental Control. Erosion and pollution control may include temporary construction work outside the right of way, where necessary, as a result of construction operations, such as haul roads and equipment storage sites.

3.1.a. Erosion and Sedimentation Control During Construction

During construction, protective structures and measures shall be implemented and maintained by the Contractor to minimize erosion and sedimentation as a result of the work being performed. All disturbed areas along the pipeline shall be grassed as soon as possible after, backfilling operations have been completed. Under no circumstance will land disturbance of more than 14 days be allowed prior to permanent stabilization.

3.1.b. Limit of Progress

The area of excavation shall be limited commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding and other such pollution control measures current in accordance with an accepted schedule. Should seasonal limitations make such coordination unrealistic, special erosion control measures shall be taken immediately to the extent feasible and justified per SCDHEC requirements for Stormwater.

3.1.c. Permanent Erosion and Sedimentation Control

Permanent structures and measures shall be provided as required and shall be constructed and maintained by the Contractor for the term of the project as defined in the South Carolina Department of Health and Environmental Control.

3.1.d. Construction in Rivers, Streams and Impoundments

Construction operations in rivers, streams and impoundments shall be restricted to those areas which must be entered for the construction of temporary or permanent structures. As soon as conditions permit, rivers, streams and impoundments shall be promptly cleared of all falsework, piling which are to be removed, debris, and other obstructions placed therein or caused by the construction operations. Fording of live streams with construction equipment will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of stream crossings are necessary. Mechanized equipment shall not be operated in live streams except as may be required to construct channel changes and temporary or permanent structures, and to remove temporary structures per SCDHEC requirements for Stormwater.

3.2 CLEARING

The Contractor shall perform all clearing necessary for installation of the complete work. Clearing shall consist of removing all trees, stumps, roots, brush, and debris in the way of the work. All materials cleared and grubbed in accordance with this Specification and shall become the property of the Contractor and unless otherwise approved shall be removed from the site and legally disposed of in accordance with all applicable regulations. Disposal of timber and other combustible materials by burning shall not be permitted.

Trees and shrubs designated to be left in place, and those outside of construction limits, shall not be damaged. Trees and shrubs that are damaged which are not scheduled to be removed shall be replaced by the Contractor with plantings of similar species and maturity at no additional cost to the Owner.

3.3 TRENCH WORK

REFERENCE DRAWINGS: WD-12A, WD-12B and WD-13

3.3.a. Terminology

The trench is divided into five specific areas:

- 1) Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
- 2) Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
- 3) Haunching: The area above the bedding or trench bottom (or foundation) and below the top of the barrel of the pipe.
- 4) Initial Backfill: The area above the haunching material and below a plane 12-inches above the top of the barrel of the pipe.
- 5) Final Backfill: The area above a plane 12-inches above the top of the barrel of the pipe.

3.3.b. Trenchwork Materials

- 1) Foundation Materials: The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. If the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will not adequately support the pipe, the Contractor shall over excavate the trench bottom and fill with crushed stone as outlined in specified in **W-3.3.e – Trench Stabilization**.
- 2) Bedding and Haunching Materials: Bedding and haunching materials for ductile iron pipe shall be select earth materials for Type 2 bedding and crushed stone for Type 4 and Type 5 bedding. Unless specified otherwise, bedding and haunching materials for PVC pipe shall be crushed stone. Where crushed stone has been utilized for trench foundation, the same material shall be used for bedding and haunching. Crushed stone shall conform to the latest revision of ASTM C 33, as amended to date, gradation #67 (ASTM #67) varying in sizes 1/4" through 3/4" and select earth materials for bedding and haunching shall be as specified for initial backfill. See Drawing **WD-12A** and **WD-12B**.
- 3) Initial Backfill: Initial backfill material shall be select earth materials or crushed stone. Crushed stone shall be as specified for bedding and haunching materials

and select backfill materials shall consist of finely divided earth, stone, dust, sand, crushed stone, or other approved material carefully placed about the pipe in uniform succeeding layers not exceeding six (6) inches in thickness. Each layer shall be uniformly placed and tamped with proper hand tools in a manner which will not disturb or injure the pipe. Backfilling shall be carried on simultaneously on both sides of the pipe in a manner which will prevent injurious side pressures from occurring. If suitable select materials are not available from trench excavation, the Contractor will be required to obtain them elsewhere. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

- 4) Final Backfill: Final backfill material shall be general excavated earth materials, shall not contain rock larger than 2-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.
- 5) Select Backfill: Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.
- 6) Concrete: Concrete for bedding, haunching, initial backfill or encasement shall be Class "B" as defined in ***W-1.2.5.2 Portland Cement Concrete***.
- 7) Flowable Fill: Flowable fills, where required for trench backfill, shall meet the requirements of South Carolina Department of Transportation "Standard Specifications for Highway Construction".

- 8) Granular Material: Granular material, where required for trench backfill, shall be sand, river sand, crushed stone or aggregate, pond screenings, crusher run, recycled concrete, or other angular material. Granular material shall meet gradation requirements for Size No. 57 or finer.

3.3.c. Excavation

- 1) All excavation of every description and of whatever substance encountered shall be performed to the depth shown or specified, or both, for all pipelines, piers, conduit, and other appurtenances. Excavation shall be accomplished by open cut, unless otherwise directed. No tunneling shall be done.
- 2) Topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and the topsoil stockpiled separately for replacement over the finished grading areas.
- 3) The sides of all trenches shall be vertical, as much as possible, to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
- 4) The top portion of the trench may be excavated to any width within the construction easement or right-of-way that will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Sheet piling and shoring may be necessary to accomplish this.
- 5) The top portion of the pipe trenches may have sloping or vertical sides to widths which will not cause damage to adjoining structures, roadways, pavements, utilities, and private property. For un-timbered trenches and trenches held by stay bracing only, the width of the lower portion of the trench to a height of two feet (2') above the top of the pipe shall not exceed the trench widths specified in **W-1.3.3.f – Trench Widths**. Where skeleton and solid sheet piling is used, trench width may be increased to dimensions approved by the City but shall be not greater than that necessary to clear the wailers when lowering pipes into the trench.
- 6) Where trench excavation may damage adjoining poles, roadways, utilities and private property, the Contractor shall install suitable sheet piling for their protection. Such orders shall in no way relieve the contractor from his responsibility of

protection of the facilities, nor shall the lack of those orders relieve the contractor from that responsibility. If trenches are excavated to widths in excess of the above limitations, or collapse because of insufficient bracing and sheeting, the Contractor will be required to use special methods of constructing pipe foundations and backfilling as specified herein at his own expense.

- 7) Trench excavation shall not advance more than two hundred (200) feet ahead of pipe laying.
- 8) Excavation in excess of depth required for proper bedding shall be corrected by using crushed stone conforming to the latest revision of ASTM C 33, gradation #67 (ASTM #67) varying in sizes 1/4" through 3/4, to bring trench bottom to grade as directed by the City. Bell holes shall be excavated in a manner which will relieve pipe bells of all load, but holes shall be small enough to ensure that support is provided throughout the length of the pipe barrel. Excavation in excess of the depths required for structures shall be corrected by placing a sub-foundation of Class "C" concrete or crushed stone.
- 9) Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Type of bedding and haunching for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Town.
- 10) The trenches shall be excavated to the required depth or elevation that allow for the placement of the pipe and bedding to the dimensions shown on the Drawings.
- 11) Where rock is encountered in trenches for pipelines, excavate to the minimum depth which will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe or accessory and the pipe shall be bedded in crushed stone conforming to the latest revision of ASTM C 33, gradation #67 (ASTM #67) varying in sizes 1/4" through 3/4.

- 12) Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Topsoil shall be carefully separated and lastly placed in its original location.
- 13) Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.3.d. Dewatering Trenches

- 1) All excavation shall be dewatered properly before laying pipe. Where running sand is encountered, dewatering shall be done by well pointing whenever possible.
- 2) Where soil conditions are not favorable for use of well points, French drains of graded stone shall be constructed to suitably located pumps and the water removed by bailing and pumping. The excavation shall be dewatered continuously to maintain a water level two feet below the bottom of the trench.
- 3) Drainage in the vicinity of excavation shall be controlled so the ground surface is properly pitched to prevent water running into the excavation. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations.
- 4) Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.
- 5) When pumping from sumps does not lower the water level two feet below the trench bottom, dewatering shall be accomplished through use of a well-point system. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.3.e. Trench Stabilization

- 1) The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- 2) If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Contractor shall over excavate the trench bottom and fill with crushed stone.
- 3) The Contractor shall undercut the ditch and backfill with crushed stone conforming to the latest revision of ASTM C 33, as amended to date, gradation Size No. 57. The stone shall be brought to grade and compacted.
- 4) Where the replacement of unsuitable material with crushed stone does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two feet below the specified trench bottom. Stabilization fabric shall be placed in the bottom of the trench and the fabric shall be supported along the trench walls until the trench stabilization, bedding, haunching and pipe have been placed at the proper grade. The ends of the filter fabric shall be overlapped above the pipe.
- 5) Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.3.f. Trench Widths

Trench widths for installation of ductile iron pipe shall be in accordance with AWWA C 600-05 as amended to date. Trenches may be of extra widths to permit the placement of timber support, sheeting, bracing and alternatives when approved by the City. The top portion of pipe trenches may have sloping or vertical sides to widths which will not cause damage to adjoining structures. All excavation shall be executed in accordance with OSHA standards. The width of the lower portion of the trench to a height of two feet (2') above the top of the pipe shall not exceed the trench widths specified in the standards cited. Where skeleton and solid sheeting is used, trench width may be increased to dimensions approved by the City but shall be not greater than that necessary to clear the wailers when lowering pipes into the trench.

Trench widths and depths for PVC pipe shall be as specified herein and outlined in AWWA C605. Trench widths shall be sufficient to provide adequate room for placement of haunching material and the pipe embedment should be compacted to the trench wall. The clear width of the trench at the top of the pipe should not exceed the pipe diameter plus 24 inches.

If the proper compaction cannot be obtained with materials from trench excavation, the Contractor will be required to obtain them elsewhere.

3.3.g. Sheeting, Bracing and Shoring

Sheeting, bracing and shoring shall be performed in any of the following instances:

- 1) Where sloping of the trench walls does not adequately protect persons within the trench from slides or cave-ins.
- 2) In caving ground.
- 3) In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced and shored.
- 4) Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.
- 5) Where necessary to maintain the top of the trench within the available construction easement or right-of-way.
- 6) In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.
- 7) Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.
- 8) Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities.

- 9) Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield shall be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be “dragged” with the bottom of the shield extending below the top of the pipe.
- 10) Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the City it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.
- 11) Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the City.

3.3.h. Trench Rock Excavation

- 1) Definition of Trench Rock: Any material that cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, and occupies an original volume of at least one cubic yard.
- 2) Blast Monitoring: Exhaust other practical means of excavating prior to utilizing blasting as a means of excavation. Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. The Contractor shall employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
- 3) Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.
- 4) The Contractor shall notify the City prior to any blasting. Additionally, the Contractor shall notify the City and local fire department before any charge is set.
- 5) The Contractor shall employ an independent, qualified specialty sub-contractor, approved by the City, to monitor the blasting by use of a seismograph, identify

the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

3.3.i. Bedding and Haunching

- 1) Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.
- 2) Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.
- 3) At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.
After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.

3.3.j. Paving and Driveway Cuts and Repairs

Pavement cuts for water main installation in existing roadways and across driveways shall be made and repaired in accordance with SCDOT "A Policy for Accommodating Utilities on Highway Rights-Of-Way", March 2019 (or most recent revision).

3.3.k. Compaction

- 1) General

- a. Compact backfill to a minimum 95 percent of the maximum dry density, unless specified otherwise. Place backfill material in uniform layers, not exceeding 12-inches, compacting each layer thoroughly.
 - b. Soil samples from the proposed construction area shall be analyzed for maximum dry density in accordance with ASTM 698 – Method C.
- 2) Backfill Under Roads
 - a. Compact backfill underlying pavement and sidewalks and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density. Place backfill material in uniform layers, not exceeding 12-inches, compacting each layer thoroughly.
 - b. The top 12-inches of materials supporting pavement shall be compacted to a minimum of 98 percent of the maximum dry density.
 - c. Soil samples from the proposed construction area shall be analyzed for maximum dry density in accordance with ASTM 698 – Method C.

3.4 SURGE BLOCKING

REFERENCE DRAWINGS: WD-05, WD-09A—WD-09C, and WD-14A—WD-A4E

- 1) Concrete surge blocking shall be installed at all bends in the pipeline, and at all fire hydrants, valves, plugs, tees, and caps as shown in Drawing **WD-14A**.
- 2) Surge Blocking shall be placed against firm, undisturbed earth and installed with minimum dimensions not less than shown in Drawings **WD-14B through WD-14E**.
- 3) A valve, blow-off and concrete dead-man shall be required at all ends of lines as shown in Drawings **WD-09A, WD-09B and WD-09C**. Refer to **WD-09A** for the size orifice for pipe 4-inch in diameter and smaller. A 2-inch orifice blow-off is required at all dead ends for pipe 6-inch diameter and larger. The blow-off is required in addition to hydrants/other blow-off assembly that are required to adequately flush lines 6-inches in size or larger.
- 4) Fire hydrants, valves, and fittings shall be installed with concrete blocking and proper joint restraint. Correctly installed Mega-Lugs may be used as a means of

joint restraint. If threaded rods are used, the rods, nuts and washers shall be of 304 stainless steel and installed as shown on Drawing **WD-05**.

3.5 PVC VALVE MARKERS

PVC valve markers shall be installed for all main line valves, air release valves and buried blow-off valves, set at right-of-way limits and distance stamped in feet shall be acceptable (**See W-I.2.11 – PVC Valve Markers**).

3.6 CONCRETE VALVE PROTECTOR RINGS

REFERENCE DRAWINGS: WD-07

Concrete protector rings shall be installed around all valve boxes to protect the valve box and for future identification purposes. See detail on Drawing **WD-07**. The concrete protector rings shall have #3 rebar reinforcement on 14" and 23" diameters measured from the center line of the valve box hole. The rings shall measure 27" in diameter with a maximum height of 4". The valve box hole shall measure a minimum of 9" in diameter. The concrete protector rings shall be installed so as to allow the valve box to be installed at the bottom of the protector ring which prevents the valve box from receiving damage if the protector ring is moved accidentally.

3.7 INSTALLATION OF SERVICE TAPS

3.7.a. General

Immediately following completion of the water main system, the Contractor shall install water taps and meter boxes for each planned lot of the subdivision. All taps shall remain exposed at the main until the system has been successfully inspected, flushed, disinfected and tested for pressure.

Installation shall conform to the details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

The water main shall be tapped with a tapping machine specifically designed for that purpose. The tap shall be a direct tap into the water main through a tapping valve. All taps shall be supervised by the City. All taps shall be made on the water main at a position so as not to be the top side of the pipe nor the bottom of the pipe. Distance between taps must be a minimum of 12-inches apart.

All residential services connected to water mains shall be saddled connections with a brass corporation cock. Connections shall be 3/4 or 1-inch (minimum) dependent on service and meter size.

3.7.b. Relocation of Service Lines

Relocate the existing meter to the new right-of-way limits and reconnect to the house service. Existing meters already located at the new right-of-way limits will not need relocating.

Before disconnecting the existing meter, the existing corporation in the main shall be closed. All existing meters and meter boxes shall be removed, if not already located at the right-of-way, reinstalled and reconnected as indicated on the Drawings.

Existing service lines shall be field-located by the Contractor. The Contractor shall be responsible for locating existing water meters, relocating the meters and meter boxes as necessary, and determining the existing size service line to reconnect the meters to the new water mains. All service lines installed under existing pavement, including streets, driveways and sidewalks, shall be installed by boring.

Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Any special fittings required to reconnect the existing meter to the new service line, or the existing private service line, shall be provided by the Contractor. To minimize out of service time, the Contractor shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.

The tap, service line and meter box shall remain under the developer's maintenance responsibility for the same warranty period as the water main. The developer shall promptly repair any damage to the water system during the warranty period.

3.8 *INSPECTION*

All valves, fire hydrants, service lines, and connections shall be subject to inspection and approval by the City Inspector or designee.

All pipe trenches, hydrant connections, and valves shall be left completely uncovered for approval by the inspector or designee before back-filling. If any portion of the water line trench is back-filled before the installation is approved by the inspector or designee, the Contractor shall re-excavate the trench for inspection and re-back fill at his own expense.

Prior to issuance of the SCDHEC operating permits, no valves shall be opened to the City of York's system without direct supervision of City personnel. Fire hydrants must be bagged on systems that are not operational.

3.9 LARGE RESIDENTIAL (MULTI-FAMILY) OR COMMERCIAL WATER METERS

REFERENCE DRAWINGS: WD-11

Water meters 4-inch and larger shall be installed in a concrete vault as detailed on Drawing **WD-15** and shall also include a backflow prevention device. See **W-I.2.13 – Backflow Prevention Devices** and the detail on Drawing **WD-11**.

Meter vaults shall be located out of traffic areas whenever possible. Meters that must be located such that they are subject to vehicle loads (i.e., parking lot, driveway, etc.) shall be equipped with traffic rated cast-in-place frame and water-tight access cover(s). Meter vaults not subject to vehicle loads shall have an aluminum BilCo-type access hatch with cast-in-place aluminum frame and lockable latch. All hatches shall be installed with permanent fall protection grating system under the access hatch doors. Grating panel(s) shall be aluminum with a powder coat paint finish that is safety yellow in color. Panel shall be designed to meet the requirements of OSHA standard 29 CFR1926.502(c) and be equipped with a hold open device to lock the grating panel(s) in the open position. Hold open device and all hardware shall be Type 316 stainless steel. Manufacturer shall provide a twenty-five year warranty against defects in material and workmanship. Hatch doors and grating shall be as manufactured by BilCo, or equal.

Meter vaults shall be water-tight and have concrete bottoms sloping to a drain hole that empties to a gravel sump below the bottom slab.

W-I.4. WATER MAIN TESTING & DISINFECTING

4.1 GENERAL

All branches of the new water distribution system shall be pressure tested and disinfected by chlorination by the Contractor before acceptance of work by the owner. Disinfection of water lines and the disposal of heavily chlorinated water following disinfection must be accomplished in accordance with AWWA Standard C651 (latest revision) and the guidelines established by the SCDHEC.

The Contractor shall notify the City at least 48 hours prior to disinfecting and testing of any part of the system and shall provide all necessary supplies, equipment, labor, and

apparatus for conduction of the tests. A City inspector or designee MUST be present during flushing AND during pressure test. Cross connections shall not be allowed during testing, flushing, chlorinating, or de-chlorinating of the new lines.

4.2 LEAKAGE & PRESSURE TEST

Ductile iron, service lines, and PVC pressure lines shall be filled with water, air completely exhausted and a leakage test made. The Contractor shall furnish a test pump, means for accurate measurement of water introduced into a line during testing, and shall furnish and install corporation stops in the line as required for blowing lines free from air and at the test pump location. No corporation stops will be allowed in copper lines, or PVC lines.

The Contractor shall furnish, install and remove all temporary bulkheads, flanges or plugs, to permit the required pressure tests, and shall furnish all equipment and labor to properly carry out such tests and to replace defective material. Test pressure shall be 150 psi or 1.5 times the maximum working pressure of the pipe, whichever is higher, as measured at the lowest point of elevation of the section of line being tested.

Piping shall be filled with water, air completely exhausted and a leakage test made. Pressure testing shall be performed in accordance with the requirements of AWWA C600 for ductile iron pipe and AWWA C605 for PVC pipe. Leakage shall be determined from the following formula, which is based on AWWA C600 and AWWA C605.

(In Inch Pound Units.)

$$L=(NxDxP^{1/2})/K$$

L= Allowable leakage in gallons per hour

N= Length of pipe tested, in feet

D= Nominal diameter of the pipe in inches

P= Average test pressure during the leakage test, in pounds per square inch (gauge).

K = 148,000 for ductile iron pipe and 148,000 for PVC pipe.

Table W-1: Leakage Allowance (Ductile Iron)

(Gallons per hour per 1,000 feet of pipe)

Pipe Diameter	Pressure 150 PSI	Pressure 200 PSI	Pressure 250 PSI
4"	0.33	0.38	0.43
6"	0.50	0.57	0.64
8"	0.66	0.76	0.85
10"	0.83	0.96	1.07
12"	0.99	1.15	1.28
14"	1.16	1.34	1.50
16"	1.32	1.53	1.71

18"	1.49	1.72	1.92
20"	1.66	1.91	2.14
24"	1.99	2.29	2.56
30"	2.48	2.87	3.21

Table W-2: Leakage Allowance (PVC)

(Gallons per hour per 1,000 feet of pipe)

Pipe Diameter	Pressure 150 PSI	Pressure 200 PSI	Pressure 250 PSI
4"	0.33	0.38	0.43
6"	0.50	0.57	0.64
8"	0.66	0.76	0.85
10"	0.83	0.96	1.07

Minimum test period shall be twenty-four (24) hours to test blocking and/or restrained joints plus two- (2) hour's leakage test; Contractor shall maintain the 24-hour test pressure \pm 5 psi for 24 hours. However, if in the opinion of the City, additional testing is required, the testing period will be extended.

Any cracked or broken pipe shall be removed and replaced with sound pieces. Joints, which leak, shall be carefully remade. Remade joints and replaced material shall be re-tested under the same conditions of operation. If joints or materials are then found to be defective, they shall be remade and replaced until the line passes the required test. All visible leaks shall be repaired regardless of the amount of leakage.

All tests shall be performed before any part of the system is connected to the tested portion of system, and all results shall be witnessed by a representative from the City. Pressure tests to be conducted after all dry utilities have been installed.

4.3 DISINFECTING AND SAMPLING

All branches of the new distribution system shall be disinfected by chlorination and shall be pressure tested by the Contractor before acceptance of work by the owner. Disinfection of all new mains in the system shall be as follows:

All new water lines must be disinfected using the procedure outlined in the AWWA Standard for Disinfecting Water Mains (ANSI/AWWA C651-05).

Mains must be adequately flushed at a velocity in the main of not less than 2.5 ft/sec to clean out construction debris prior to chlorination.

Mains must pass the pressure test prior to chlorination. Prior to chlorination, the person who will chlorinate a new line must submit to the City the calculations he/she used to determine the type and amount of chemicals needed for the chlorination as well as an explanation of the

procedure that will be used for the chlorination. The procedure can be adjusted, if necessary, with the prior approval of the City.

During chlorination a back-flow prevention device must be employed to protect the distribution system from contamination with the heavily chlorinated solution used to disinfect the line. A double check valve assembly or a reduced pressure zone assembly should be used for this purpose.

A City representative must be present, once chlorination equipment is set up but prior to the onset of chlorination, to inspect the equipment and review the procedure being used.

All new water mains shall be chlorinated after flushing with a chlorine solution having a concentration of 50 to 100 mg/l of chlorine. Water main shall have minimum 25 mg/l chlorine residual after a 24-hour retention period.

Following the chlorination application and holding period, the line must be flushed until the chlorine residual of the water leaving the main is no higher than that generally found in the distribution system (i.e., no greater than 2.0 mg/l and no less than 0.50 mg/l). City personnel must be contacted before the flushing crew leaves the site to check that the chlorine level is within the acceptable range or if further flushing is necessary. The chlorine residual must be measured and reported.

Flushed water may require de-chlorination before being released to storm drains, ditches or streams. Chlorinated water must be disposed of per current SCDHEC requirements.

The newly disinfected line must pass two consecutive bacteriological tests with samples taken at least 24 hours apart in order to be approved for use. The line is not to be flushed between the collections of these two sample sets. The person who collects the sample will make certain to run the hydrant or sample line long enough to get a representative sample.

Samples for bacteriological analysis on the new line are to be collected at least every 1200 feet, plus one sample at the beginning and end of the line and one sample from each branch off the line. Samples are to be analyzed in accordance with *Standard Methods for the Examination of Water and Wastewater* and shall show the absence of total coliform bacteria. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported. If non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated. All samples must be analyzed by a certified laboratory. SCDHEC may request that a heterotrophic plate count analysis be conducted on a case-by-case basis where disinfection problems are suspected.

If initial disinfection fails to produce a satisfactory bacteriological result or if other water quality factors are affected, the main may be re-flushed and re-sampled. If the bacteriological result is still unsatisfactory the main must be re-chlorinated until acceptable bacteriological results are obtained.

In locations where hydrants are not available and at the request of the City, the contractor shall install a ¾" tap with two corporation stops and sufficient service tubing for acquiring a sample. Once testing is complete, both corporation stops shall be shut off and the tubing shall be coiled up inside of a meter box installed flush with the ground surface.

NOTE: All chlorine analyses must be done using an EPA approved method.

Water Construction Design and Development Checklist

Project name:

There may be design requirements that are not addressed in the following checklist.

COMPLETED BY:

Printed name: _____ Signature: _____ Date: _____

A. GENERAL PROJECT/PLAN REQUIREMENTS:

1. Engineer's seal and signature. The City requires that all development plans submitted for review be signed and sealed by a Professional Engineer licensed in the State of South Carolina.
2. Legend of sanitary sewer and water lines, other utilities and structures, existing and proposed ground and pavement profile.
3. Summary of quantities of all water lines and appurtenances (i.e. lengths of lines with sizes and type, number of hydrants, valves, service connections and any other relevant appurtenances.). The number and type of water taps must be identified.
4. All materials conform to the latest City of York, State and Federal regulations or standards. The Engineer shall clearly identify any and all proposed variations and deviations from the Standard Specifications and certify that all materials and equipment permanently installed in the work will conform to the latest City standards. The certification must be received prior to the pre-construction meeting or water line construction commences.
5. Existing water lines labeled on plans with size and length and show the nearest existing valve(s) to be used for cut-off purposes.
6. Location of all existing/proposed fire hydrants within 500 feet of the proposed construction.
7. Road names, state and or county route numbers, and right-of-way widths must be shown.
8. Proposed water lines are shown with reference distances from right-of-way property boundary, buildings, other utilities, etc.
9. Location of existing houses, buildings, fences, wells, septic systems and other structures are shown on plans.

10. North arrow on all water line plan sheets.
11. Where a line is to be bored or tunneled; indicate location and length of bore or tunnel and type of pipe and casing or tunnel liner. Casings should extend a minimum of 5' beyond the existing or proposed edge of pavement. Show the location of the boring pit and the receiving pit on the plans
12. Horizontal and vertical separation of water and sewer lines must meet current SC DHEC specifications.
13. Plans must show all fittings, fire hydrants, and valves including sizes. Each appurtenance must be properly labeled.
14. Plans must show all connections to the existing mains.
15. Water system must be designed in accordance with available pressures and fire flow. Pressure calculations and supporting documents must be included with the plan submittal.
16. Water line locations must be shown relative to the back of curb or edge of pavement and right-of way limits.
17. Water pipe sizes and materials must be noted on plans.
18. Submit a completed SCDOT encroachment application package for review and signature. The water and/or sewer proposed for construction will ultimately be owned and operated by City; therefore, SCDOT requires that the encroachment application be completed referencing the City rather than the developer. For SCDOT application instructions, visit www.scdot.org/doing/encroachment_permit.shtml.
19. All water details must be the most current City standard details.
20. If comments are made by the City, the Project Engineer will be responsible for making such changes and providing a copy of correspondence to City.
21. The developer should allow a minimum of 30 days for plan approval by the City. Construction cannot begin until the City approves the plans and issues authorization to proceed with construction.
22. A preconstruction meeting, on site or at the City Office, will be scheduled by City upon request by the developer, Design Engineer, or contractor. At this meeting, the Design Engineer should be prepared to produce a tentative construction schedule and provide contractor contact information, as well as, any other pertinent information. Do not begin construction until the preconstruction meeting has been held.

Development Certification and Acceptance

The following list is intended to clarify City of York policies and procedures regarding the acceptance of development infrastructure into the City water system for ownership, operations, and maintenance. It does not override any previous policy or procedure issued. The developer's engineer (Design Engineer) must certify all installations including testing and daily construction reports.

City personnel shall be given a minimum of 5 working days notice prior to any testing.

Installation

- Design Engineer or his ***designated representative*** shall be on site daily during utility construction activities. The Design Engineer is not required to be on site for all construction, but should review enough activity to certify construction. Designated representatives include inspectors, soils testing companies, etc.
- Design Engineer shall produce daily logs of construction activity. Contractors shall not provide this information. These must be provided to City prior to acceptance.
- Design Engineer shall review pipe bedding and approve prior to installation. This shall be noted on inspection reports.
- Compaction must be conducted and tested in lifts to specifications.
- Pipe must be properly bedded according to specifications.
- Should conditions dictate or City personnel require, trench stabilization must be provided.
- All valves, blow-offs, hydrants, etc. must be at final grade prior to testing.
- Fire hydrants shall be covered until operational.

Connection to City water systems shall only be conducted under direct review of City personnel. No valves shall be opened for any reason without City personnel review.

Testing

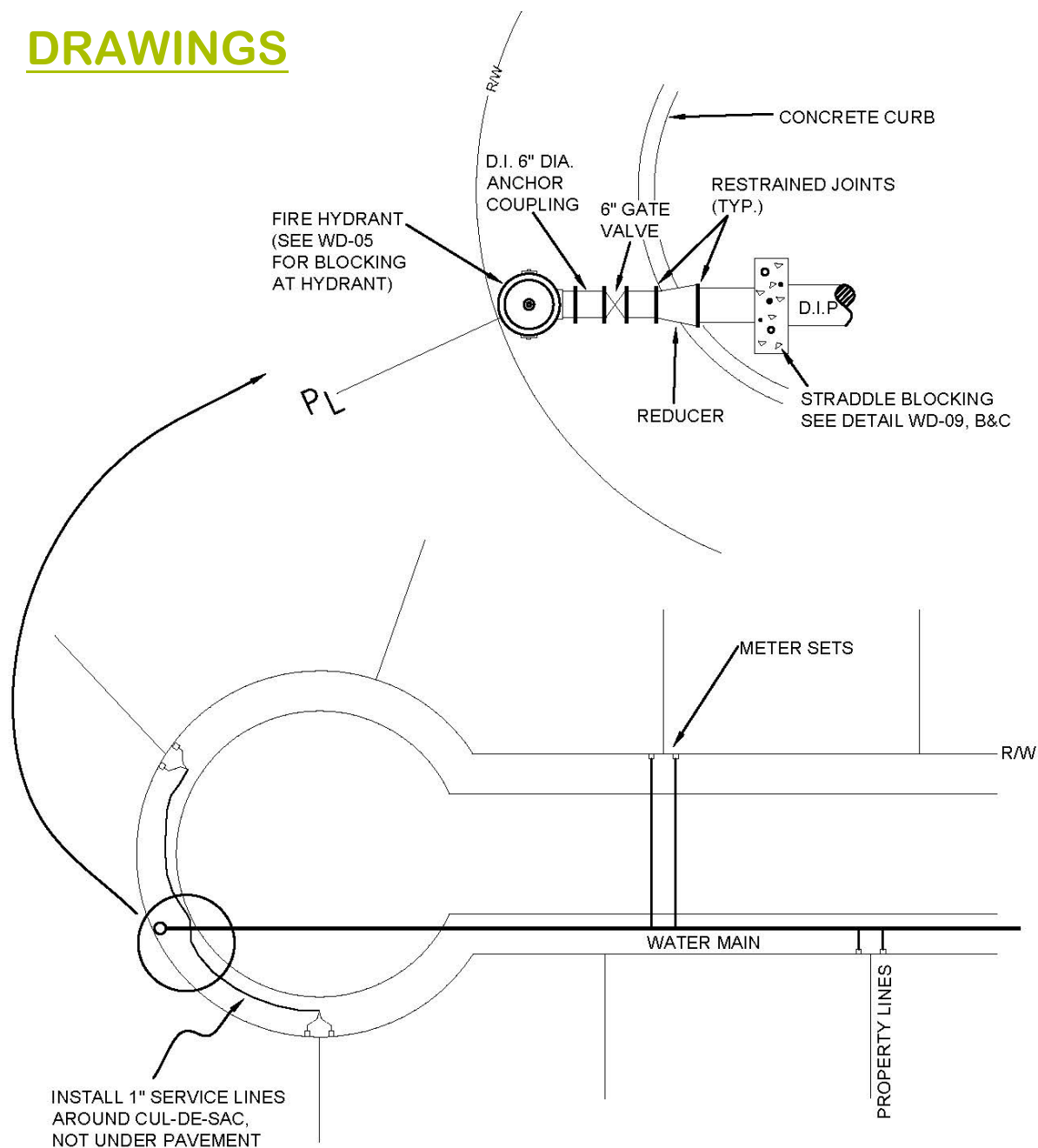
- Compaction tests must be conducted to specifications. Results shall be supplied to City prior to acceptance.
- Pressure tests must be completed to specifications. Design Engineer must certify. City personnel must witness.
- All fire hydrants on tested section shall be blown off at the conclusion of pressure tests.
- All tracer wire shall be tested for continuity.
- All valves shall be exercised fully.
- Bacteriological sampling shall be witnessed by City personnel.

Final Acceptance Requirements

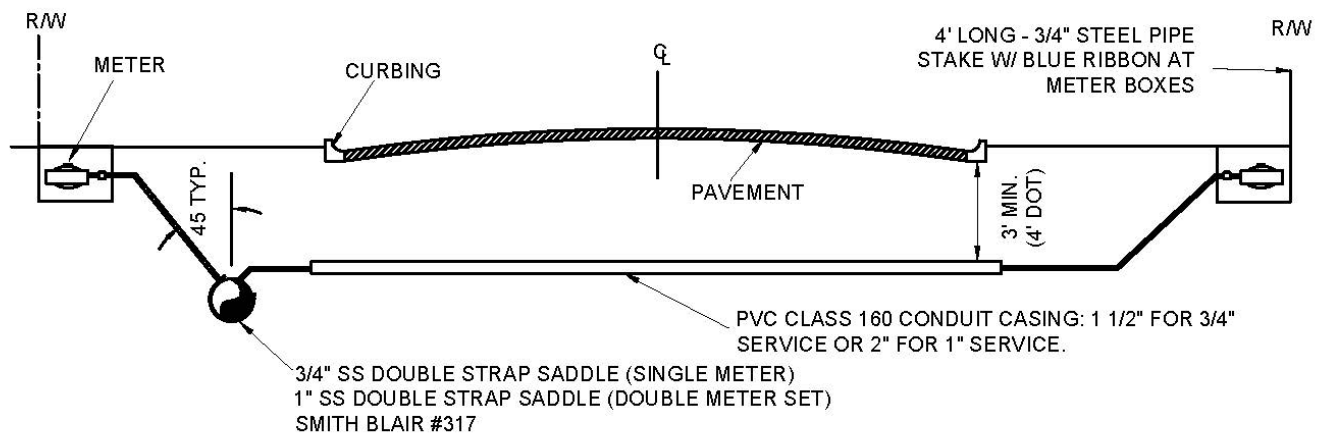
- Record Drawings received in print (blue line copy and mylar copy) and digital formats. PDF is required. AutoCAD or ArcView shapefiles are required. AutoCAD and Shapefiles must be on proper coordinate systems.
- Engineer's Certifications and Testing Results
- Field Reviews Completed
 1. All meter boxes level, clean, and to final grade. All shall be properly marked.
 2. Meter boxes must not be set in driveways or sidewalks.
 3. All valves open and shut freely and are left to open.
 4. All hydrants placed to final grade and aligned properly.
 5. All hydrants are factory painted white.
 6. All tracer wire easily accessible, connected, and tested.
 7. All valve boxes aligned vertically over the operating nut and to proper grade with correct labeling.
 8. All valves operational with operating nuts visible for inspection.
 9. The site is cleaned up and the area is restored.
 10. All punchlist items are properly completed to the satisfaction of the City.

NO SYSTEM SHALL BE OPENED TO THE ACTIVE CITY DISTRIBUTION SYSTEM UNTIL THE OPERATING PERMIT HAS BEEN RECEIVED.

DRAWINGS

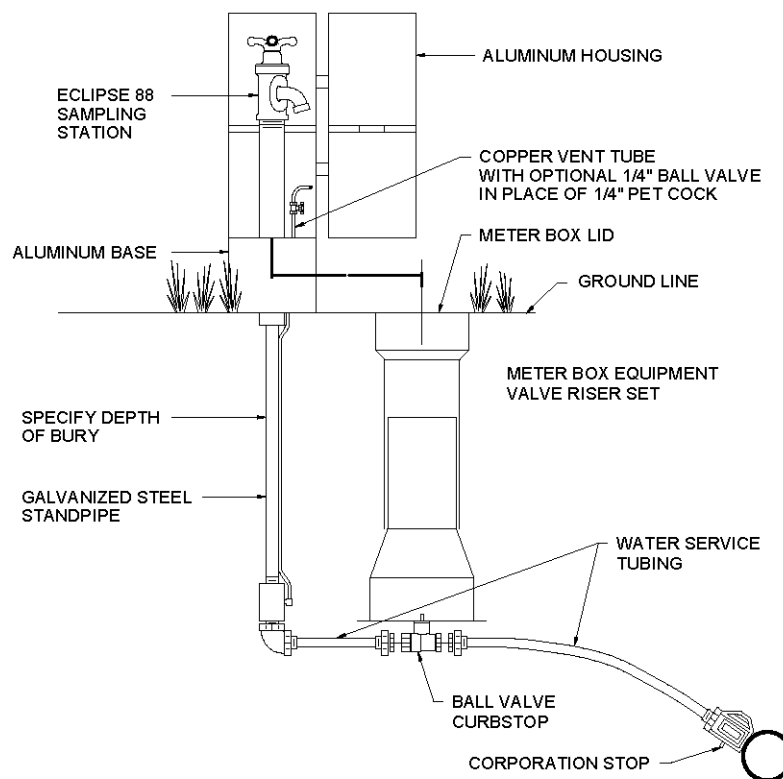


WD-01, CUL-DE-SAC WATER MAIN & SERVICE LINE PLACEMENT, N.T.S.



WD-02, WATER SERVICE LINE CONNECTIONS WITHIN SUBDIVISIONS, N.T.S.

ECLIPSE NO. 88 SAMPLING STATION



Sampling Stations shall be 3' bury (min.), with a 3/4" FIP inlet, and a (3/4" hose or unthreaded) nozzle.

All stations shall be enclosed in a lockable, nonremovable, aluminum-cast housing.

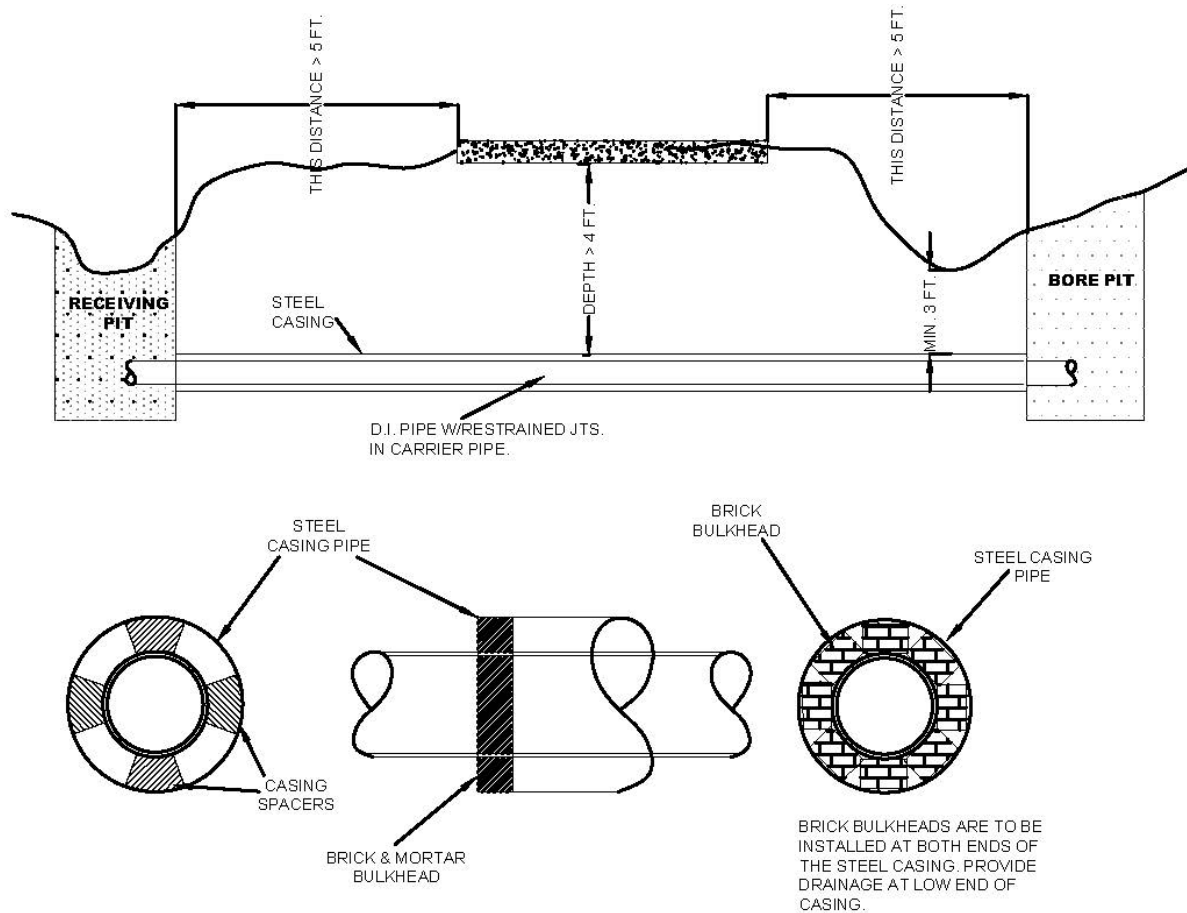
When opened, the station shall require no key for operation, and the water will flow in an all brass waterway.

All working parts will also be of brass and be removable from above ground with no digging. Exterior piping shall be galvanized steel (brass pipe also available).

A copper vent tube will enable each station to be pumped free of standing water to prevent freezing and to minimize bacteria growth.

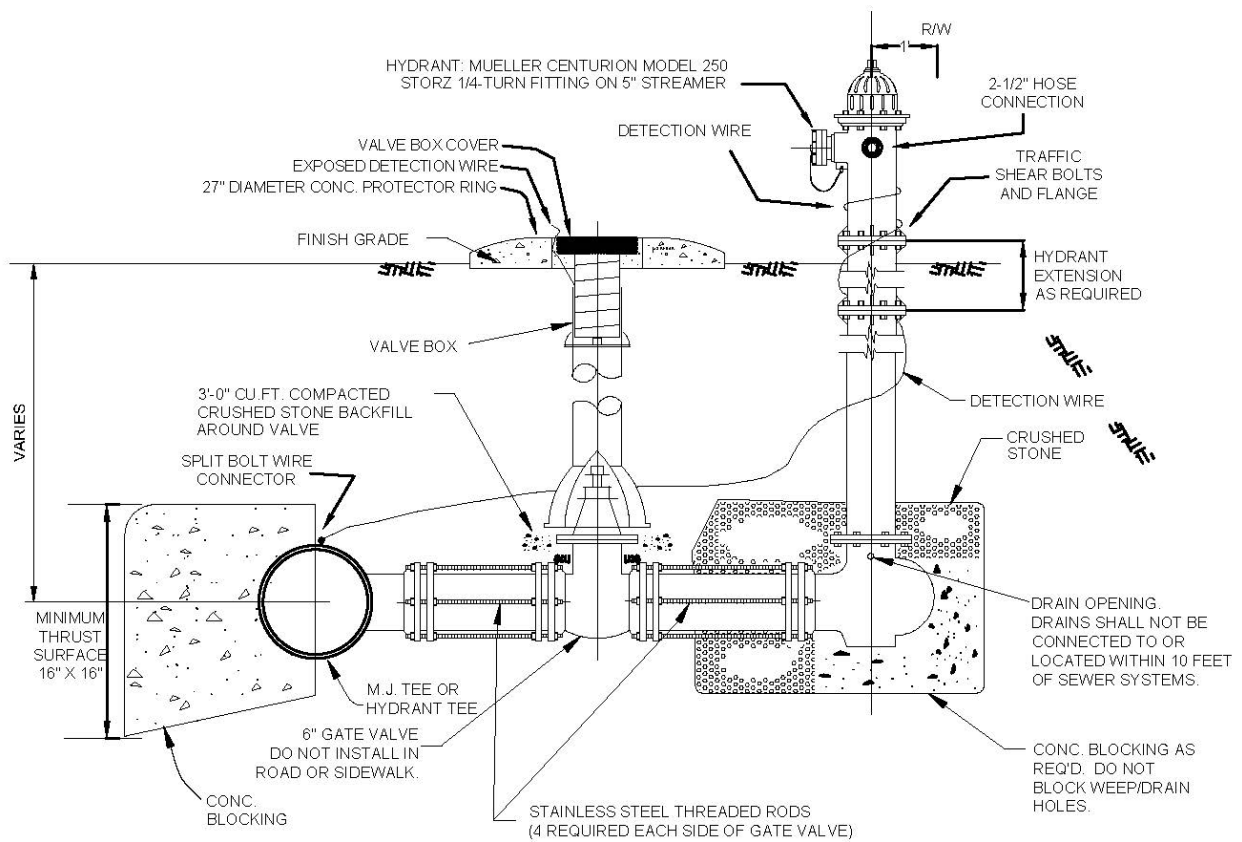
Eclipse No. 88 Sampling Station shall be manufactured by Kupferle Foundry, St. Louis, MO 63102.

WD-03, WATER SAMPLING STATION, N.T.S.



CASING SPACERS SHALL BE FLANGED, BOLT-ON STYLE WITH A TWO-SECTION STAINLESS STEEL SHELL LINED WITH A PVC LINER, MINIMUM 0.09-INCH THICK ALSO HAVING A HARDNESS OF 85-90 DUROMETER. RUNNERS SHALL BE ATTACHED TO STAINLESS STEEL RISERS WHICH SHALL BE PROPERLY WELDED TO THE SHELL. THE HEIGHT OF THE RUNNERS AND RISERS SHALL BE MANUFACTURED SUCH THAT THE PIPE DOES NOT FLOAT WITHIN THE CASING. CASING SPACERS SHALL BE CASCADE WATERWORKS MANUFACTURING COMPANY OR EQUAL. INSTALL SPACER EVERY 10' OF CARRIER PIPE (2 MIN. PER EACH JOINT), PLUS 1 ADDITIONAL SPACER WITHIN 2' OF EACH END OF THE CASING.

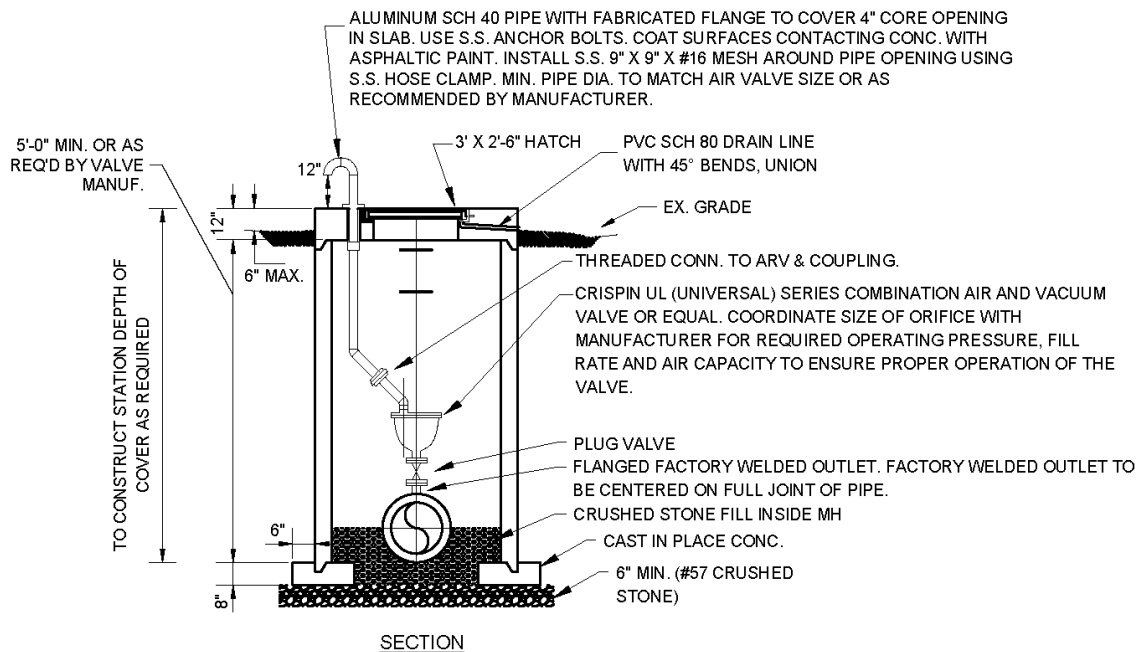
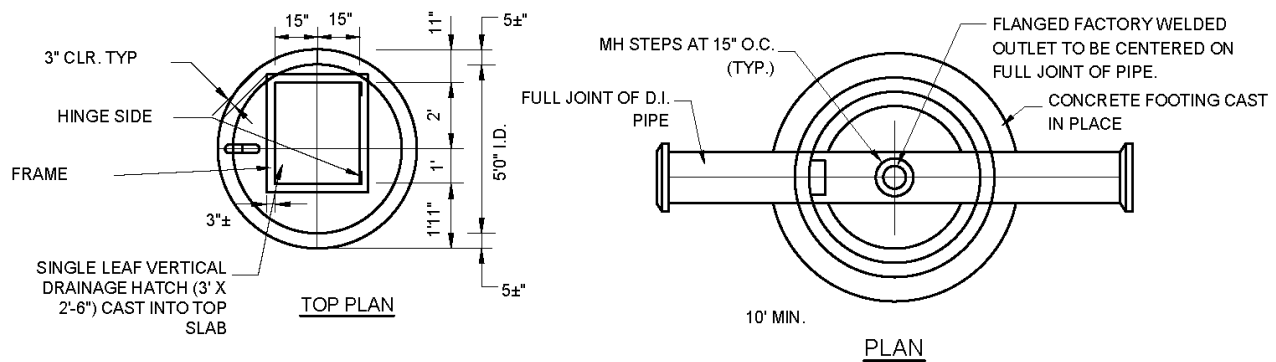
WD-04, STEEL PIPE CASING DETAIL, N.T.S.



DETAIL OF FIRE HYDRANT CONNECTION

N.T.S

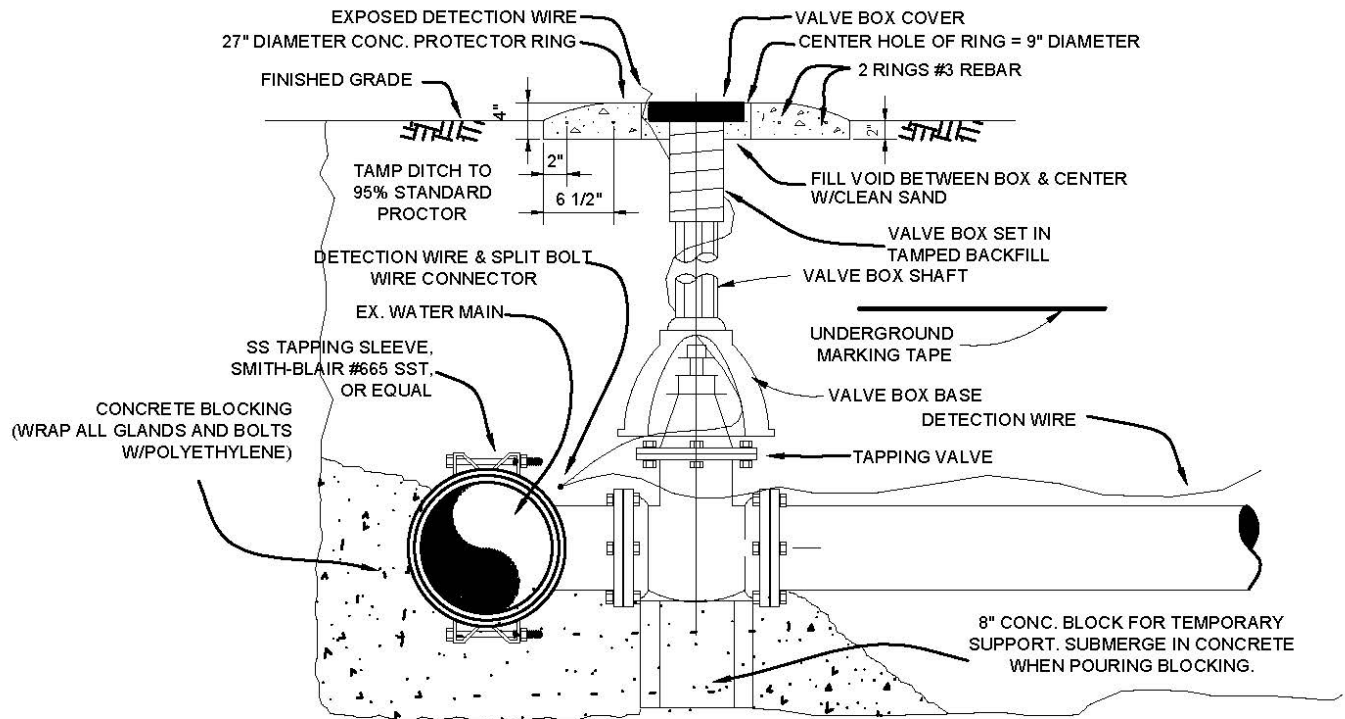
WD-05, FIRE HYDRANT CONNECTION & INSTALLATION DETAIL, N.T.S.



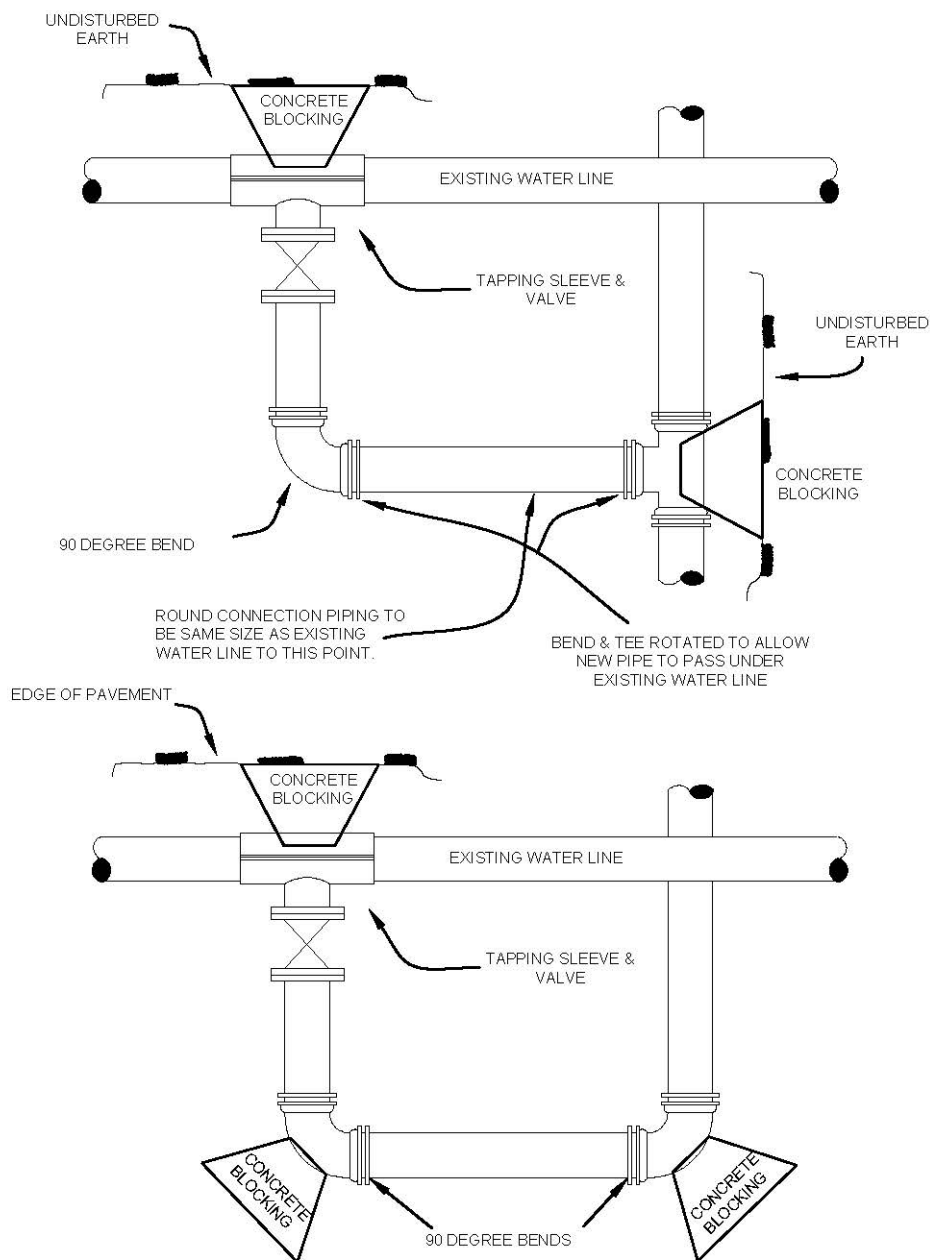
NOTES:

1. MAINTAIN A CONTINUOUS HORZ. OR DOWNHILL GRADE ON EACH SIDE OF STATION AS REQUIRED TO MAINTAIN HIGHPOINT AT ARV.
2. ADJUST ARV AND ASSOCIATED PIPING AS REQUIRED FOR ARV INSTALLED. ADJUST FOR OTHER SIZES ACCORDINGLY.

WD-06, AIR RELEASE VALVE DETAIL, N.T.S.



WD-07, WATER MAIN TAP & BLOCKING DETAIL, N.T.S



NOTES:

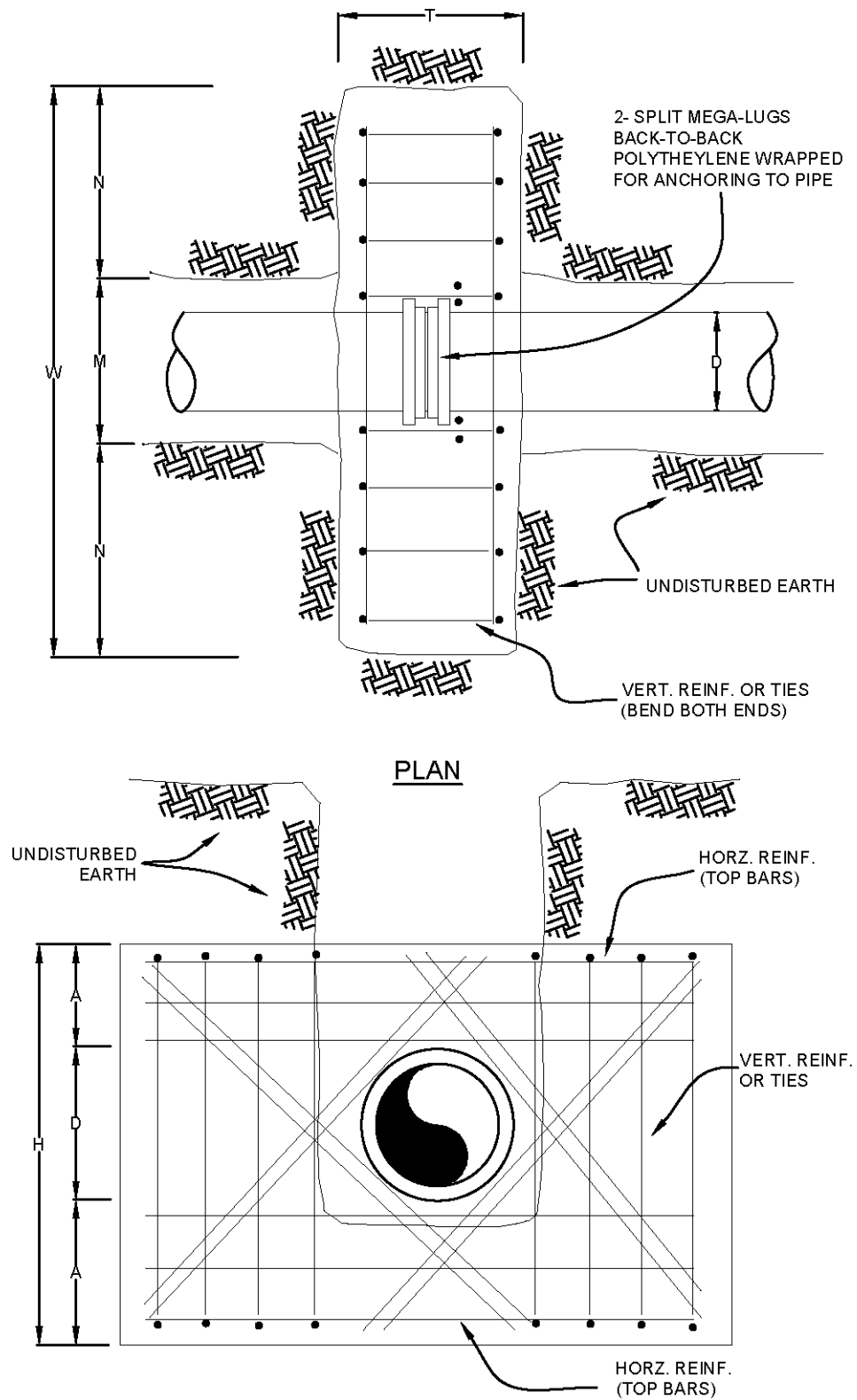
1. ALL JOINTS BETWEEN TAPPING VALVE & TEE/BOTH 90 DEGREE BENDS SHALL BE FULLY RESTRAINED TOGETHER. RETAINER GLANDS ARE NOT AN ACCEPTABLE METHOD OF JOINT RESTRAINT.
2. ALL CONCRETE BLOCKING SHALL BE AGAINST UNDISTURBED SOIL.
3. A BACKTAP SHALL NOT BE INSTALLED BY THE CONTRACTOR UNLESS SPECIFICALLY SHOWN ON THE WATER LINE DRAWINGS APPROVED FOR CONSTRUCTION.
4. SEE WD-14A - 14-E FOR BLOCKING DIMENSIONS.

WD-08, WATER MAIN BACK TAP & BLOCKING DETAIL, N.T.S

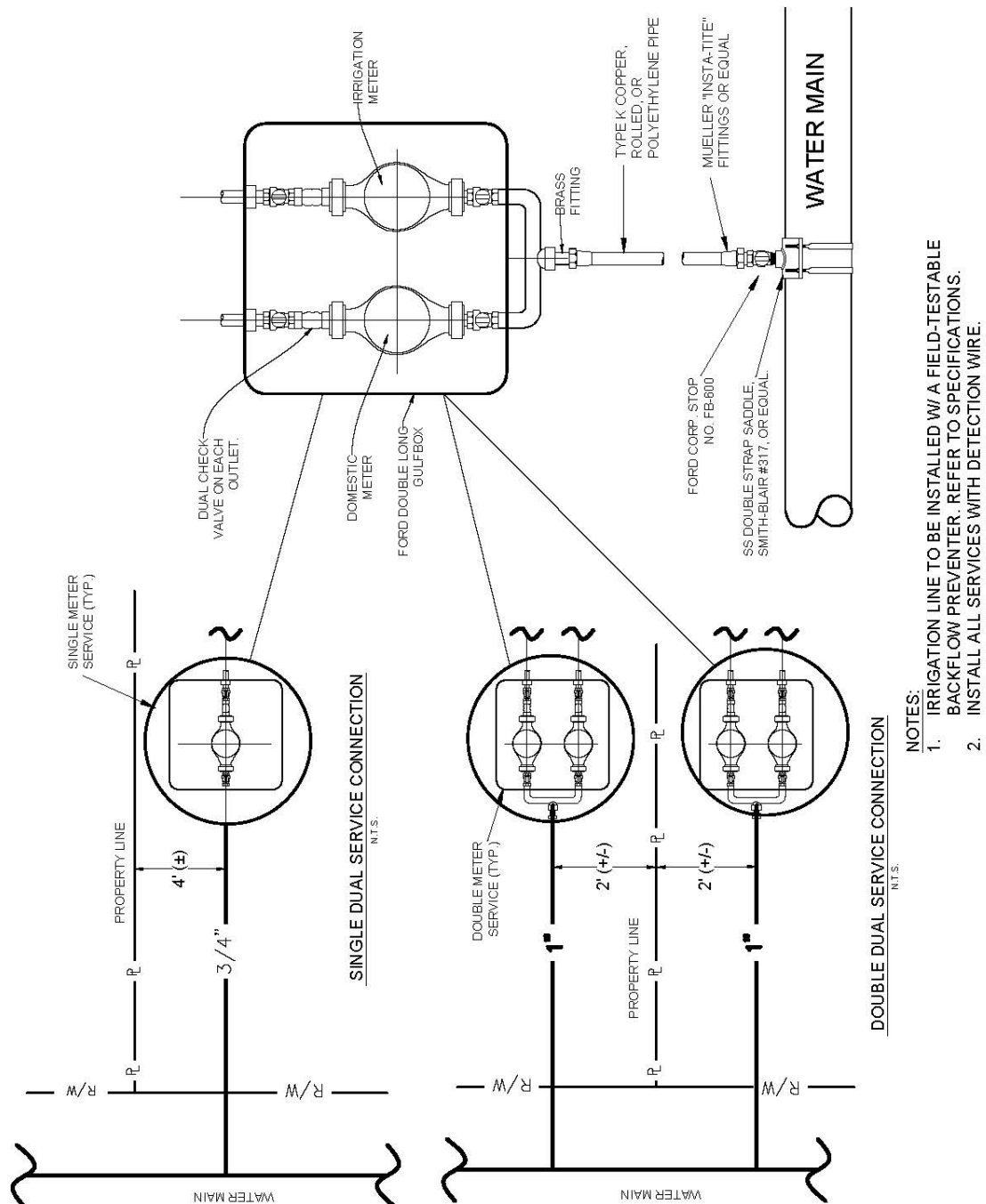


PRESSURE: 100 P.S.I. SOIL: 2000 P.S.F.							BLOCKING REINFORCEMENT		
CONCRETE BLOCKING							HOR. (MAIN) REINF.		VERT. REINF.
DIA.	A	H	M	N	W	T	TOP	BOTTOM	(TEMP.)
30"	2'-0"	6'-6"	4'-6"	2'-3"	9'-0"	1'-6"	3-#6 EF	3-#6 EF	#4 @ 9" EF
24"	1'-6"	5'-0"	4'-0"	2'-0"	8'-0"	1'-0"	3-#6 EF	3-#6 EF	#4 @ 12" EF
20"	1'-4"	4'-4"	3'-8"	1'-6"	6'-8"	1'-0"	2-#6 EF	2-#6 EF	#4 @ 12" EF
18"	1'-0"	3'-6"	3'-6"	1'-6"	6'-6"	1'-0"	2-#5 EF	2-#5 EF	#4 @ 12" EF
16"	1'-0"	3'-4"	3'-4"	1'-4"	6'-0"	1'-0"	2-#5 EF	2-#5 EF	#4 @ 12" EF
12"	1'-0"	3'-0"	3'-0"	1'-0"	5'-0"	1'-0"	2-#4 EF	2-#4 EF	#4 @ 12" EF
10"	10"	2'-6"	2'-10"	1'-0"	4'-10"	10"	2-#4 EF	2-#4 EF	#3 @ 12" EF
8"	10"	2'-4"	2'-8"	1'-0"	4'-8"	8"	2-#4	2-#4	#4 @ 10"
6"	10"	2'-2"	2'-6"	1'-0"	4'-6"	6"	2-#4	2-#4	#4 @ 10"
PRESSURE: 200 P.S.I. SOIL: 2000 P.S.F.							BLOCKING REINFORCEMENT		
CONCRETE BLOCKING							HOR. (MAIN) REINF.		VERT. REINF.
DIA.	A	H	M	N	W	T	TOP	BOTTOM	(TEMP.)
30"	3'-6"	9'-6"	4'-6"	3'-6"	11'-6"	2'-0"	3-#8 EF	3-#8 EF	#5 @ 12" EF
24"	2'-6"	7'-0"	4'-0"	3'-0"	10'-0"	1'-6"	3-#7 EF	3-#7 EF	#4 @ 9" EF
20"	2'-2"	6'-0"	3'-8"	2'-6"	8'-8"	1'-6"	2-#7 EF	2-#7 EF	#4 @ 9" EF
18"	2'-0"	5'-6"	3'-6"	2'-0"	7'-6"	1'-0"	2-#7 EF	2-#7 EF	#4 @ 12" EF
16"	1'-6"	4'-4"	3'-4"	2'-0"	7'-4"	1'-0"	2-#6 EF	2-#6 EF	#4 @ 12" EF
12"	1'-6"	4'-0"	3'-0"	1'-6"	6'-0"	1'-0"	2-#5 EF	2-#5 EF	#4 @ 12" EF
10"	1'-0"	2'-10"	2'-10"	1'-4"	5'-6"	1'-0"	2-#4 EF	2-#4 EF	#3 @ 12" EF
8"	1'-0"	2'-8"	2'-8"	1'-0"	4'-8"	10"	2-#4	2-#4	#4 @ 10"
6"	10"	2'-2"	2'-6"	1'-0"	4'-6"	8"	2-#4	2-#4	#4 @ 10"
PRESSURE: 250 P.S.I. SOIL: 2000 P.S.F.							BLOCKING REINFORCEMENT		
CONCRETE BLOCKING							HOR. (MAIN) REINF.		VERT. REINF.
DIA.	A	H	M	N	W	T	TOP	BOTTOM	(TEMP.)
30"	3'-9"	10'-0"	4'-6"	6'-0"	16'-6"	2'-0"	#9 @ 6" EF	#9 @ 6" EF	#7 @ 12" EF
24"	2'-6"	7'-0"	4'-0"	5'-0"	14'-0"	2'-0"	3-#7 EF	3-#7 EF	#4 @ 9" EF
20"	2'-6"	6'-8"	3'-8"	4'-3"	12'-2"	1'-9"	2-#7 EF	2-#7 EF	#7 @ 12" EF
18"	2'-3"	6'-0"	3'-6"	3'-6"	10'-6"	1'-6"	2-#7 EF	2-#7 EF	#4 @ 12" EF
16"	2'-0"	5'-4"	3'-4"	3'-0"	9'-4"	1'-6"	2-#6 EF	2-#6 EF	#4 @ 12" EF
12"	1'-9"	4'-6"	3'-0"	2'-0"	7'-0"	1'-0"	2-#5 EF	2-#5 EF	#6 @ 12" EF
10"	1'-0"	2'-10"	2'-10"	1'-6"	5'-10"	1'-0"	2-#4 EF	2-#4 EF	#3 @ 12" EF
8"	1'-0"	2'-8"	2'-8"	1'-6"	5'-8"	1'-0"	2-#4	2-#4	#4 @ 10"
6"	1'-0"	2'-6"	2'-6"	1'-0"	4'-6"	1'-0"	2-#4	2-#4	#4 @ 6"

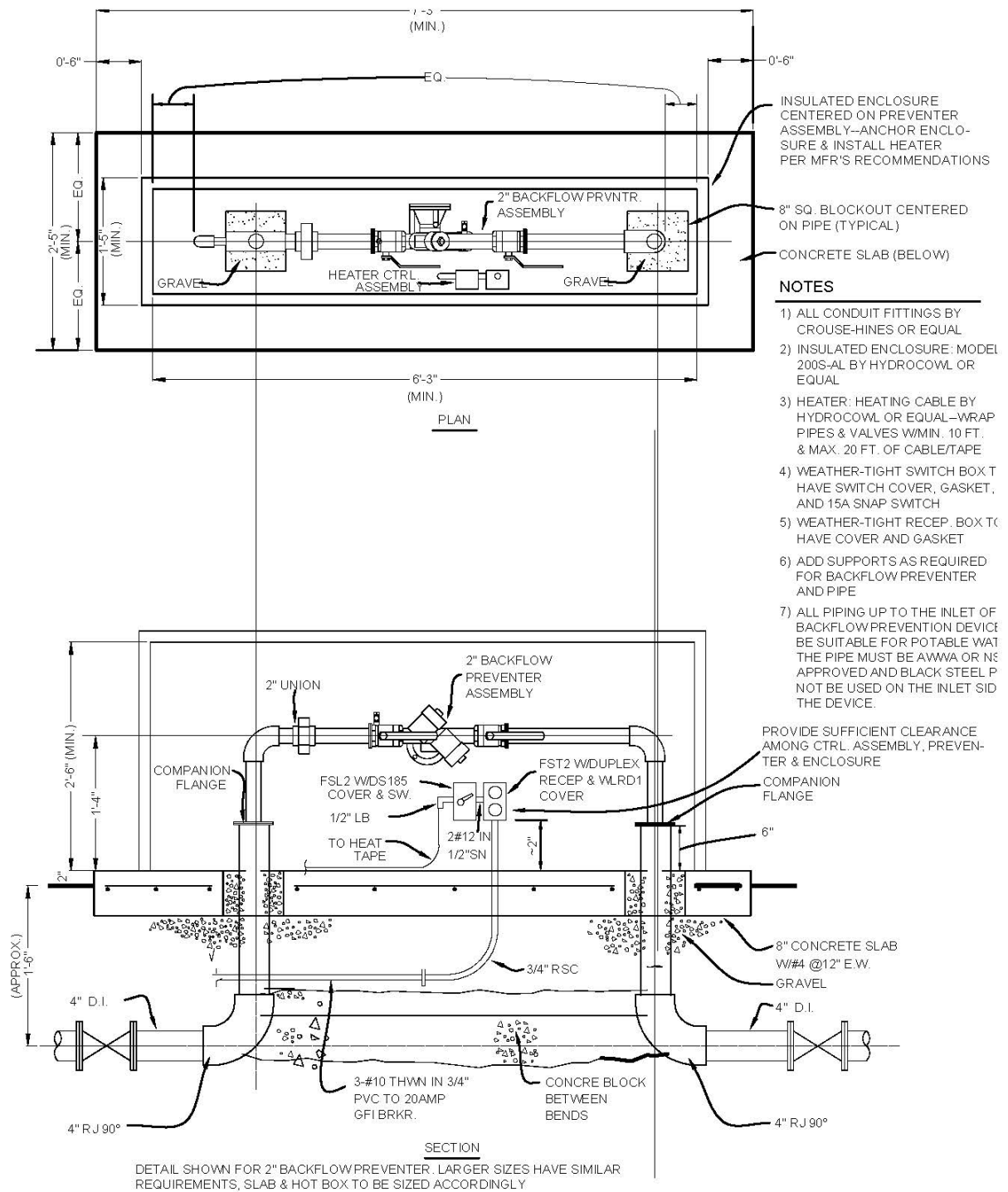
WD-09B, STRADDLE BLOCKING DIMENSIONS



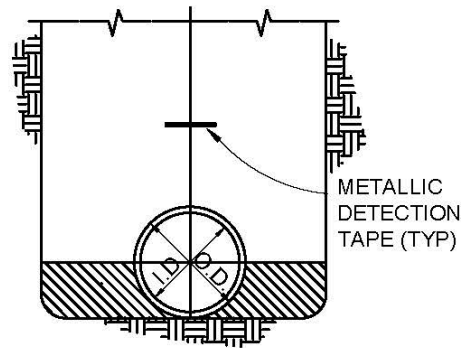
WD-09C, STRADDLE BLOCKING PLAN AND ELEVATION



WD-10, SINGLE AND DOUBLE METER WATER SERVICE DETAIL, N.T.S.

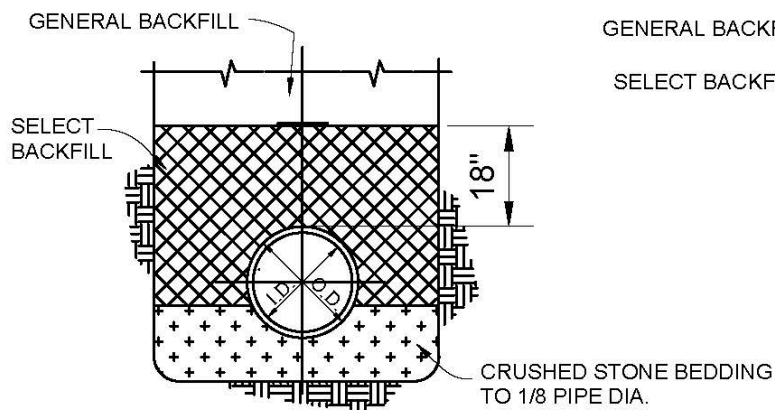


WD-11, BACKFLOW PREVENTION ASSEMBLY INSTALLATION, N.T.S.

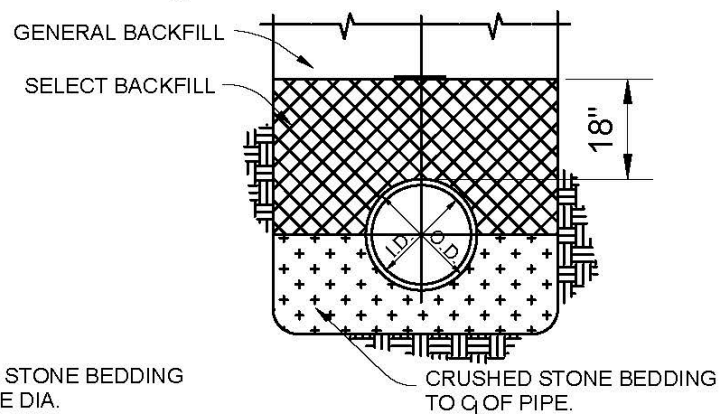


TYPE 2

FLAT-BOTTOM TRENCH WITH GENERAL
BACKFILL. UNDERCUT TRENCH @ BELLS.



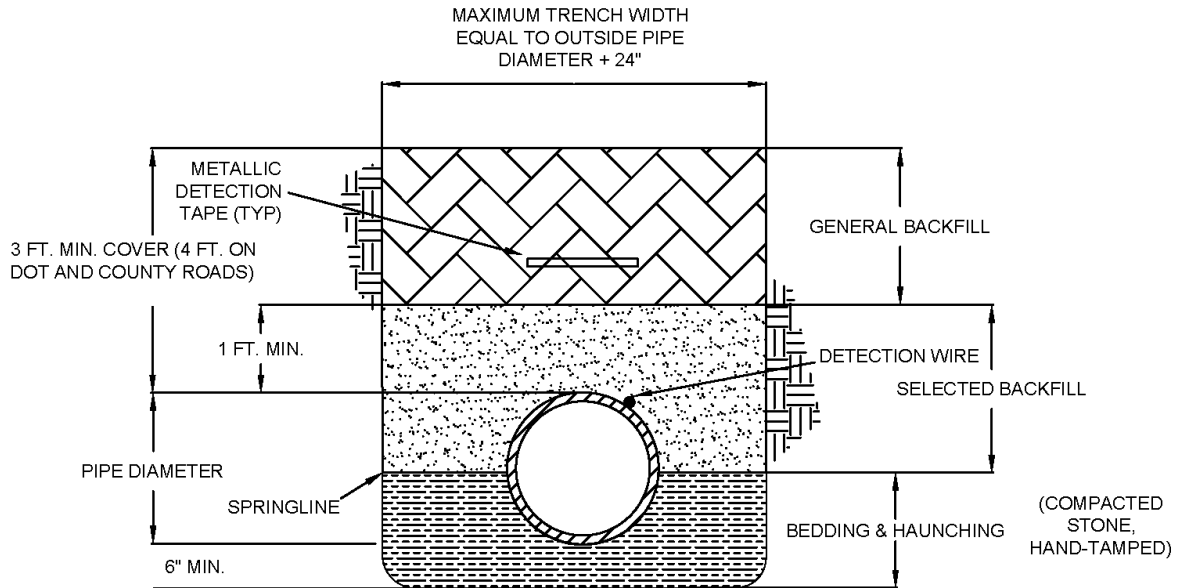
TYPE 4



TYPE 5

NOTE: TYPE 1 & TYPE 3 BEDDING NOT ALLOWED FOR D.I.P.

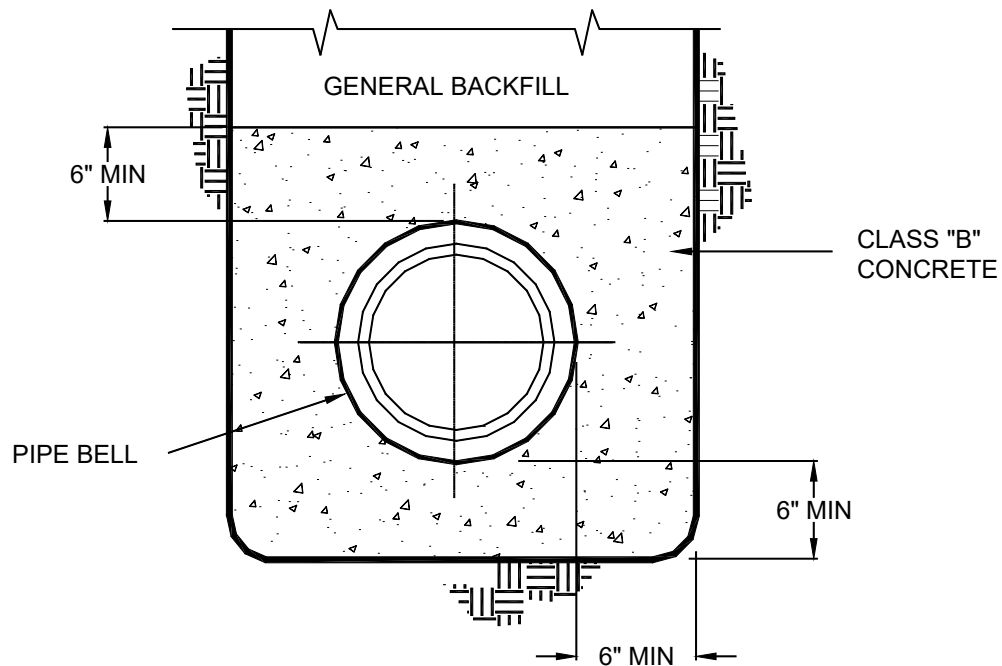
WD-12A, BEDDING DETAILS FOR USE WITH DUCTILE IRON PIPE, N.T.S.



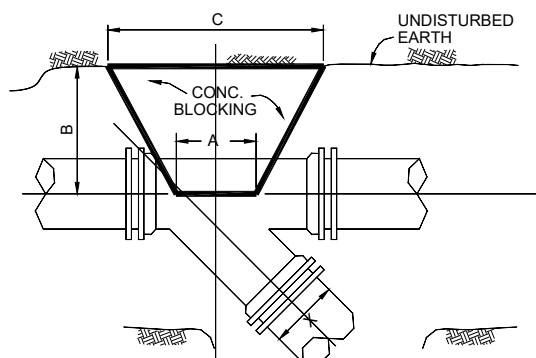
NOTES:

- 1) SELECTED BACKFILL SHALL BE FREE OF ALL ROCKS, DIRT CLOGS, ROOTS, STICKS, AND ALL OTHER DEBRIS AND IS TO BE COMPOSED OF FINELY DIVIDED EARTH, STONE, DUST, SAND OR CRUSHED STONE.
- 2) GENERAL BACKFILL IS TO CONSIST OF GENERAL EXCAVATED MATERIALS THAT CONTAIN NO ROCKS.

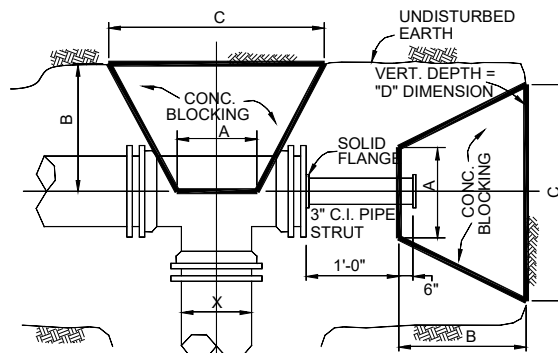
WD-12B, PVC PIPE BEDDING DETAILS (8" - 12"), N.T.S



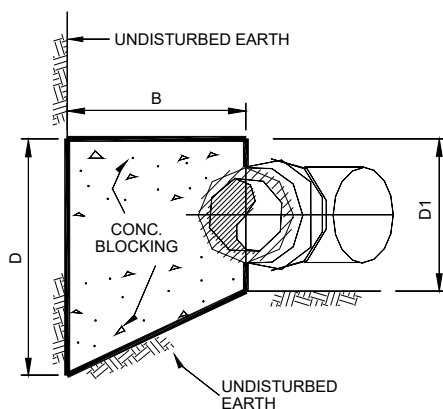
WD-13, CONCRETE ENCASEMENT, N.T.S



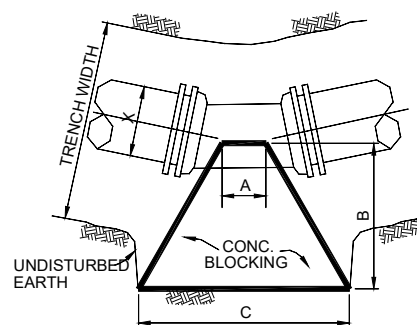
WYES



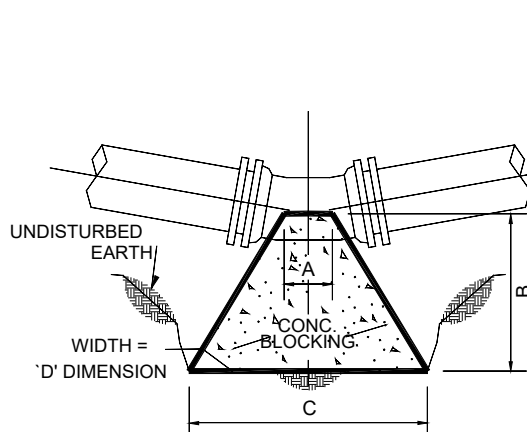
TEES



SECTION

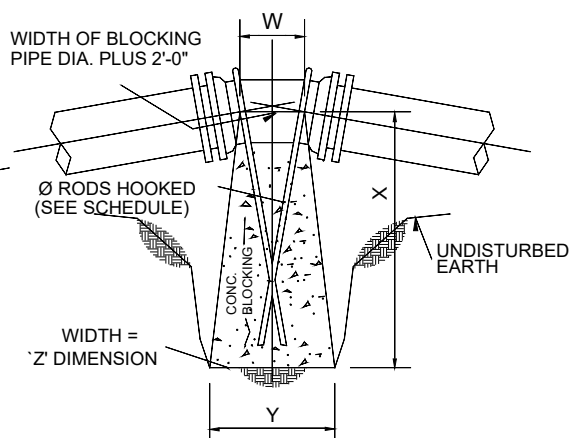


BENDS



VERTICAL UP BENDS

N.T.S.



VERTICAL DOWN BENDS

N.T.S.

WD-14A, CONCRETE BLOCKING DETAILS, N.T.S

CONC. BLOCKING DIMENSIONS					
X	A	B	C	D	D1
TEES - 30" RUN					
30"	3'-0"	6'-0"	9'-0"	6'-0"	3'-6"
24"	2'-6"	4'-0"	6'-6"	5'-4"	3'-6"
20"	2'-2"	3'-4"	5'-6"	4'-4"	3'-6"
18"	2'-0"	3'-0"	5'-0"	4'-0"	3'-6"
16"	1'-10"	2'-6"	4'-4"	3'-6"	3'-6"
12"	1'-6"	2'-4"	3'-8"	2'-6"	2'-6"
10"	1'-2"	2'-4"	2'-6"	2'-6"	2'-6"
8"	1'-0"	2'-4"	2'-0"	2'-6"	2'-6"
6"	10"	2'-4"	1'-0"	2'-6"	2'-6"
TEES - 24" RUN					
24"	2'-6"	4'-6"	7'-0"	5'-0"	3'-0"
20"	2'-2"	3'-4"	5'-6"	4'-4"	3'-0"
18"	2'-0"	3'-0"	5'-0"	4'-0"	3'-0"
16"	1'-10"	2'-2"	4'-0"	4'-0"	3'-0"
12"	1'-6"	2'-0"	3'-0"	3'-0"	2'-0"
10"	1'-2"	2'-0"	3'-0"	2'-0"	2'-0"
8"	1'-0"	2'-0"	2'-2"	2'-0"	2'-0"
6"	10"	2'-0"	1'-2"	2'-0"	2'-0"
TEES - 20" RUN					
20"	2'-2"	3'-10"	6'-0"	4'-0"	2'-8"
18"	2'-0"	3'-0"	5'-0"	4'-0"	2'-8"
16"	1'-10"	2'-8"	4'-6"	3'-6"	2'-8"
12"	1'-6"	2'-0"	3'-6"	2'-8"	2'-8"
10"	1'-2"	2'-0"	3'-2"	2'-0"	1'-8"
8"	1'-0"	1'-8"	2'-8"	1'-8"	1'-8"
6"	10"	1'-8"	1'-6"	1'-8"	1'-8"
TEES - 18" RUN					
18"	2'-0"	3'-0"	5'-0"	4'-2"	2'-6"
16"	1'-10"	2'-4"	4'-2"	4'-0"	2'-6"
12"	1'-6"	2'-0"	3'-6"	2'-8"	2'-6"
10"	1'-2"	2'-0"	3'-2"	2'-0"	1'-6"
8"	1'-0"	1'-8"	2'-6"	1'-8"	1'-6"
6"	10"	1'-8"	1'-6"	1'-6"	1'-6"
TEES - 16" RUN					
16"	1'-10"	2'-8"	4'-6"	3'-6"	2'-4"
12"	1'-6"	2'-6"	4'-0"	2'-4"	2'-4"
10"	1'-2"	1'-10"	3'-0"	2'-4"	2'-4"
8"	1'-0"	1'-6"	2'-2"	2'-0"	1'-4"
6"	10"	1'-6"	2'-0"	1'-4"	1'-4"
TEES - 12" RUN					
12"	1'-6"	2'-6"	3'-0"	3'-0"	2'-0"
10"	1'-2"	1'-6"	2'-8"	2'-6"	2'-0"
8"	1'-0"	1'-6"	2'-6"	2'-0"	1'-0"
6"	10"	1'-6"	2'-4"	1'-0"	1'-0"
PLUG - SAME AS TEE EXCEPT THAT THE LARGER SIZE IN UNEQUAL RUNS SHALL BE USED					

CONC. BLOCKING DIMENSIONS					
X	A	B	C	D	D1
TEES - 10" RUN					
10"	1'-2"	1'-10"	3'-0"	2'-4"	1'-10"
8"	1'-0"	1'-6"	2'-4"	1'-10"	1'-0"
6"	10"	1'-6"	2'-2"	1'-2"	0'-10"
TEES - 8" RUN					
8"	1'-0"	1'-6"	2'-6"	1'-8"	1'-8"
6"	10"	1'-6"	2'-4"	1'-0"	1'-0"
TEES - 6" RUN					
6"	10"	1'-6"	2'-4"	1'-0"	1'-0"
90° BENDS					
30"	2'-10"	7'-8"	10'-6"	7'-2"	3'-6"
24"	2'-6"	5'-6"	8'-0"	6'-0"	3'-0"
20"	2'-2"	4'-10"	7'-0"	4'-10"	2'-8"
18"	1'-10"	4'-2"	6'-0"	4'-6"	2'-6"
16"	1'-6"	4'-0"	5'-6"	4'-0"	2'-4"
12"	1'-2"	2'-10"	4'-0"	3'-0"	2'-0"
10"	1'-0"	2'-0"	3'-0"	2'-10"	1'-10"
8"	10"	1'-8"	2'-6"	2'-4"	1'-8"
6"	8"	1'-4"	2'-0"	1'-6"	1'-0"
45° BENDS					
30"	1'-4"	5'-8"	7'-0"	5'-10"	3'-6"
24"	1'-0"	4'-0"	5'-0"	5'-3"	3'-0"
20"	1'-0"	3'-6"	4'-6"	4'-0"	2'-8"
18"	10"	3'-2"	4'-0"	3'-8"	2'-6"
16"	10"	2'-8"	3'-6"	3'-4"	2'-4"
12"	8"	2'-8"	3'-4"	2'-0"	2'-0"
10"	6"	2'-0"	2'-6"	1'-10"	1'-10"
8"	6"	1'-4"	1'-10"	1'-8"	1'-8"
6"	6"	1'-4"	1'-10"	1'-0"	1'-0"
22 1/2° BENDS					
30"	1'-4"	3'-8"	5'-0"	4'-2"	3'-6"
24"	1'-0"	3'-6"	4'-6"	3'-0"	3'-0"
20"	1'-0"	2'-6"	3'-6"	2'-8"	2'-8"
18"	10"	2'-2"	3'-0"	2'-6"	2'-6"
16"	10"	1'-10"	2'-8"	2'-4"	2'-4"
12"	8"	1'-6"	1'-8"	2'-0"	2'-0"
10"	6"	1'-4"	1'-4"	1'-10"	1'-10"
8"	6"	1'-4"	1'-0"	1'-8"	1'-8"
6"	6"	1'-0"	1'-0"	1'-0"	1'-0"
11 1/4° BENDS					
30"	1'-4"	2'-4"	3'-0"	3'-6"	3'-6"
24"	1'-0"	2'-0"	2'-4"	3'-0"	3'-0"
20"	1'-0"	1'-10"	2'-0"	2'-8"	2'-8"
18"	10"	1'-10"	2'-8"	1'-6"	1'-6"
16"	10"	1'-8"	2'-4"	1'-4"	1'-4"
12"	8"	1'-6"	2'-0"	1'-0"	1'-0"
10"	6"	1'-4"	1'-4"	1'-0"	1'-0"
8"	6"	1'-4"	1'-0"	1'-0"	1'-0"
6"	6"	1'-0"	1'-0"	1'-0"	1'-0"
PRESSURE: 150 P.S.I.(MAX.) SOIL: 2000 P.S.F.					

WD-14B, CONCRETE BLOCKING DIMENSIONS – 150 PSI

CONC. BLOCKING DIMENSIONS					
X	A	B	C	D	D1
TEES - 30" RUN					
30"	3'-0"	7'-4"	10'-0"	7'-2"	3'-6"
24"	2'-6"	5'-6"	8'-0"	5'-8"	3'-6"
20"	2'-2"	4'-2"	6'-4"	5'-0"	3'-6"
18"	2'-0"	3'-8"	5'-8"	4'-6"	3'-6"
16"	1'-10"	3'-2"	5'-0"	4'-0"	3'-6"
12"	1'-6"	3'-2"	4'-8"	2'-6"	2'-6"
10"	1'-2"	2'-4"	3'-2"	2'-6"	2'-6"
8"	1'-0"	2'-4"	2'-2"	2'-6"	2'-6"
6"	10"	2'-4"	1'-4"	2'-6"	2'-6"
TEES - 24" RUN					
24"	2'-6"	5'-6"	8'-0"	5'-8"	3'-0"
20"	2'-2"	4'-2"	6'-4"	5'-0"	3'-0"
18"	2'-0"	3'-8"	5'-8"	4'-6"	3'-0"
16"	1'-10"	3'-2"	5'-0"	4'-6"	3'-0"
12"	1'-6"	2'-6"	4'-0"	3'-0"	2'-0"
10"	1'-2"	2'-2"	3'-4"	2'-6"	2'-0"
8"	1'-0"	2'-0"	2'-8"	2'-0"	2'-0"
6"	10"	2'-0"	1'-6"	2'-0"	2'-0"
TEES - 20" RUN					
20"	2'-2"	4'-8"	6'-4"	5'-0"	2'-8"
18"	2'-0"	3'-8"	5'-8"	4'-6"	2'-8"
16"	1'-10"	3'-2"	5'-0"	4'-0"	2'-8"
12"	1'-6"	2'-10"	4'-4"	2'-8"	2'-8"
10"	1'-2"	2'-2"	3'-4"	2'-6"	1'-8"
8"	1'-0"	1'-8"	2'-8"	2'-0"	1'-8"
6"	10"	1'-8"	2'-0"	1'-8"	1'-8"
TEES - 18" RUN					
18"	2'-0"	4'-0"	5'-8"	4'-6"	2'-6"
16"	1'-10"	3'-2"	5'-0"	4'-0"	2'-6"
12"	1'-6"	3'-0"	4'-6"	2'-6"	2'-6"
10"	1'-2"	2'-2"	3'-4"	2'-6"	1'-6"
8"	1'-0"	1'-8"	2'-6"	2'-0"	1'-6"
6"	10"	1'-8"	2'-0"	1'-6"	1'-6"
TEES - 16" RUN					
16"	1'-10"	3'-4"	5'-0"	4'-0"	2'-4"
12"	1'-6"	3'-4"	4'-10"	2'-4"	2'-4"
10"	1'-2"	2'-4"	3'-6"	2'-4"	2'-4"
8"	1'-0"	1'-8"	2'-8"	2'-0"	1'-4"
6"	10"	1'-6"	2'-4"	1'-4"	1'-4"
TEES - 12" RUN					
12"	1'-6"	2'-4"	3'-10"	3'-0"	2'-0"
10"	1'-2"	2'-0"	3'-2"	2'-6"	2'-0"
8"	1'-0"	1'-6"	2'-8"	2'-0"	2'-0"
6"	10"	1'-6"	2'-4"	1'-4"	1'-0"
PLUG - SAME AS TEE EXCEPT THAT THE LARGER SIZE IN UNEQUAL RUNS SHALL BE USED					

CONC. BLOCKING DIMENSIONS					
X	A	B	C	D	D1
TEES - 10" RUN					
10"	1'-2"	2'-0"	3'-2"	2'-6"	1'-10"
8"	1'-0"	1'-8"	2'-8"	2'-0"	1'-10"
6"	10"	1'-6"	2'-4"	1'-4"	0'-10"
TEES - 8" RUN					
8"	1'-0"	1'-8"	2'-8"	2'-0"	1'-8"
6"	10"	1'-6"	2'-4"	1'-4"	0'-8"
TEES - 6" RUN					
6"	10"	1'-6"	2'-4"	1'-0"	1'-0"
90° BENDS					
30"	2'-10"	9'-2"	12'-0"	8'-4"	3'-6"
24"	2'-6"	7'-6"	10'-0"	6'-6"	3'-0"
20"	2'-2"	6'-10"	9'-0"	5'-0"	2'-8"
18"	1'-10"	5'-6"	7'-4"	5'-0"	2'-6"
16"	1'-6"	4'-10"	6'-4"	4'-6"	2'-4"
12"	1'-2"	3'-6"	4'-8"	3'-6"	2'-0"
10"	1'-0"	3'-0"	4'-0"	3'-0"	1'-10"
8"	10"	2'-2"	3'-0"	2'-8"	1'-8"
6"	8"	1'-4"	2'-0"	2'-0"	1'-0"
45° BENDS					
30"	1'-4"	7'-0"	8'-4"	6'-6"	3'-6"
24"	1'-0"	5'-6"	6'-6"	5'-4"	3'-0"
20"	1'-0"	4'-8"	5'-8"	4'-4"	2'-8"
18"	10"	4'-2"	5'-0"	4'-0"	2'-6"
16"	10"	3'-8"	4'-6"	3'-6"	2'-4"
12"	8"	2'-4"	3'-0"	3'-0"	2'-0"
10"	6"	2'-0"	2'-6"	2'-6"	1'-10"
8"	6"	2'-0"	2'-6"	1'-8"	1'-8"
6"	6"	1'-10"	2'-4"	1'-0"	1'-0"
22 1/2° BENDS					
30"	1'-4"	4'-4"	5'-8"	5'-0"	3'-6"
24"	1'-0"	3'-6"	4'-6"	4'-0"	3'-0"
20"	1'-0"	2'-8"	3'-8"	3'-4"	2'-8"
18"	10"	2'-6"	3'-4"	3'-0"	2'-6"
16"	10"	2'-2"	3'-0"	2'-8"	2'-4"
12"	8"	1'-8"	2'-4"	2'-0"	2'-0"
10"	6"	1'-4"	1'-8"	1'-10"	1'-10"
8"	6"	1'-4"	1'-6"	1'-8"	1'-8"
6"	6"	1'-0"	1'-4"	1'-0"	1'-0"
11 1/4° BENDS					
30"	1'-4"	3'-0"	4'-4"	3'-6"	3'-6"
24"	1'-0"	2'-6"	3'-6"	3'-0"	3'-0"
20"	1'-0"	2'-0"	3'-0"	2'-8"	2'-8"
18"	10"	1'-8"	2'-0"	2'-6"	2'-6"
16"	10"	1'-6"	2'-0"	1'-6"	1'-0"
12"	8"	1'-4"	1'-6"	1'-6"	1'-0"
10"	6"	1'-4"	1'-6"	1'-0"	1'-0"
8"	6"	1'-0"	1'-6"	1'-0"	1'-0"
6"	6"	1'-0"	1'-0"	1'-0"	1'-0"
PRESSURE: 200 P.S.I.(MAX.) SOIL: 2000 P.S.F.					

WD-14C, CONCRETE BLOCKING DIMENSIONS – 200 PSI

CONC. BLOCKING DIMENSIONS					
X	A	B	C	D	D1
TEES - 30" RUN					
30"	3'-0"	8'-0"	11'-0"	8'-0"	3'-6"
24"	2'-6"	6'-6"	9'-0"	6'-6"	3'-6"
20"	2'-2"	5'-0"	7'-2"	5'-6"	3'-6"
18"	2'-0"	4'-6"	6'-6"	5'-0"	3'-6"
16"	1'-10"	3'-10"	5'-8"	4'-6"	3'-6"
12"	1'-6"	3'-6"	5'-0"	3'-0"	2'-6"
10"	1'-2"	2'-4"	4'-0"	2'-6"	2'-6"
8"	1'-0"	2'-4"	3'-0"	2'-6"	2'-6"
6"	10"	2'-4"	1'-6"	2'-6"	2'-6"
TEES - 24" RUN					
24"	2'-6"	7'-0"	9'-6"	6'-0"	3'-0"
20"	2'-2"	5'-4"	7'-6"	5'-4"	3'-0"
18"	2'-0"	4'-6"	6'-6"	5'-0"	3'-0"
16"	1'-10"	4'-2"	6'-0"	4'-4"	3'-0"
12"	1'-6"	4'-0"	5'-6"	2'-8"	2'-0"
10"	1'-2"	3'-10"	5'-0"	2'-8"	2'-0"
8"	1'-0"	2'-6"	3'-6"	2'-0"	2'-0"
6"	10"	2'-0"	2'-0"	2'-0"	2'-0"
TEES - 20" RUN					
20"	2'-2"	5'-4"	7'-6"	5'-4"	2'-8"
18"	2'-0"	4'-6"	6'-6"	5'-0"	2'-8"
16"	1'-10"	4'-2"	6'-0"	4'-4"	2'-8"
12"	1'-6"	4'-0"	5'-6"	2'-8"	2'-8"
10"	1'-2"	3'-10"	5'-0"	2'-0"	1'-8"
8"	1'-0"	3'-0"	4'-0"	1'-8"	1'-8"
6"	10"	1'-8"	2'-2"	1'-8"	1'-8"
TEES - 18" RUN					
18"	2'-0"	4'-6"	6'-6"	5'-0"	2'-6"
16"	1'-10"	4'-2"	6'-0"	4'-4"	2'-6"
12"	1'-6"	4'-0"	5'-6"	2'-8"	2'-6"
10"	1'-2"	3'-10"	5'-0"	2'-0"	1'-6"
8"	1'-0"	3'-6"	4'-6"	1'-6"	1'-6"
6"	10"	1'-8"	2'-6"	1'-6"	1'-6"
TEES - 16" RUN					
16"	1'-10"	3'-8"	6'-0"	4'-8"	2'-4"
12"	1'-6"	2'-10"	4'-4"	3'-4"	2'-4"
10"	1'-2"	3'-2"	4'-4"	2'-4"	2'-4"
8"	1'-0"	2'-0"	3'-0"	2'-4"	1'-4"
6"	10"	2'-0"	2'-10"	1'-4"	1'-4"
TEES - 12" RUN					
12"	1'-6"	3'-0"	4'-6"	3'-2"	2'-0"
10"	1'-2"	2'-10"	4'-0"	2'-6"	2'-0"
8"	1'-0"	2'-0"	3'-0"	2'-6"	2'-0"
6"	10"	1'-8"	2'-6"	1'-6"	1'-0"
PLUG - SAME AS TEE EXCEPT THAT THE LARGER SIZE IN UNEQUAL RUNS SHALL BE USED					

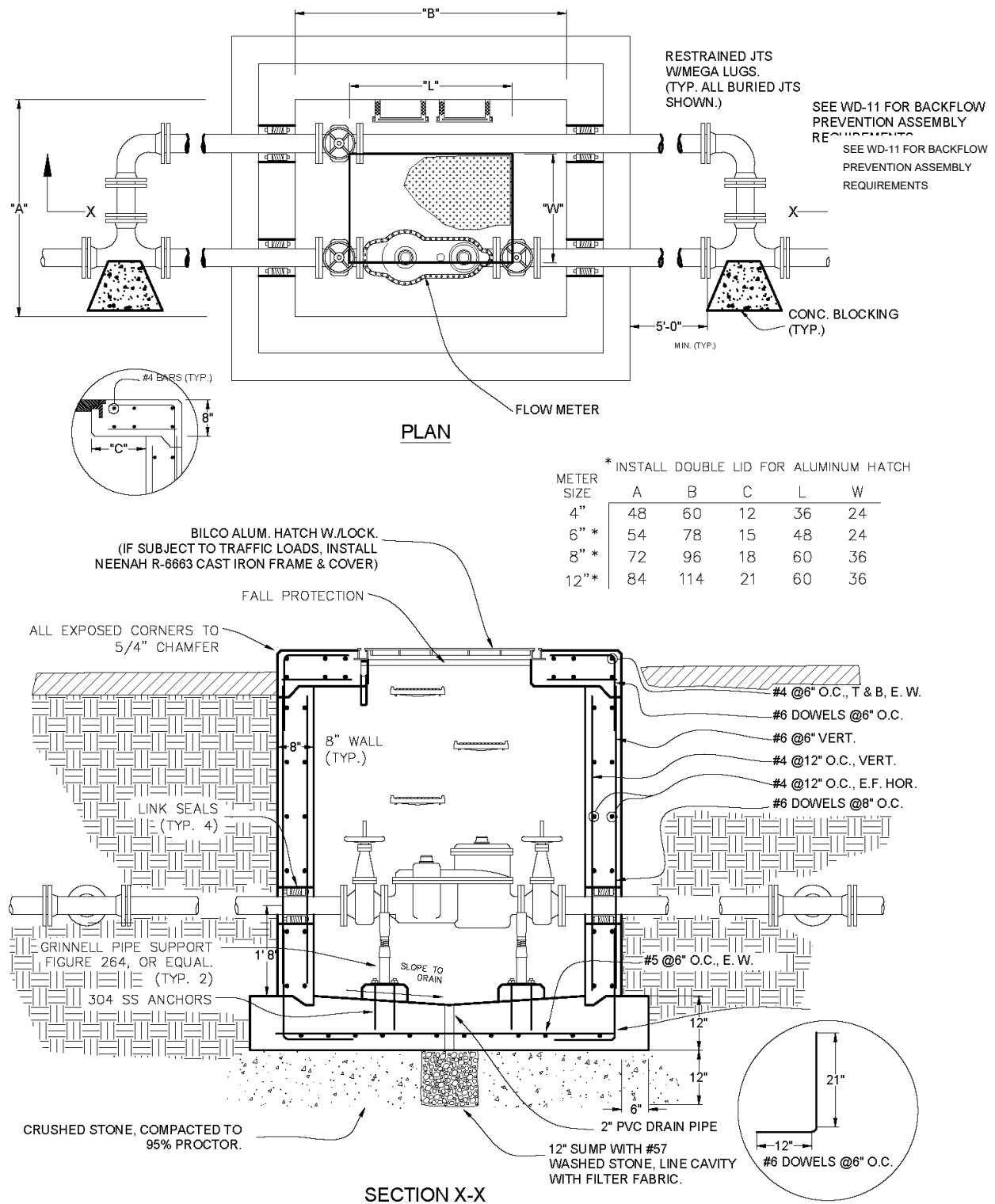
CONC. BLOCKING DIMENSIONS					
X	A	B	C	D	D1
TEES - 10" RUN					
10"	1'-2"	2'-10"	4'-0"	2'-6"	1'-10"
8"	1'-0"	2'-0"	3'-0"	2'-6"	1'-10"
6"	10"	1'-8"	2'-6"	1'-6"	0'-10"
TEES - 8" RUN					
8"	1'-0"	2'-0"	3'-0"	2'-6"	1'-8"
6"	10"	1'-8"	2'-6"	1'-6"	0'-8"
TEES - 6" RUN					
6"	10"	1'-8"	2'-6"	1'-6"	1'-0"
90° BENDS					
30"	2'-10"	11'-2"	14'-0"	9'-0"	3'-6"
24"	2'-6"	9'-6"	12'-0"	6'-8"	3'-0"
20"	2'-2"	8'-4"	10'-6"	5'-4"	2'-8"
18"	1'-10"	7'-2"	9'-0"	5'-0"	2'-6"
16"	1'-6"	6'-6"	8'-0"	4'-6"	2'-4"
12"	1'-2"	4'-8"	5'-10"	3'-6"	2'-0"
10"	1'-0"	3'-8"	4'-8"	3'-0"	1'-10"
8"	10"	2'-10"	3'-8"	2'-8"	1'-8"
6"	8"	2'-0"	2'-6"	2'-0"	1'-0"
45° BENDS					
30"	1'-4"	8'-2"	9'-6"	7'-2"	3'-6"
24"	1'-0"	7'-6"	8'-6"	5'-2"	3'-0"
20"	1'-0"	6'-0"	7'-0"	4'-4"	2'-8"
18"	10"	5'-2"	6'-0"	4'-2"	2'-6"
16"	10"	4'-2"	5'-0"	4'-0"	2'-0"
12"	8"	2'-6"	3'-0"	2'-6"	1'-10"
10"	6"	2'-0"	3'-0"	2'-0"	1'-8"
8"	6"	2'-0"	2'-6"	1'-8"	1'-8"
6"	6"	1'-6"	2'-0"	1'-6"	1'-0"
22 1/2° BENDS					
30"	1'-4"	5'-8"	7'-0"	5'-0"	3'-6"
24"	1'-0"	4'-6"	5'-6"	4'-0"	3'-0"
20"	1'-0"	3'-6"	4'-6"	3'-6"	2'-8"
18"	10"	3'-2"	4'-0"	3'-6"	2'-6"
16"	10"	2'-8"	3'-6"	3'-0"	2'-0"
12"	8"	2'-0"	3'-0"	2'-0"	2'-0"
10"	6"	2'-0"	2'-6"	1'-10"	1'-10"
8"	6"	1'-4"	1'-8"	1'-8"	1'-8"
6"	6"	1'-0"	1'-6"	1'-0"	1'-0"
11 1/4° BENDS					
30"	1'-4"	3'-8"	5'-0"	3'-6"	3'-6"
24"	1'-0"	3'-0"	4'-0"	3'-0"	3'-0"
20"	1'-0"	2'-0"	3'-0"	2'-8"	2'-8"
18"	10"	2'-0"	2'-6"	2'-6"	2'-6"
16"	10"	1'-8"	2'-6"	2'-0"	1'-4"
12"	8"	1'-6"	2'-2"	1'-4"	1'-4"
10"	6"	1'-6"	1'-6"	1'-4"	1'-4"
8"	6"	1'-4"	1'-6"	1'-0"	1'-0"
6"	6"	1'-0"	1'-6"	1'-0"	1'-0"
PRESSURE: 250 P.S.I.(MAX.) SOIL: 2000 P.S.F.					

WD-14D, CONCRETE BLOCKING DIMENSIONS – 250 PSI

PRESSURE: 150 P.S.I.					
45° BEND					
PIPE DIA.	W	X	Y	Z	ØROD DIA.
30"	1'-5"	13'-0"	13'-0"	13'-0"	2"
24"	1'-3"	11'-3"	11'-3"	11'-3"	1 1/2"
20"	1'-1"	10'-0"	10'-0"	10'-0"	1 1/2"
16"	12"	8'-6"	8'-6"	8'-6"	1"
12"	10"	7'-2"	7'-2"	7'-2"	1"
10"	8"	6'-3"	6'-3"	6'-3"	3/4"
8"	6"	5'-6"	5'-6"	5'-6"	3/4"
6"	4"	4'-6"	4'-6"	4'-6"	3/4"
22 1/2° BEND					
PIPE DIA.	W	X	Y	Z	ØROD DIA.
30"	2'-0"	11'-0"	11'-0"	11'-0"	1 1/2"
24"	1'-8"	8'-10"	8'-10"	8'-10"	1 1/2"
20"	1'-5"	7'-10"	7'-10"	7'-10"	1 1/2"
16"	1'-4"	7'-0"	7'-0"	7'-0"	1"
12"	1'-3"	5'-9"	5'-9"	5'-9"	1"
10"	12"	5'-0"	5'-0"	5'-0"	3/4"
8"	10"	4'-4"	4'-4"	4'-4"	3/4"
6"	8"	3'-8"	3'-8"	3'-8"	3/4"

WD-14E, DOWN BEND CONCRETE BLOCKING DIMENSIONS – 150 PSI

Note: For higher pressure than shown, provide engineering design for larger size blocking required.



WD-15, MULTI-FAMILY COMMERCIAL WATER METER INSTALLATION, N.T.S.