

Specifications and Details for the Design and Construction of Sanitary Sewer and Water Systems



Columbus/Muscogee County & Fort Moore

2023

**SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF SANITARY
SEWER SYSTEMS-COLUMBUS/MUSCOGEE COUNTY**

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SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF SANITARY SEWER SYSTEMS-COLUMBUS/MUSCOGEE COUNTY

Section 1.01 – Purpose:

This section of the Specifications describes materials to be incorporated into sanitary sewer lines and requirements for installation and use of these materials. The Contractor/Developer shall furnish all materials and perform all labor necessary to fulfill the requirements of these Specifications. **When public sanitary sewer service is desired in a development, the main(s) and other system upgrades necessary to support the development with an acceptable level of service, i.e. main line connections, lift stations, road bores, manholes, monitoring equipment, or any other upgrades necessary to meet CWW standards, will be at the Developer's expense.**

Compliance with these specifications by the Contractor/Developer is required to ensure a public sanitary sewer system constructed with materials approved by Columbus Water Works (CWW). Compliance with these specifications by the Contractor/Developer is a condition of acceptance of the sanitary sewer system into the maintenance program and creates no contractual relationship between CWW and the Contractor. CWW reserves the right to reject any installed items not in compliance with these specifications. *Columbus Water Works also reserves the right to accept exceptions to these standards if conditions warrant changes. Any proposed changes must be clearly indicated on drawings and addressed in a cover letter to CWW. Only changes approved by CWW Engineering will be acceptable.* Latent indications of deficient installation or materials of the sanitary sewer system and/or appurtenances will be the responsibility of the Developer to rectify at his expense.

Section 1.02 – Definitions:

Unless the context specifically indicates otherwise, the meanings of terms used in these Specifications for the Design and Construction of Sanitary Sewers shall be as follows:

- A. "Columbus Water Works" (CWW) shall mean the operating organization working under the policies and direction of the Board of Water Commissioners.
- B. "Engineer" shall mean Owner's/Developer's engineer that is a licensed Professional Engineer (PE) **in the state of Georgia.**
- C. "Division of Engineering" shall mean CWW Engineering office, which is authorized to have jurisdiction over the sanitary sewer system design and construction.
- D. "Owner/Developer" shall mean any individual, firm association, syndicate, partnership, corporation, trust, or any other entity proposing to subdivide land or provide new or renewed sanitary sewer service for him or for another.
- E. "Contractor" shall mean the constructor or his representative, whether doing work on a contract basis with CWW or working directly for the Owner/Developer.
- F. "Shall" is mandatory; "May" is permissive.

- G. “Building Sewer” or “Service Lateral” shall mean that part of the horizontal piping of a drainage system which extends from the ends of the building drain and which receives the discharge of the building drain and conveys it to a public sanitary sewer, private sanitary sewer, individual sewage-disposal system or other point of disposal.
- H. “Building Drain” shall mean that part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer three (3) feet outside the building wall.
- I. “Public Sanitary sewer” shall mean a common sanitary sewer controlled by public authority.
- J. “Sanitary Sewer” shall mean a sanitary sewer, which carries liquid and waterborne waste from residences, commercial buildings and industrial plants which excludes storm, surface and groundwater.
- K. “Sewage” shall mean any liquid waste containing animal or vegetable matter in-suspension or solution and may include liquids containing chemicals in solution.
- L. “Sewer” shall mean a pipe or conduit for carrying sanitary sewer.
- M. “Subdivision Sanitary Sewer” shall mean a main sanitary sewer that conveys “sewage” from “building sewers” in an area of subdivided land to a trunk line.
- N. “Trunk Line” shall mean any main line of CWW sanitary sewer system.

Section 1.03 - General:

A. Applicable Standards:

Supply all materials and perform all work in accordance with CWW standards, City of Columbus Ordinance 83-101 (#04-74), American Water Works Association (AWWA) standards, WEF Manuals of Practice, ASCE Manuals and Reports on Engineering Practice, Recommended Standards for Sewage Works, Great Lakes Upper Mississippi River Board of State Sanitary Engineers (10-State Standards), Environmental Protection Agency (EPA) Publications, WEF Journals, latest editions of each, and standards referenced therein, and manufacturers specifications for installation.

B. Laws and Regulations:

The Contractor’s/Developer’s attention is directed to the fact that all applicable federal, state, county, and city law, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the project throughout. The Contractor shall keep fully informed of all laws, ordinances, and regulations of the federal, state, county, city and municipal governments or authorities in any manner affecting those engaged or employed in the work or the materials used in the work and of all orders and decrees of bodies or tribunals having any jurisdiction or

authority over the same. If any discrepancy or inconsistency should be discovered in these specifications herein referred to, in relation to any such law, ordinance regulation, order or decree, the Contractor shall herewith report the same, in writing, to CWW.

For all sanitary sewer systems installed within Columbus/Muscogee County, contractors shall possess a valid Georgia Utility Contractor's License and GSCWW Level IA certification. The Contractor shall at all times observe and comply with all such existing and future laws, ordinances, and regulations, and shall protect and indemnify CWW, and their agents against the violation of any such law, ordinance, regulation, order or decree, whether by the Contractor or by the Contractor's employees.

The Contractor/Developer is responsible for enforcing safety in accordance with all OSHA and other regulations. CWW assumes no responsibility for the Contractor's/Developer's job site safety program.

C. Lands and Rights of Way:

In order for the sanitary sewer system to be accepted by CWW, the Developer shall provide all necessary easements to insure full ingress and egress for the purpose of maintaining said system. Easements will be a minimum of twenty (20) feet wide and in the name of Columbus Water Works.

Any easement which is intended to be dedicated to Columbus Water Works must be included on the as-built. The easement must be recorded at the county clerk's office by at least one of the two following ways:

1. A CWW sanitary sewer easement agreement form and two (2) drawings shall be recorded with the county clerk. The Engineer shall furnish easement drawings on 8 ½" x 11" or 8 ½" x 14" sheet size. The drawing must be clear and legible for printing and at a reasonable scale. The drawing must show property lines, the name of property owners with length of line encroaching on each property owner, size of line, width of easement, scale of drawing, north arrow, land lot and district numbers. Any street names or other existing easements shall also be shown. All easement plats shall utilize a title block.
2. The following verbiage can be included on the final recorded plat: "Water and sanitary sewer easements are granted for the purpose of constructing and maintaining water mains and sanitary sewers and for no other purpose, and the duly authorized agents and employees of the Columbus Water Works shall have the right of access to the said strip of land for the purpose of constructing said water and sanitary sewer mains and for inspecting and maintaining the same in good serviceable condition, and for said purposes they shall have the right to cut and remove any trees or vegetation which may interfere with proper construction and maintenance; and during construction the Columbus Water Works may use any additional adjacent ground which may be necessary for temporary storage of excavated dirt or materials required for construction."

D. Testing, Inspection & Acceptance of Work:

1. Testing of Materials:

Unless otherwise specifically provided for in the Specifications, the inspection and testing of products to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by CWW; the cost of such inspection and testing shall be paid by the Contractor. The Contractor shall furnish evidence, satisfactory to CWW, that the products have passed the required tests prior to their incorporation into the work. The Contractor shall promptly segregate and remove rejected products from the site of the work.

2. Inspection:

The Contractor/Developer shall furnish CWW with every reasonable facility for ascertaining whether or not the work performed and products used are in accordance with the requirements and intent of the Specifications. No work shall be done or products used without suitable inspection by CWW. Failure to reject any defective work or product shall not in any way prevent later rejection when such defects are discovered, or obligate CWW to final acceptance.

3. Authority and Duties of CWW Inspector:

The Inspector will be authorized to inspect all work done and all products furnished, including preparation, fabrication and manufacture of the products to be used. The Inspector may reject material and workmanship or suspend the work until any question at issue can be referred to and resolved by CWW and the Contractor/Engineer. The responsibility of the Contractor is not lessened by the presence of the Inspector.

4. Acceptance of Work and Materials:

All products furnished and all work done that is not in accordance with the approved drawings or Specifications or that is defective will be rejected. All rejected products or work shall be removed. All unacceptable products or work shall be replaced with other products or work that conforms to the approved drawings and specifications. Service will not be allowed until installation is acceptable to CWW.

5. Contractor's/Developer's Responsibility:

Inspection of the work will not relieve the Contractor/Developer of any obligations to meet the requirements of the Specifications and defective work shall be made good regardless of whether such work has been previously inspected and accepted. The failure of CWW to reject improper work shall not be considered a waiver of any defect that may be discovered later.

Section 1.04 - Sequence of Activities:

The following is the sequence of steps which will be required for preliminary activities as well as construction and final acceptance activities for successful acceptance of the sanitary sewer system by CWW:

- Submit to CWW Division of Engineering electronic (PDF) of construction drawings for water and sanitary sewer review.
- CWW review of drawings.
- CWW returns marked up drawings back to Engineer and keeps a file copy.
- Engineer's review (transpose CWW mark ups onto construction drawings).
- Engineer returns five (5) transposed drawings (3 full sets, plus 2 additional site plan sheets) for approval.
- CWW reviews, stamps and sends back one (1) approved set of drawings with the Approved for Construction letter and fee sheet for any commercial development. The "Approved for Construction" status is valid for one (1) year from date of approval. The fees listed on the commercial fee sheet, as-builts, and sewer documents are due before water and/or sewer service will be provided.
- At the pre-construction conference, the CWW Inspector will give the Contractor an approved set of plans and go over CWW approved plans, discuss the dates of construction, and review anticipated procedures.
- One (1) copy of CWW stamped approved plans shall be maintained on site by the Contractor at all times.
- Notify CWW Inspector forty-eight (48) hours before pipe construction begins.
- CWW Inspector checks and approves all stockpiled materials prior to construction.
- To coordinate flushing of a new line, call the CWW Inspector and give at least a forty-eight (48) hour notice.
- Give twenty-four (24) hours' notice to CWW Inspector for final inspection of the system.
- Contractor/Developer shall submit as-built drawings to CWW for approval. See Section 1.24.
- CWW final acceptance is based upon receipt of sanitary sewer availability fees and approved as-built drawings.

The following is a more in-depth explanation of the above steps and should be thoroughly studied:

A. Construction Drawings:

1. The Engineer will be required to furnish two (2) full sets of preliminary construction plans to CWW Division of Engineering for review and comment. The plan must include the Engineer's sewer system design and flow calculations. Upon completion of the preliminary review, the Developer of the project will be notified by CWW of the availability status of sanitary sewers. Additional copies needed by the Contractor/Developer will be submitted as required. *The Engineer will need to show all proposed easements with widths on the first submittal. Typical easements are*

twenty (20) feet wide and should be dedicated easements. The first submittal should also include any phase lines for subdivisions.

2. CWW Division of Engineering will review the submitted construction plans and make changes as necessary to indicate to the Contractor/Developer any changes which need to be made prior to construction activity. CWW Engineering will review the plans, but the responsibility for the design will be with the Engineer. Any plans marked “Amend and Resubmit” or “Rejected” will require a resubmittal prior to construction. Plans marked “No Exceptions Taken” or “Make Corrections Noted” may be stamped approved for construction by CWW Division of Engineering. In this case, a Contractor/Developer is permitted to begin construction activities.
3. All drawings submitted to CWW Engineering shall be stamped by a Professional Engineer registered in the State of Georgia. The drawings shall include the following basic information:
 - Engineer’s name, address, and phone number.
 - Developer’s name, address, and phone number.
 - Subdivision identification or project identification, revision number of the plans, scale, date of latest drawing, north arrow, and sheet number.
 - Location map and drainage basin or creek.

B. Submittals Required:

The Contractor/Developer shall furnish drawings and descriptive literature for all manufactured and fabricated products to CWW for review. Additional information such as special drawings, schedules, calculations, system curves, etc., shall be provided as requested by CWW.

C. Site Plan Drawings:

1. The Contractor/Developer shall review and check drawings and submittals and shall indicate approval by initials and date. Contractor/Developer shall furnish CWW three (3) full sets and two (2) site plans of construction drawings and all submittals. A transmittal form shall accompany each submittal or group of submittals.
2. Plan and profile sheets shall be provided for ALL proposed sanitary sewers except service laterals. Profiles shall have a horizontal scale of not more than one hundred (100) feet to the inch and a vertical scale of not more than ten (10) feet to the inch.

D. Columbus Water Works Review:

All submittals will be reviewed, stamped, and dated by CWW before being returned to the Engineer with the following acceptance comments:

1. No Exceptions Taken: Plans are approved without modification.
2. Make Corrections Noted: Comply with comments marked on drawings by CWW. Plans are approved.
3. Amend and Resubmit: Comments are excessive. Make necessary changes and resubmit.
4. Rejected: Drawings are insubstantial and/or non-compliant with Specifications; return to Engineer.

E. Drawings for Construction:

Drawings or other submittals not bearing the CWW approval stamp shall not be utilized for construction purposes. The Contractor/Developer shall maintain a complete set of construction drawings at the job site bearing CWW approval color stamp.

F. Construction Notification:

It shall be the responsibility of the Contractor/Developer to notify CWW Division of Engineering of the date of construction and name of the Contractor performing said construction, as well as his address and telephone number.

G. Construction and Inspection Procedure:

Curb and Gutter should be in prior to the sanitary sewer, unless approved by CWW Inspector. Avoid cleanouts in the curb and gutter.

The Contractor/Developer will install the sanitary sewer main including all manholes along with all service lines, cleanouts, etc. Installation of sanitary sewer mains shall be in accordance with the following procedures:

1. Notify the CWW Inspector forty-eight (48) hours before any pipe is to be laid. Where the sanitary sewer line is to be within a new road right-of-way, all curbing must be in place. The pipe, manholes, fittings, gaskets, etc., must be on the site and ready to be inspected. A pre-construction conference is required with the CWW Inspector on site. *The approved CWW stamped plans will be given to the Contractor at this meeting.*
2. CWW does not locate sanitary sewer lines in subdivisions that have not yet been accepted.
3. Testing shall be done in accordance with Section 1.22 of these specifications.

4. After passing test results, sewer availability fees have been received (if applicable), and as-built drawings have been accepted, the Owner/Developer will be notified that the line is accepted for maintenance by CWW.
5. Field changes may be worked out with an onsite review with the CWW Inspector, Contractor, and Engineer. Agreement to changes shall be noted on the Inspector's drawings, initialed by the parties in attendance, and verified on the as-built drawings.
6. Numbers to Call:

For inspection, testing, or questions, contact the Engineering Department at (706) 649-3478 or (706) 649-3472.

H. As-Built Drawings:

See Section 1.24 – Requirements for As-Built Drawings.

I. Final Acceptance:

Final acceptance into the sanitary sewer system will take place upon receipt by CWW of as-built drawings prepared on a recorded plat and sanitary sewer availability fees and any applicable charges due to CWW. CWW must have a copy of the as-built drawing before water service will be provided. Once the as-built is provided then water service can be applied for. CWW will only accept the main line for maintenance when all other utilities are in, the cleanout locations are properly set at the right of way line and the as-built drawings have been accepted by CWW.

Section 1.05 - Requirements to Connect to Sanitary Sewer System:

This section sets forth general requirements to be met where sanitary sewers are to be constructed by a Developer and accepted into the CWW sanitary sewer system for maintenance.

A. Required Sanitary Sewer Connections:

1. All sinks, dish washing machines, lavatories, basins, shower baths, bathtubs, laundry tubs, washing machines, and similar plumbing fixtures or appliances shall be connected to the sanitary sewer system when there is "sanitary sewer availability" and when the structure is capable of being "served".
2. No person shall make connections of roof down spouts, foundation drains, areaway drains, swimming pools, or other sources of surface runoff or groundwater into a building sanitary sewer or building drain which in turn is connected directly or indirectly to the sanitary sewer system unless such connection is approved for purposes of disposal of polluted surface drainage and for which a discharge permit has been issued.

B. Sanitary Sewer Availability:

1. Sanitary sewer shall be considered available, to a site not within a subdivision, when the ground level floor of the structure can be connected by gravity flow to a public sanitary sewer line in any public right-of-way or easement, which is within a distance as determined by CWW.
2. In order for sanitary sewer service to be considered "available," there must be adequate capacity in the sanitary sewer line, sanitary sewer collection system, and the receiving wastewater treatment plant, as determined by CWW. Capacity upgrades necessary, due to new development, are the responsibility of the Developer.

C. Capability of Being Served:

1. The sanitary sewer system is designed to provide gravity service to the ground level floor of structures. Basements and below-ground living areas may or may not be capable of sanitary sewer service due to vertical accessibility.

D. Connecting to Sanitary Sewer:

1. Application and Payment of Fees:
 - a. The Owner/Developer must apply in person at the CWW Customer Service Department. All fees must be paid in full at the time of application in order for the application to be processed.

E. Physical Connection to Sanitary Sewer:

1. CWW Owned Sanitary Sewers:
 - a. Where a sanitary sewer tap and stub out has been previously provided, the Owner is responsible for having the sanitary sewer connection completed, at his own expense, from the structure to the stub out.
 - b. Where no sanitary sewer stub-out is provided and where installation is feasible CWW will, for a fee, make a tap for the Owner and will install the service lateral and riser to the edge of the permanent easement or public right-of-way. It is the Owner's responsibility to have the sanitary sewer connection completed from the stub-out to the structure, including a clean out at the property line/easement per CWW detail S-9.
2. For Developer Owned Sanitary Sewers:
 - a. Connection to a Developer owned sanitary sewer shall be the responsibility of the Developer at his own expense to provide the physical connection from the sanitary sewer and provide a stub-out to the property line. All such construction by the Developer must be conducted in accordance CWW Sanitary Sewer Specifications.

- b. A connection to a service lateral will not be allowed until the sanitary sewer system is accepted by CWW for maintenance and all fees have been paid.
- 3. Structure to Stub-out Permitting:
 - a. A plumbing permit must be obtained through the City of Columbus Inspection and Building Codes Enforcement Department in order to make the physical connection from the structure generating wastewater to the stub-out/cleanout provided by CWW or the Developer. The City of Columbus Inspections and Codes Enforcement Department must inspect all physical connections to the CWW sanitary sewer stub-out/cleanout.
- 4. Sand and Oil/Grease Interceptors:
 - a. All users involved in the preparation of food for commercial purposes shall provide oil/grease traps. The design criteria for oil/grease interceptors is shown in Columbus, Ga. Ordinance 83.101 and CWW “Program for the Control of Grease and Oil in the Sanitary Sewer System”.
 - b. All users whose wastewater is generally accompanied by unusually large quantities of grit, sand or gravel shall be required to install a sand/grit interceptor. All car/truck wash systems shall be required to install sand traps. The design criteria for sand/grit interceptors is shown in Columbus, Ga. Ordinance 83.101 and CWW “Program for the Control of Grease and Oil in the Sanitary Sewer System”.
- 5. Septic Tanks:
 - a. Conditions for which Sanitary Sewers are required and Septic Tanks allowed:
 - i. For new subdivisions in areas where CWW has active sanitary sewer available in the drainage basin, active sanitary sewer service shall be provided to all lots.
 - ii. To facilitate future collection system expansion, sanitary sewer systems must be considered and easements granted even for subdivisions which do not have sanitary sewer services available. Construction plans must include plan view of future sewer lines for entire subdivision or development with proposed easements. Conditions may warrant wider than typical easements. A site visit by a CWW representative and the Engineer may be necessary before plans are approved. All future manholes should be staked and line of sight cut prior to the field meeting. Additional design may be required. Easements must be recorded on a final plat and shown on final as-built drawings. It will be the Developer’s responsibility to provide sanitary sewer easements on the property so as to allow for adequate access for future tie-in to the CWW sanitary sewer system. Consideration must be given to DNR required 25-foot vegetative buffers along creeks, at the time of preliminary design, and the site visit. Easements should be placed accordingly.

- iii. In the event that septic tanks are required as temporary sanitary sewer options, gravity sewer design and easements are required for future public sewer service.

F. Prohibited Sanitary Sewer Locations.

1. Generally, no sanitary sewers shall be located in or under detention basins, ponds, lakes, dams or slopes which will prohibit access by maintenance vehicles.
2. No sanitary sewer mains will be accepted that are installed through or in close proximity to an abandoned landfill site or any other site used for waste disposal.

Section 1.06 – Materials:

The Contractor/Developer shall furnish all pipe, manholes, fittings, and other material required to complete the work. All materials shall be manufactured in the United States, unless approved by CWW. Materials will be in accordance with the following:

A. Description:

This section includes requirements for furnishing pipe, fittings, and structures. The term “Manufacturer” shall mean an organization, which has at least ten (10) years’ experience in producing and furnishing materials of size and type specified. All manufacture and testing of materials will be conducted in facilities located in the U.S.A. and operating under laws and regulations of the U.S.A.

B. Quality Assurance:

1. All material suppliers shall be ISO registered or provide the services of an independent inspection agency. Prior to the start of manufacturing, any Manufacturer not meeting the ISO registration requirements, shall submit to CWW the name of an independent inspection agency for approval. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical tests, sample visual inspection of quality assurance tests performed on in-process pipe and fittings, and a sample visual and dimensional inspection or finished product for this project. Chemical samples shall be taken from each ladle of iron and the Manufacturer’s chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus, silicon, magnesium, chromium, manganese, tin, aluminum, cerium, copper, and lead. When chemical values fall outside the Manufacturer’s control limits, additional mechanical property tests shall be performed to assure minimum mechanical properties are met.
2. Reinforced Concrete Pipe (R.C.P.) shall be accepted on the basis of plant load-bearing tests, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in ASTM C 76. Provide results of tests on pipe, joint material, and made-up joints performed by an independent testing laboratory approved by CWW if requested. Include materials, absorption, crushing (where applicable), and hydrostatic leakage tests on pipe of each size in accordance with applicable

specifications. Each length of pipe shall be stamped by the approved testing laboratory. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Pipe that has been repaired or patched at the gasket grooves, shoulders, or barrel shall not be accepted.

3. Polyvinyl Chloride Pipe (PVC) shall be accepted on the basis of CWW inspection and the Manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, if requested. Provide results of tests on pipe, joint material, and made-up joints performed by an independent testing laboratory approved by CWW if requested. Include materials, absorption, crushing (where applicable), and hydrostatic leakage tests on pipe of each size in accordance with applicable specifications. Each length of pipe shall be stamped by the approved testing laboratory. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Pipe that has been repaired or patched at the gasket grooves, shoulders, or barrel shall not be accepted.
4. Submit affidavits of compliance from the Manufacturer for the following:
 - a. Reinforced Concrete Pipe in accordance with the requirements of ASTM C 76 and gasket type joints conforming to ASTM C 443.
 - b. Ductile iron pipe in accordance with the requirements of AWWA C151/ANSI A21.51 and these specifications. Cement mortar lining of ductile iron pipe in accordance with the requirements of AWWA C104/ANSI A21.4 and these specifications. Rubber gasket joints for push-on or mechanical joints shall be in accordance with the requirements of AWWA C111/ANSI A21.11 and these specifications.
 - c. Polyvinyl Chloride Pipe in accordance with the requirements of ASTM D 3034 and elastomeric gasket in accordance with the requirements of ASTM D 3212.
 - d. All pipe shall be certified that it is in compliance with this specification and shall be certified by a Professional Engineer.
5. Within forty-eight (48) hours' notice CWW and its agents shall be allowed a full inspection of the manufacturing operations, testing procedures, and quality compliance documentation.

C. Reinforced Concrete Pipe (R.C.P.):

1. Pipe shall be reinforced concrete bell and spigot conforming to ASTM C 76 for Wall B pipe and shall be supplied in lengths of at least six (6) feet.
2. Pipe shall have rubber gasket type joints conforming to ASTM C 443. A rectangular groove shall be supplied in the spigot end to receive the rubber gasket, and it shall be

so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four (4) sides.

3. Bell and spigot surfaces shall be accurately formed and smooth to provide a close siding fit with a nominal clearance of one-sixteenth (1/16) inch.

D. Ductile Iron Pipe (D.I.P.):

1. All D.I.P. shall be furnished in lengths of at least eighteen (18) to twenty (20) nominal feet. D.I.P. shall be manufactured by American Cast Iron Pipe Company or U.S. Pipe and shall be made in the U.S.A unless approved by CWW.
2. D.I.P. shall conform to ANSI/AWWA C151/A21.51. CWW requires a minimum of pressure class 250 but may request additional design data on sizing.
3. D.I.P. shall be cement lined in accordance with AWWA C104. Pipe shall be furnished with a bituminous outside coating. Manufacturer shall demonstrate ability to produce a high-performance lining. Plans/specifications may call for the exterior of ductile iron pipe to be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be two hundred (200) g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than three (3) mils with a local minimum not less than two (2) mils. All pipe shall be manufactured and coated in the United States at the pipe Manufacturer's facility. Soil conditions may require a V Bio Polywrap approved by DIPRA.
4. Push-on joints for D.I.P. shall be rubber gasketed joints in accordance with the applicable requirements of AWWA C111/ANSI A21.11. Standard push-on joints shall not exceed the Manufacturer's specifications. Standard and special deflection bells shall not exceed the Manufacturer's specifications. Restrained joint pipe shall be American "Flex-Ring", U.S. Pipe "TR-Flex", Amarillo Fast Grip, or Barracuda Gaskets. All "restrained" bells shall be painted yellow.
5. Mechanical joints for D.I.P. shall be rubber gasket joints in accordance with the applicable requirements of AWWA C111/ANSI A21.11. Mechanical joints shall not exceed the Manufacturer's specifications. The pressure rating for mechanical joints shall be a minimum of two hundred and fifty (250) psi.
6. Pipe Manufacturer may be required to provide a Manufacturer's representative for product design and installations seminars and provide on-site review of material as requested by CWW.
7. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of two hundred and fifty (250) psi. Fittings shall be cement lined in accordance with AWWA C104 and shall be furnished with a bituminous coating. In lieu of cement lining and bituminous coating, fittings may be provided with a fusion bonded coating and lining meeting the requirements of AWWA C116.

E. Polyvinyl Chloride Pipe (PVC):

1. PVC gravity sanitary sewer pipe shall be SDR 35 pipe, manufactured in accordance with ASTM D 3034 and shall be supplied in lengths not longer than fourteen (14) feet unless approved by CWW.
2. Pipe and fittings shall be of the bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage in accordance to ASTM D 3212. The joint system shall be subject to the approval of CWW and shall be identical for pipe and fittings. Fittings for pipe shall be one (1) piece with no solvent-welded joints. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings delivered ready for use.
3. All PVC gravity sanitary sewer pipe shall be laid with a minimum of Type 5 bedding. The installation shall conform to the requirements of ASTM D 2321. See Detail S-10 for chart on pipe materials and laying conditions. Do not install pipe that has exceeded the UV date stamp or that has visible cracks. Do not store pipe in direct sunlight.
4. When installed in a casing, the pipe shall be supported by stainless steel casing spacers as manufactured by Advance Products and Systems, Inc., BWM, Cascade Waterworks Manufacturing CCI Pipeline, Pipeline Seal and Insulator, Inc., or approved equal. Install in accordance with Manufacturer's instructions.

F. Detection Tape:

1. Detection tape is required for all sanitary sewer mains and laterals.
2. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewer Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum two (2) inches when buried less than ten (10) inches below the surface. Tape width shall be minimum three (3) inches when buried greater than ten (10) inches and less than twenty (20) inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

G. Tracer Wire:

1. Tracer Wire shall be installed on the centerline of all mains and laterals (to property line). Tracer wire shall be green in color #12 awg, and eight hundred eight ten thousandths (0.0808) inch in diameter. Tracer wire shall be manufactured by Copperhead model #1230HS, Pro-Trace® HF-CCS PE30 or approved equal.
2. A water tight connection to the wire shall be provided on the lateral. Wire shall not enter manhole through boot.

H. Adapter Couplings:

1. Adapter couplings shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials.
2. Adapters shall provide a positive seal against infiltration and exfiltration and remain leak proof and root proof up to four point three (4.3) psi.
3. The adapter Manufacturer shall provide steel clamps, adapter donuts, and other required accessories. Couplings shall be equal to products of Fernco and shall be installed in accordance with the Manufacturer's recommendations.
4. CWW allows use of a transition coupling such as manufactured by "Harco".

I. Manholes:

1. Precast Concrete Sections:

- a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be four thousand (4,000) psi. The minimum shell thickness shall be six (6) inches or one-twelfth (1/12) of the inside diameter of the riser of the largest cone diameter, whichever is greater.
- b. Seal joints between precast sections by means of rubber "O" ring gaskets or flexible, butyl rubber sealant equal to products of Concrete Sealants CS202, Kent Seal No.2, or Ram-Nek.
- c. Sealant shall not be pre-formed type with a minimum nominal diameter of one (1) inch.

2. Iron Castings:

- a. Cast iron manhole frames and covers shall be gray iron, conforming to ASTM A 48 for Class 30 gray iron and all applicable local standards.
- b. All castings shall be tough, close grained, smooth, and free from blow holes, blisters, shrinkage, strains, cracks, cold shots, and other imperfections.
- c. No casting will be accepted which weighs less than ninety-five (95) percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking.
- d. All castings shall be thoroughly cleaned in the shop and given two (2) coats of approved bituminous paint before rusting begins.
- e. All castings shall be AASHTO H-20/HS-20 traffic rated, capable of passing the proof load test as described in AASHTO M 306.

- f. Manhole frames and covers shall be one of the following types:

Type	Design Weight	Manufacturer's Reference
Standard	385#	U.S. Foundry 223 Ring & Cover (Columbus, GA Standard)
Watertight	385#	U.S. Foundry 223 BN Ring & Cover (Columbus, GA Standard)

Type	Design Weight	Manufacturer's Reference
Standard	370#	EJ V-1349 2HL Sewer Ring & Cover Product # 41349041A01 (Columbus, GA Standard)
Watertight	370#	EJ V-1349 Sewer Ring & Cover Product # 41349040A01 (Columbus, GA Standard)

- g. All frames and covers shall have machined horizontal bearing surfaces and have "SEWER" cast into the cover.
- h. All manholes shall have standard frames and covers except where specifically shown otherwise on the drawings.
- i. Watertight covers shall be bolt-down type and shall be equipped with two (2) one-half (1/2) inch stainless steel bolts and a one-eighth (1/8) inch red rubber or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole. Bolt holes shall have the full three hundred and sixty (360) degree circle within the cover's radius when bored through the cover.

3. Rubber Boots:

Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

4. Plastic Steps:

Manhole steps of polypropylene molded around a steel rod, equal to products of M.A. Industries, shall be used.

5. Brick and Mortar:

- a. Brick and mortar shall be used to raise manhole to finish grade. Brick and mortar are not to exceed one (1) foot in height. If manhole must be raised higher to match finish grade, concrete riser sections are to be used.
- b. Brick shall be whole and hard burned, conforming to ASTM C 32 Grade MS.

- c. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 144.
- d. Inside/outside of brick riser section shall be of a mortar finish.

Section 1.07 - Design:

A. Design Period:

- 1. Sanitary sewer systems should be designed for the estimated ultimate tributary population. Tributary population is considered to be all areas upstream of the discharge point of the system being designed. Sanitary sewers must be designed and easement provided to the uppermost and lowermost property lines of the development being served. Consideration should be given to the maximum anticipated capacity of institutions, industrial parks, etc.
- 2. Sanitary sewer systems must be designed and easements recorded for all developments, including those in basins that currently do not have sanitary sewer available. Sanitary sewer availability fees will not be required at time of plan approval for basin area that is not being developed in the current phase.

B. Design Factors:

1. General:

In determining the required capacities and materials of sanitary sewers, the following factors should be considered:

- a. In some circumstances CWW may require a review of the Engineer's basis of design to include but not be limited to the following:
 - i. Maximum daily sewage flow based on accepted peaking factors.
 - ii. Minimum flows to maintain two (2) fps.
 - iii. Additional maximum sewage or waste flow from industrial plants.
 - iv. Groundwater infiltration.
 - v. Topography of the area.
 - vi. Depth of excavation.
 - vii. Manholes in flood plain.

- b. New sanitary sewers for residential areas shall be designed on the basis of an average daily flow of sewage of not less than four hundred (400) gallons per household per day. Peaking factors will be addressed on a case by case basis.
- c. Sanitary sewers shall not be designed to transport storm water.

2. Details of Design and Construction:

- a. No sanitary sewer mains shall be less than eight (8) inches in diameter.
- b. All sanitary sewers in street right-of-way shall have a minimum of three (3) feet of cover at the inlet end of all service laterals at the street right-of-way, and over any part of the collector sanitary sewer or service lateral within the street right of way when possible. Laterals shall be installed using a riser as shown in Details S-8, S-9 and S-11.

3. Sanitary Sewer Slopes:

- a. All sanitary sewers shall be so designed and constructed to give mean velocities, when flowing half full, of not less than two (2) feet per second nor greater than ten (10) feet per second*. The following table shows the minimum slopes allowed.

Sewer Size	Min. Slope in ft/100ft.
8"	.50
10"	.40
12"	.35
14"	.22
15"	.20
16"	.20
18"	.20

- b. Maximum slopes up to eighteen (18) percent are allowed, however, any designs with slopes greater than fifteen (15) percent Engineer must submit flow calculations with plans.

* Special design considerations may be incorporated to allow slightly higher velocities or greater slopes.

4. Ductile Iron Pipe Requirements:

- a. D.I.P. for sanitary sewers shall be used under the following circumstances:
 - i. Proposed sanitary sewer line is less than three (3) feet of cover.
 - ii. Proposed sanitary sewer line crosses below a storm sewer with less than two (2) feet of separation.
 - iii. Proposed sanitary sewer line is over fourteen (14) feet deep.

- iv. Proposed sanitary sewer line is at or over the maximum slope.
- v. When installing force mains.
- vi. When crossing a stream or ditch.
- vii. When crossing a Railroad right of way.
- b. D.I.P. for sanitary sewers may be required by the CWW Engineering Department under the following circumstances:
 - i. Under pavement.
 - ii. When trench conditions necessitate, such as a rocky, wet area, poor backfill material or as directed by CWW Engineering Department.
 - iii. Crossing a D.O.T. right of way.
 - iv. When above ground improvements or other special circumstances necessitate.

5. Drop Manholes:

- a. CWW reserves the right to determine the use of either an inside or outside drop on a case by case basis. An outside drop at the manhole shall be provided wherever the drop is greater than two (2) feet, (vertical differences between the inverts in and out). Drop manholes shall not take the place of the maximum deflection angle requirements for sanitary sewer lines.
 - b. Inside drop manholes are permitted as long as they meet the following criteria:
 - i. Only to be installed when connecting to an existing manhole.
 - ii. Installation is done in compliance with Details S-2A.
 - iii. Approved by CWW during plan review process.
6. Maximum deflection angles between influent and effluent sanitary sewer lines shall be ninety (90) degrees or greater.
7. Maximum distance between two manholes shall be four hundred (400) feet.
8. Minimum depth of a manhole shall be no less than five (5) feet unless approved by CWW.

9. Sanitary Sewer Laterals into Manholes:

- a. Inverts for sanitary sewer laterals shall be a minimum of six (6) inches above the manhole invert at the deepest point of the individual lateral.
- b. Individual sanitary sewer laterals directly out of manholes may be cored and booted five (5) feet below finished grade as long as three (3) to six (6) inches of pipe extends past manhole wall.
- c. For manholes over six (6) feet deep, laterals shall be five (5) feet below top of manhole lid. Provide core and rubber boot connection with three (3) to four (4) inches of pipe extended into manhole.
- d. The minimum slope of sanitary sewer laterals between the property line (or edge of easement) and the connection to the sewer main or manhole shall be two (2.00) percent.

10. Air Valves for Sewage Service:

- a. Valves shall be combination air valves and shall be equal to Val-matic.

Section 1.08 – Handling Materials:

Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, manholes, and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

A. Handling:

Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.

B. Distribution:

Distribute and place pipes and materials so as to not interfere with traffic. Do not string pipe more than one thousand (1,000) feet beyond the area where pipe is being laid. Do not obstruct drainage ditches or create a traffic hazard.

C. Storage:

Store all pipes, which cannot be distributed, along the route. Make arrangements for the use of suitable storage areas with CWW Inspector.

Section 1.09 – Construction along Highways, Streets and Roadways:

Install pipe lines and accessories along highways, streets, and roadways in accordance with the applicable regulations of the Georgia Department of Transportation and Columbus Consolidated Government with reference to construction operations, safety, traffic control, road maintenance and repair. Refer to sections 1.19 and 1.20 for additional roadway requirements.

A. Protection of Traffic:

Provide and maintain suitable signs, barricades and lights for protection of traffic. Removal of highway signs for construction shall be under permission of the Georgia Department of Transportation or the Columbus Consolidated Government. Do not close or block any highway, street or roadway without first obtaining permission from the proper authorities. Traffic control shall conform to the Manual on Uniform Traffic Control Devices for Streets and Highways. Manuals may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington DC., 404 Publication Number FHWA-SA-89-006 (or latest revision). Flagmen shall be certified by a GDOT approved flagman training program.

B. Construction Operations:

In accordance with Georgia law, the Contractor shall call 811 to request marking of utilities in all areas in which construction activities are scheduled. Perform all work along highways, streets and roadways to minimize interference with traffic.

1. Clearing and Grubbing:

Erosion control measures shall be installed in accordance with approved drawings and all applicable regulations prior to clearing and grubbing and shall be properly maintained during the life of the project.

2. Trenching, Laying and Backfilling:

Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day maintaining positive drainage, which does not impact traffic.

3. Shaping:

Reshape damaged slopes, side ditches and ditch lines immediately after completing backfill operations. Replace topsoil if necessary to re-establish sod and other landscaping removed from shoulders.

C. Excavated Materials:

Do not place excavated material along highways, streets, and roadways in a manner which obstructs traffic. Sweep all scattered and excavated material off the pavement. Wash the street if necessary.

D. Drainage Structures:

Keep all ditches, culverts, cross drains and other drainage structures clear of excavated material and free to drain at all times.

E. Maintaining Highways, Streets, Roadways and Driveways:

Maintain streets, highways, and roadways in suitable condition for movement of traffic until completion and final acceptance of the work. Use street running plate to maintain traffic until pavement replacement is completed.

F. Easements:

Contractor/Developer will be responsible for providing any necessary easement agreements. See Section 1.03 (c).

Section 1.10 – Existing Underground Utilities and Obstructions:

It is the responsibility of the Contractor/Developer to locate all existing utilities along the path of construction. Drawings shall indicate underground utilities or obstructions that are known to exist. Where these or unforeseen underground utilities are encountered, the location and alignment may be changed, upon written approval of CWW, to avoid interference. Such changes will be marked up on Contractor's/Developer's as-built plans.

Section 1.11 – Water and Sewer Separation:

Water mains shall maintain a minimum ten (10) foot edge to edge separation from sewer lines, whether the sewer operates by gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the ten (10) foot horizontal separation, the water main must be separated a minimum of eighteen (18) inches above the top of the sewer. Where the water main crosses a sewer line, an eighteen (18) inch vertical separation shall be maintained and a full joint of water pipe shall be centered over the sewer line. Adjustments to this shall be made by CWW.

No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

Section 1.12 – Connection to Existing Pipe Lines:

CWW or their approved Contractor will make connections to existing pipe lines with necessary materials.

A. Location:

Before laying pipe, locate the points of connection to existing pipe lines and uncover as necessary for CWW to confirm the nature of the connection to be made.

B. Interruption of Services:

CWW or their Contractor will make connections to existing pipe lines only when system operations permit.

Section 1.13 – Excavation:

Excavate all material encountered and dispose of excess excavated material not required for backfilling in accordance with applicable local, state and federal regulations.

A. Depth of Trenches:

Excavate trenches to provide a minimum cover of three (3) feet, to the top of pipe. Within the proximity of highways, streets, or roadways, excavate to place the top of the pipe at a minimum of four (4) feet below the nearest pavement edge, and at least two (2) feet below the bottom of the drainage ditch.

B. Width of Trenches:

Excavate trenches wide enough to allow proper installation of pipe, fittings, and other materials, and not less than six (6) inches clear of the outside barrel of the pipe on any side at any point.

C. Bell Holes:

At each joint, excavate bell holes to a depth and width which will permit the joint to be made properly and to relieve any stresses on the pipe bell.

D. Earth Excavation:

Excavate and prepare the trench bottom to support the pipe uniformly throughout its length. For ductile iron pipe, the trench shall meet the requirements of Standard Laying Condition Type 2 in accordance with AWWA C-151. If the trench is excavated to excessive width or depth, provide sand or gravel to achieve Standard Laying Condition Type 4 in accordance with AWWA C-151. (See Detail S-10).

E. Bracing and Sheet piling:

When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities, or trees which are specifically required to remain, provide bracing and sheet piling. Remove bracing and sheet piling in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheet piling in place when in the

opinion of CWW it cannot be safely removed. Cut off sheeting left in place at least two (2) feet below the surface.

1. Timber:

Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.

2. Steel Sheet Piling:

Continuous lock joint steel sheet piling may be substituted for timber sheeting when approved by CWW. Steel piling may be removed, without cutting, provided the rate of removal is kept in pace with the tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where ordered to be left in place by CWW for reasons of safety, will be cut off where directed.

F. De-Watering Trenches:

Maintain a water level two (2) feet below the bottom of the trench by pumping out water continuously. Continue to de-water running sand by using well pointing. Where soil conditions do not permit the use of well pointing, construct trench drains of crushed stone or gravel to conduct water to sumps.

G. Trench Stabilization:

Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, CWW will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with crushed stone bedding material. Place and compact this material to bring the trench to the required grade. No pipe shall be laid directly on excavated rock. Trench stabilization shall be in accordance with Detail S-10.

Section 1.14 – Laying and Jointing Pipe and Fittings:

Lay all pipe and fittings to accurately conform to the lines and grades approved by CWW as follows:

A. Handling:

Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe. Examine all pipes carefully for cracks and other defects as it is laid. Do not use pipe or other materials which are known to be defective. Lower all pipe, fittings, and accessories into the trench by suitable means. Do not drop or dump pipe or accessories into the trench. If any pipe or other material is discovered to be defective or damaged after being

laid, remove and replace it. Clean pipe and fittings thoroughly before laying. Keep the pipe line clean until final acceptance.

B. Alignment and Gradient:

Lay pipe straight in alignment and gradient. Maintain suitable equipment along with competent personnel on the job to lay out angles and ensure that deflection allowances are not exceeded.

C. Expediting Work:

Do all of the following promptly: excavate the trench, call for inspection, install the pipe, fittings, and manholes, and backfill as soon as possible. Notify CWW Engineering Department twenty-four (24) hours before backfilling is to commence. All thrust restraint must be in place at time of inspection. The Contractor must receive approval to backfill by the Inspector. Any deficiencies noted by the Inspector must be brought into compliance and a second inspection must be scheduled, as directed by CWW.

Do not leave un-jointed pipe in the trench. Backfill and compact as soon as possible after laying and jointing is completed. Plug the exposed end of the installed pipe each day at the close of work with an approved plug and at all other times when work is not in progress, pipe must be sealed with an approved plug. If necessary to backfill over the end of an uncompleted pipe, close the end with an approved plug.

D. Laying Pipe in Trenches:

Lay the pipe with solid bearing throughout its length. All Pipe bedding shall be done as specified in AWWA C-151 or last revision. Refer to typical Detail S-10.

1. Earth Trenches:

Grade the bottom of the trench to a true line. Lay the pipe in clean bedding material, free of rock, organics and other unsuitable materials.

2. Wet Trenches:

Do not lay pipe in water. Provide de-watering equipment to maintain a ground water level two (2) feet below the bottom of the pipe while the pipe is being laid.

3. Blasted Rock Trenches:

Do not lay pipe directly on to blasted rock. Keep a minimum six (6) inch layer of crushed stone underneath the pipe at the highest peak of the blasted rock as in Detail S-10.

E. Joint Assembly:

1. Joints shall be assembled in accordance with the Manufacturer's recommendations.

F. Cutting:

Cut pipe using an abrasive wheel saw. Remove all burrs and smooth the end before jointing.

Section 1.15 – Bedding of Sanitary Sewer:

Bed pipelines in accordance with the detail drawings included in Detail S-10 or S-14 and the following specifications.

A. Materials:

1. Bedding for PVC pipe shall meet the requirements of Class I materials as defined by ASTM D 2321. All other bedding materials shall be crushed stone unless shown or specified otherwise.
2. Crushed stone bedding material shall meet the requirements of Georgia Department of Transportation Specification 800.01 for Number 57 stone.
3. Where specifically allowed, earth bedding shall be suitable materials selected from materials excavated from the trench. Bedding shall be clean and free of rock, organic, and other unsuitable material.

B. General:

Compact stone bedding material by tamping or slicing with a flat blade shovel. Prepare the trench bottom to support the pipe uniformly throughout its length. Provide bell holes to relieve pipe bells of all load. If the trench is excavated to excessive width or depth, provide the next better class of bedding. In rock trenches, bed pipe in at least six (6) inches of suitable bedding. See Detail S-10 for classes and types of bedding allowed by CWW. Bedding shall then be carefully placed and compacted to provide full support under and up to the centerline of the pipe.

C. Manholes:

1. Excavate to a minimum of twelve (12) inches below the planned elevation of the base of the manhole.
2. Place and compact stone bedding material to the required grade before installing the manhole.

D. Force Main:

1. Unless shown otherwise on the drawings, bed force mains in suitable bedding materials.

2. Bedding shall be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

Section 1.16 – Manholes:

- A. Manholes shall be located no more than four hundred (400) feet apart and shall be located at all changes in grade direction or line size. Typical manhole details are included herein. All laterals out of manholes shall be cored and rubber boots installed per CWW Detail S-6.

- B. Precast Concrete:

Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. If preformed openings must be enlarged or altered, or if new openings must be made in the field, minimize the amount of material removed to provide closely matched surfaces for grouting. Install gaskets in accordance with Manufacturer's recommendations to produce a watertight structure. Grout all joints and lift points inside and outside with a non-shrink grout.

- C. Brick Risers:

Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, three quarter (3/4) inch thick, on the inside and outside. Brick risers shall be no greater than twelve (12) inches high unless approved by CWW Inspector.

- D. Inverts:

Form channels as shown on the drawings, rounded and troweled smooth. Maintain consistent grade through the invert. Core and boot all manhole connections.

- E. Future Laterals:

Where future laterals have been identified, provide the first length of pipe for future lateral sanitary sewers, properly laid to alignment and grade and suitably capped. All future laterals shall be installed per CWW Detail S-8. Inverts for sanitary sewer laterals shall be one half (0.50) foot above the sanitary sewer main invert unless approved by the CWW Inspector.

- F. Top Elevations:

Frame and Covers: unless frame and cover are at grade, the frame shall be cast into the cone section.

Build manholes outside of paved areas and right of way to eighteen (18) inches above ground unless otherwise shown on the plans or directed by CWW. Build manholes in paved areas and right of way to existing grades.

G. Drop Connections:

Manholes requiring drop connections shall be shown on the approved drawings. Construct drop connections of the same materials as the upstream sanitary sewer and in accordance with the details shown herein.

H. PVC Pipe Connections:

Make all manhole connections to PVC pipe with the connector specified. Couplings shall be grouted into the manhole opening after jointing with the PVC pipe.

I. Steps shall be installed in all manholes over four (4) feet deep. See Detail S-1.

J. Manholes in a flood zone shall have bolt down lids.

Section 1.17 - Lift Stations:

Lift stations are a last resort consideration to be covered under a separate specification by CWW Division of Engineering. CWW must approve Lift stations before design drawings are submitted.

Section 1.18 – Backfilling:

All trenches are to be backfilled and compacted to prevent settlement and displacement of the pipe.

A. Material:

Backfill trenches with earth only. Do not use rock or organic material excavated from trenches in the backfill. If necessary, furnish suitable earth material to backfill the trench. Use select material for initial backfill.

B. Compaction:

Consolidate backfill material in the bottom of the trench and up to two (2) feet above the pipe in six (6) inch layers.

C. Initial Backfill:

1. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
2. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least eighteen (18) inches above the pipe barrel. Layer depths shall be a maximum six (6) inches for pipe eighteen (18) inches in diameter and smaller, and a maximum of twelve (12) inches for pipe larger than eighteen (18) inches in diameter.

3. Backfill and compact on both sides of the pipe simultaneously to prevent side pressures.
4. Compact each layer thoroughly with suitable hand tools or tamping equipment.
5. Initial backfill shall be compacted to a minimum ninety (90) percent of the maximum dry density based on standard proctor unless shown or specified otherwise. The Contractor will provide the service of an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

D. Final Backfill:

1. Backfill carefully to restore the ground surface to its original condition. Remove all excavated rock from the ground surface and restore the area to a mowable condition, free from rock and deleterious materials.
2. The top six (6) inches shall be topsoil when directed by CWW.
3. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of. The site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
4. After initial backfill material has been placed and compacted, backfill with final backfill material. Final backfill shall not contain more than one-third (1/3) broken rock, of which no stone or boulder will be six (6) inches in diameter or weigh more than fifty (50) pounds. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
 - In six (6) inch layers, if using light power tamping equipment such as a “jumping jack”.
 - In one (1) foot layers, if using heavy tamping equipment, use a hammer with tamping feet.
5. If the trench settles, refill and grade the surface to conform to the adjacent surfaces. The Contractor will provide the service or an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

Section 1.19 – Removing and Replacing Pavement:

A. Removing Pavement:

Remove existing pavement as necessary for installing the pipeline and appurtenances. When pipeline crosses pavement at an angle other than perpendicular, then the pavement shall be overlaid at ninety (90) degrees to the pavement edge and replaced to the ends of the excavation.

1. Marking:

Before removing any pavement, mark the pavement neatly paralleling pipe. Space the marks to the width of the trench.

2. Breaking:

Break asphalt pavement along the marks using jack hammers or other suitable tools as directed by CWW. Cut Portland cement concrete pavement along the marks by use of pavement saws.

3. Machine Pulling:

Do not pull pavement with machines until completely broken and separated from pavement to remain.

4. Damage to Adjacent Pavement:

Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

5. Sidewalk:

Remove and replace sidewalks for their full width, without installing additional joints.

6. Curbs:

Remove and replace or tunnel under any curb encountered. All pavement and/or curbing repairs or replacement will require City of Columbus Engineering Department's approval as a condition of acceptance.

B. Replacing Pavement:

During backfilling, arrange to have the compaction tested by an approved independent testing laboratory if required by CWW, Local or State DOT. After the compaction testing has been satisfactorily completed, then replace all pavement, sidewalk, and curb in accordance with Georgia Department of Transportation and/or City of Columbus standard details as required. Payment for all costs incurred for testing shall be the Contractor's responsibility. Columbus Consolidated Government requires a two (2) year warranty for all pavement replacement. GA State DOT requires a one (1) year period.

Section 1.20 – Roadway Crossing:

Furnish and install pipe casing and install the pipeline therein in accordance with the drawings and in accordance with Georgia Department of Transportation and City of Columbus specifications.

A. General:

Operate well points or drainage systems in the vicinity of the casing construction to prevent the accumulation of water in the casing and to maintain the ground water table below the casing invert.

B. Pipe Casing:

Furnish all material and equipment and perform all labor required to install steel pipe casing as required by the CWW. Casings need to be placed at all roadway and driveway crossings by Contractor for future service connections. All casings shall terminate at a three (3) foot minimum for in-line fitting or connection.

1. Boring:

The steel casing pipe shall be a minimum of Schedule 30 steel pipe manufactured from steel conforming to ASTM A-139, Grade B. Size and minimum wall thickness shall be as follows:

UNDER HIGHWAYS:

<u>Pipe Diameter</u> <u>Inches</u>	<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Minimum Inches</u>
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
14	22	0.250
16	24	0.250
18	30	0.312
20	30	0.312
24	36	0.375
30	42	0.375

UNDER RAILROADS:

<u>Pipe Diameter</u> <u>Inches</u>	<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Minimum Inches</u>
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.312
14	24	0.344
16	30	0.406
18	30	0.406
20	32	0.469
24	36	0.469
30	42	0.500

The outside of the casing pipe shall be primed and coated with a hot coal tar enamel a minimum of three thirty seconds (3/32) inch thick. Only new primed and coated pipe shall be used.

When casing depth exceeds fifteen (15) feet, it is the responsibility of the Developer's Engineer to calculate the required casing wall thickness.

Install the steel pipe casing by the dry boring method. Bore the hole and install the casing through the soil simultaneously by using a cutting head on a continuous auger mounted inside the casing pipe. Lengths of casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

C. Installation of Pipe:

After installation of the casing is complete, install the pipelines as shown on the Drawings. Close the ends of the casing with either four (4) inch brick walls sealed with Portland cement mortar OR end seals by CCI Piping Systems Model ESW or ESC (or equal). Leave a four (4) inch by eight (8) inch opening at the bottom of the lowest closure for drainage. Piping inside casings shall be restrained at every joint. See Detail Drawing A-24 for restraining fittings to steel casing pipe.

D. Safety:

Provide all necessary bracing bulkheads and shields to ensure complete safety to all traffic at times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

Section 1.21 - Concrete Piers:

Construct piers as shown on Details S-15 through S-19 and in accordance with the following requirements:

A. Material:

1. Concrete shall have a compressive strength of not less than three thousand (3000) psi, with not less than five and one half (5.5) bags of cement per cubic yard and a slump between three (3) and five (5) inches.
2. For job mixed concrete, submit the concrete mix design for approval.
3. Ready-mixed concrete shall be mixed in accordance with ASTM C 94.
4. Reinforcing steel shall conform to the requirements of ASTM A 615, grade 40.

B. Bearing:

1. Where earth excavation reveals undisturbed earth subsurface, construct piers with spread footing foundations as shown herein.
2. Where rock excavation reveals level or benched rock having a minimum safe bearing value of twenty thousand (20,000) psf, construct piers with foundations bearing directly on rock. Drill a minimum of four (4) holes into the rock under each pier and grout dowels into place to anchor the pier to the rock. Grout holes from bottom up using a grout pump. Take extreme care to ensure that the entire hole is filled with grout prior to inserting the dowel.

C. Installation:

1. Employ experienced form work carpenters to construct forms. Build form work sufficiently strong to resist movement and distortion during pouring and to protect the pier from caving in or lateral movement.
2. Before placing concrete, dewater the bottom and clean out all mud, loose earth, and extraneous matter.
3. Pour concrete as soon as possible after the forms have been approved. Do not leave the excavation open for prolonged periods of time. Protect the excavation from surface water. Do not allow water to accumulate in the excavation or in surrounding areas.
4. Take all necessary precautions to protect the work and personnel on the site. Cover open holes when work is not in progress. Examine all the surrounding excavations and embankments for possible hazards.

Section 1.22 – Testing:

Clean and test all lines before requesting final acceptance. Where any obstruction is met, clean the sanitary sewers by means of rods, swabs or other instruments. When requested by CWW flush out lines and manholes before final inspection. CWW Inspector must be present for all required testing. Additional tests may be required if deemed necessary by CWW Inspector.

A. Gravity Sanitary Sewers:

1. Pipelines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.
2. If required, install suitable weirs in manholes selected by CWW to determine the leakage of ground water into the sanitary sewer. Measure leakage only when all visible leaks have been repaired and the ground water is above the top of the pipe. If leakage in any section of the sanitary sewer line exceeds twenty-five (25) gpd/inch diameter/mile, locate and repair leaks. Repair methods must be approved by CWW. After repairs are completed, retest for leakage. The maximum length of line for each infiltration test shall be five thousand (5,000) feet.
3. Test PVC gravity sanitary sewers for excessive deflection by passing a “Mandrel” through the line with a diameter equal to ninety-five (95) percent of the inside diameter of the pipe. The following guidelines will be utilized when mandrel testing:

PIPE SIZE	MANDREL DIAMETER
8”	7.20
10”	9.50
12”	11.40
15”	14.25

Excavate and properly reinstall any section of pipe not passing this test. Retest until results are satisfactory.

4. No connection shall be made to existing sanitary sewers until sanitary sewers being laid are inspected and approved by CWW. All connections to existing sanitary sewer system will be made by CWW, unless Contractor is authorized to do so by CWW.
5. Ensure service lateral installation and backfill is sufficient to limit obstructions and deflections in the laterals. The minimum allowable slope on laterals within the easement or public right-of-way shall be two (2.00) percent.

B. Force Mains:

1. All sections of pipeline subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section will be considered ready for testing after completion of all thrust restraint and backfilling.

2. Furnish, install and remove all temporary bulkheads, flanges or plugs required to perform the pressure test and furnish all equipment and labor to carry out the test.
3. Pressure test force mains at pressure determined by CWW and measured at the lowest point. Test for a minimum of two (2) hours. Leakage shall not exceed twelve hundredths (0.12) gph/inch diameter/1,000ft.
4. If leaks are detected, locate, repair and retest. Repair methods must be approved by CWW. If results are not totally satisfactory, CWW may require testing for a longer time.

C. Hydra-static Testing on Manholes:

When required by CWW, all manholes shall be hydra-statically tested in the following manner after backfilling and tamping has been completed:

1. Each manhole indicated on the drawings shall be tested for water tightness.
2. All connecting piping shall be plugged. Manhole and downstream pipe shall be filled with water, allowed to stand for one (1) hour, and then refilled. If measurable water level drop occurs after a second one (1) hour period, the Contractor shall repair the leakage and retest at no additional cost to the Owner.

D. Low Pressure Air Testing:

When required by CWW, all lines shall be air tested in the following manner after backfilling and tamping has been completed:

1. Test Preparation:
 - a. Prior to testing for acceptance, the pipe should be cleaned.
 - b. All wyes, tees or end-of-side sanitary sewer stubs shall be plugged with flexible-joint caps or acceptable alternate, securely fastened to withstand the internal test pressure.

2. Test Procedure:

The sanitary sewer segment being tested shall be pressurized to three point five (3.5) psi. A short period of time (2-4 minutes) may be required to allow the pressure to stabilize. The pressure shall not decrease more than one (1.0) psi (from 3.5 to 2.5 psi) during the time periods shown below:

<u>Pipe Size</u>	<u>Time/110 FT</u>
6	5.7 min.
8	7.6 min.
10	9.4 min.
12	11.3 min.

3. Test failure:

If the pipe installation fails to meet the infiltration or air test requirements shown above, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of these tests and the results of the air test shall be neatly tabulated by the Contractor and submitted to CWW Inspector.

E. Leak Testing by use of a Weir:

When infiltration flow is present in the sanitary sewer system being inspected for acceptance a weir test shall be conducted to insure the flow is under the allowable leakage rate. All weirs shall be approved by the CWW Inspector prior to their use in conducting the test.

Section 1.23 – Protection and Restoration of Work Area:

A. General:

1. The Contractor shall use reasonable care to avoid damaging existing buildings, equipment, and vegetation. If the Contractor's failure to use reasonable care causes damage to any of this property, the Contractor shall replace or repair the damage at no expense to CWW. If the Contractor fails or refuses to make such repair or replacement, the Contractor shall be liable for the cost.
2. Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

B. Man-Made Improvements:

Protect, or remove and replace, with CWW approval, all fences, piers, docks, walkways, mail boxes, pipelines, drain culverts, power, gas, telephone and television lines and cables and other improvements that may be encountered in the work.

C. Cultivated Growth:

Do not disturb cultivated trees or shrubbery unless approved by the CWW. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nursery person.

D. Cutting of Trees:

Do not cut trees for the performance of the work unless specifically approved by CWW and the City of Columbus. Removal and/or replacement of plantings on the city right-of-way must be approved by the City Arborist. Protect trees that remain in the vicinity of the work from damage by equipment. Do not store spoil from excavation against the trunks. Remove excavated material, stored over the root system of trees, within thirty (30) days to allow proper natural watering of the root system.

Repair any damaged tree more than three (3) inches in diameter, not to be removed, under the direction of an experienced nursery person. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, woodpiles, or trash piles will be permitted on the work site.

E. Grassing:

Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of residential areas, plant the entire area disturbed by the work in Fescue, Bermuda, Clover, St. Augustine or mixtures of these or other suitable groundcover upon completion of work in any area. In all areas, promptly establish successful stands of grass. During non-seasonal months for establishment of permanent grassing, temporary grassing is required such as winter rye.

F. Erosion Control:

Plan the excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. Erosion control activities must comply with City of Columbus requirements. Erosion control permitting is the responsibility of the Developer.

G. Disposal of Rubbish:

Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, City, State and Federal.

Section 1.24 – Requirements for As-Built Drawings:

- A. The Developer/Owner is responsible for furnishing as-built drawings to CWW as soon as the sanitary sewer construction work has been completed.
- B. As-built drawing guidelines are as follows:
 - 1. It is the Engineer's responsibility to ensure that the necessary information is received from the Contractor to complete the as-built drawings.
 - 2. As-built data must be in NAD 1983 State Plane Georgia West (U.S. feet) and North American Vertical datum of 1988 (NAVD 88).
 - 3. As-built documents shall include horizontal dimensioning to all valves, hydrants, fittings, etc., referenced from permanent monuments such as property corners, right-of-way markers, or other physical and permanent markers.
 - 4. As-built should be prepared on a copy of a recorded plat or on an otherwise prepared drawing with a reference to a recorded plat book and folio number. In this instance, a copy of the recorded plat should be supplied with the as-built submittal.
 - 5. Sanitary Sewer line as-builts should be on a separate plan sheet from other utilities.
 - 6. The as-builts shall contain the name of the development.
 - 7. The location of all sanitary sewer mains, Manholes, cleanouts, caps/plugs, stream crossings and road crossings shall be shown.
 - 8. Land lots and districts shall be shown.
 - 9. All lots are to be numbered and block stated.
 - 10. Road names shall be on plans.
 - 11. The term "As-Built" in large clear print on the plans.
 - 12. The "As-Built" drawings are to be submitted on 22" x 34" paper. Submit one (1) sewer as-built drawing for the initial review. After all corrections have been made, submit five (5) sewer as-built drawings, a pdf file containing all as-built documents, and one (1) digital copy. Acceptable digital formats include: DXF or DWG files, ESRI GIS shapefiles, ESRI GIS Geodatabase.
 - 13. Minimum scale is one (1) inch equals one hundred (100) feet. The as-builts may be drawn on more than one sheet if necessary to obtain the minimum scale of one (1) inch equals one hundred (100) feet. If multiple sheets are used, then an overall key map shall be included.

14. When a phase of a subdivision is completed, a location sketch of entire subdivision with said phase outlines shown on plans.
15. Contour lines are acceptable as long as they are faint and do not interfere with or overpower details of the drawing.
16. Out-lots should be so noted.
17. As-built plans shall show by appropriate dimensions to the location of all plugged future connecting fittings to the nearest foot. The dimensions are to be parallel with and perpendicular to the property lines to the nearest foot.
18. No hand drawn or marked up construction plans will be accepted as an as-built drawing.
19. The as-built shall have a north arrow and legend.
20. The as-built shall show all necessary horizontal information in order to locate the system. Label lines with length, material, diameter, and depth.
21. The as-built drawings must be sharp, clear, clean and legible and must be suitable for filming as permanent records.
22. The Easement Agreement Verbiage shall be noted on the final recorded plat. The sewer system will not be accepted until this verbiage is recorded on the final plat. Submit a copy of the final recorded plat showing this statement.
23. The Sanitary Sewer Availability Fees must accompany the final as-built drawings. The as-built drawings must be approved before any services can be given to the Developer/Builder.

24. The following notes shall be placed on the sanitary sewer as-built drawings and quantities filled in:

"AS-BUILT NOTES":

THIS AS-BUILT PLAT OF THE SANITARY SEWER LINE AND APPURTENANCES IS A FACSIMILE OF THE OFFICIAL RECORDED PLAT. IT IS ON FILE IN THE OFFICE OF THE CLERK OF SUPERIOR COURT OF MUSCOGEE COUNTY, GEORGIA (PLAT BOOK_____, FOLIO_____). THIS PLAT REFLECTS ALL OF THE SAME PERTINENT PROPERTY LINE DATUM AS SHOWN ON THE RECORDED VERSION. PLEASE REFER TO THE RECORDED PLAT FOR OFFICIAL SIGNED CERTIFICATES.

CONTRACTOR FOR THIS JOB WAS _____

ADDRESS _____

PHONE NO. _____

____ LF 8" Service Main
____ LF 6" Service Laterals
____ Manholes

**SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF SANITARY
SEWER SYSTEMS-COLUMBUS/MUSCOGEE COUNTY**

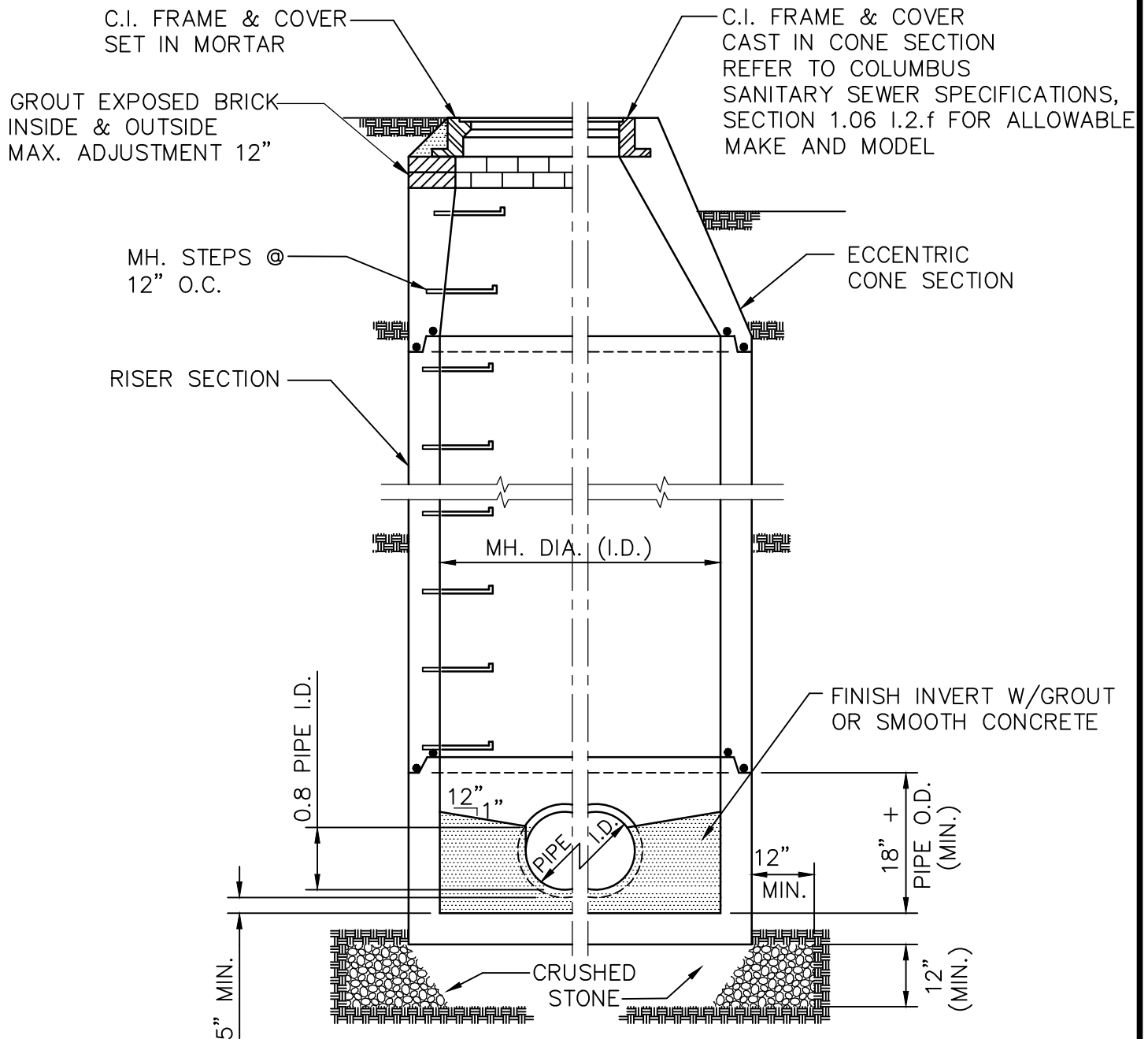
TABLE OF STANDARD DETAIL DRAWINGS

SUBJECT	DETAIL
PRECAST CONCRETE MANHOLE DETAIL WITH ECCENTRIC CONE SECTION	S-1
PRECAST CONCRETE MANHOLE OUTSIDE DROP DETAIL WITH ECCENTRIC CONE SECTION	S-2
PRECAST CONCRETE MANHOLE INSIDE DROP DETAIL WITH ECCENTRIC CONE SECTION	S-2A
PRECAST CONCRETE OVERSIZED MANHOLE DETAIL	S-3
PRECAST MANHOLE OVER EXISTING SEWER DETAIL	S-4
PRECAST CONCRETE SHALLOW MANHOLE DETAIL	S-5
RUBBER BOOT DETAIL	S-6
SERVICE CONNECTION DETAIL	S-7
SEWER LATERAL RISER	S-8
CONNECTING SERVICE TO SEWER LATERAL RISER	S-9
STANDARD PIPE LAYING CONDITIONS	S-10
SEWER LATERAL RISER WHEN CONNECTION IS LESS THAN 5 FT DEEP	S-11
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SUBJECT	DETAIL
PIPE STRAP DETAIL	S-19
CONCRETE COLLAR DETAILS	S-20
CONCRETE TRANSITION COLLAR DETAIL	S-21
WATER STOP COLLAR DETAIL	S-22
UTILITY LOCATIONS FOR 60' RIGHT-OF-WAY	S-23

TOP AT GRADE

TOP ABOVE GRADE



PRECAST CONCRETE MANHOLE DETAIL WITH ECCENTRIC CONE SECTION

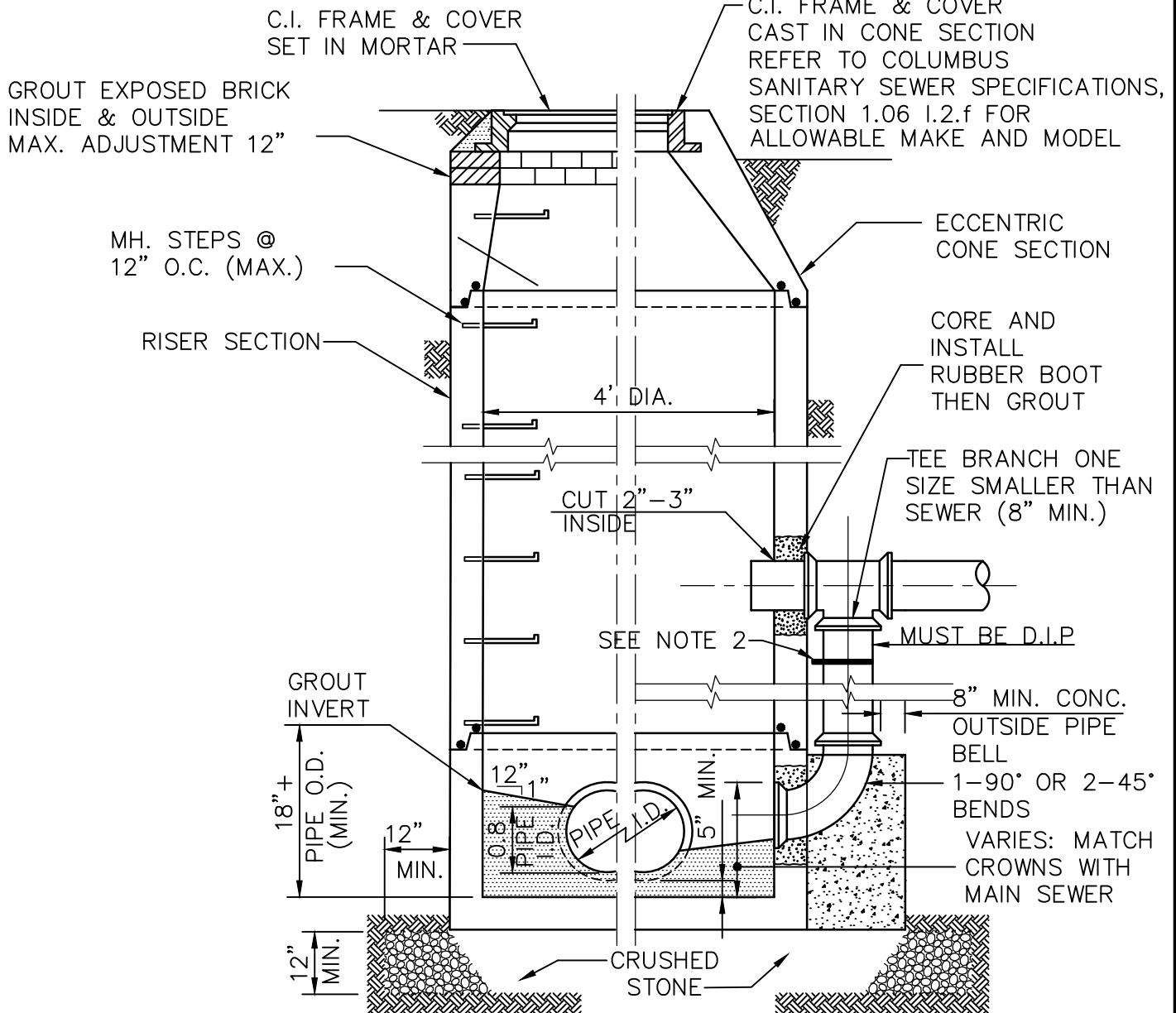
SCALE: N.T.S.

DATE: NOVEMBER 2019

S-1

TOP AT GRADE

TOP ABOVE GRADE



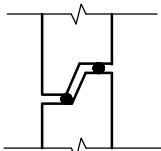
HALF SECTION

STANDARD MANHOLE

HALF SECTION

DROP MANHOLE

SEALANT LOCATIONS SHOULD CAUSE A SQUEEZE OUT EFFECT



JOINT SEALER

NOTE:

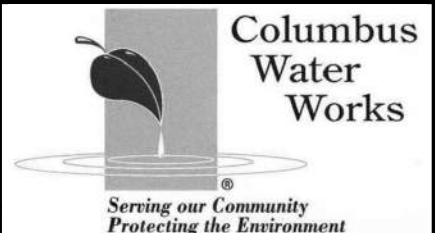
1. ALL MANHOLES TO BE CORED AND RUBBER BOOT INSTALLED. DROP MANHOLE REQUIRED WITH 2' OR GREATER DROP.
2. FOR OUTSIDE DROP CONNECTION VERTICAL PIPING, STAINLESS STEEL STRAPS SHALL BE ATTACHED TO THE EXTERIOR OF THE MANHOLE WITH ANCHOR WEDGES. ANCHOR WEDGES SHALL BE SPACED NO GREATER THAN 5 FT FOR VERTICAL DROPS 5 FT AND GREATER.

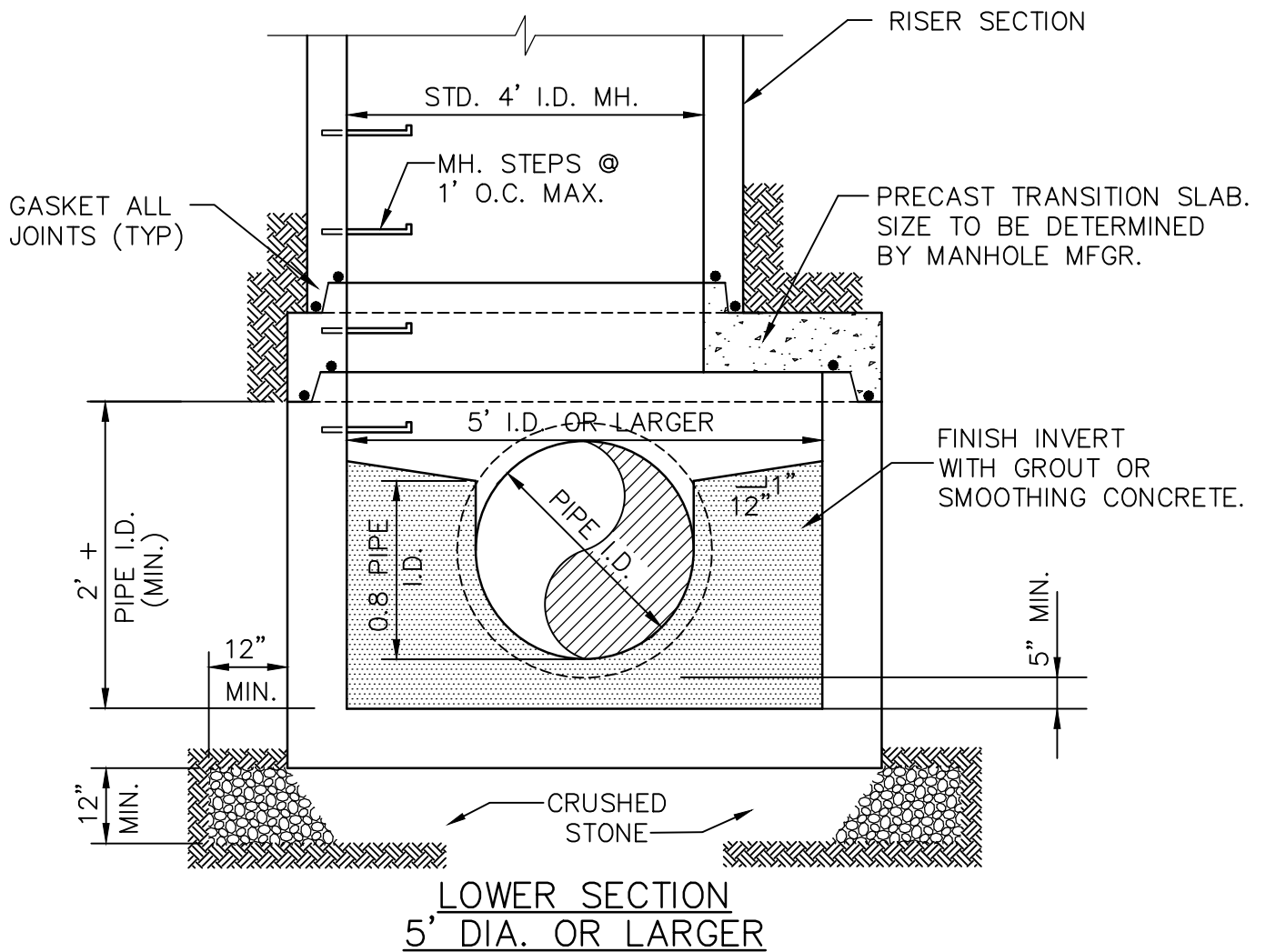
PRECAST CONCRETE MANHOLE OUTSIDE DROP DETAIL WITH ECCENTRIC CONE SECTION

SCALE: N.T.S.

DATE: NOVEMBER 2019

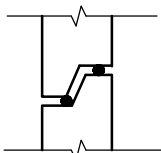
S-2





NOTE: ALL MANHOLES TO BE CORED AND RUBBER BOOT INSTALLED.

SEALANT LOCATIONS
SHOULD CAUSE A
SQUEEZE OUT EFFECT



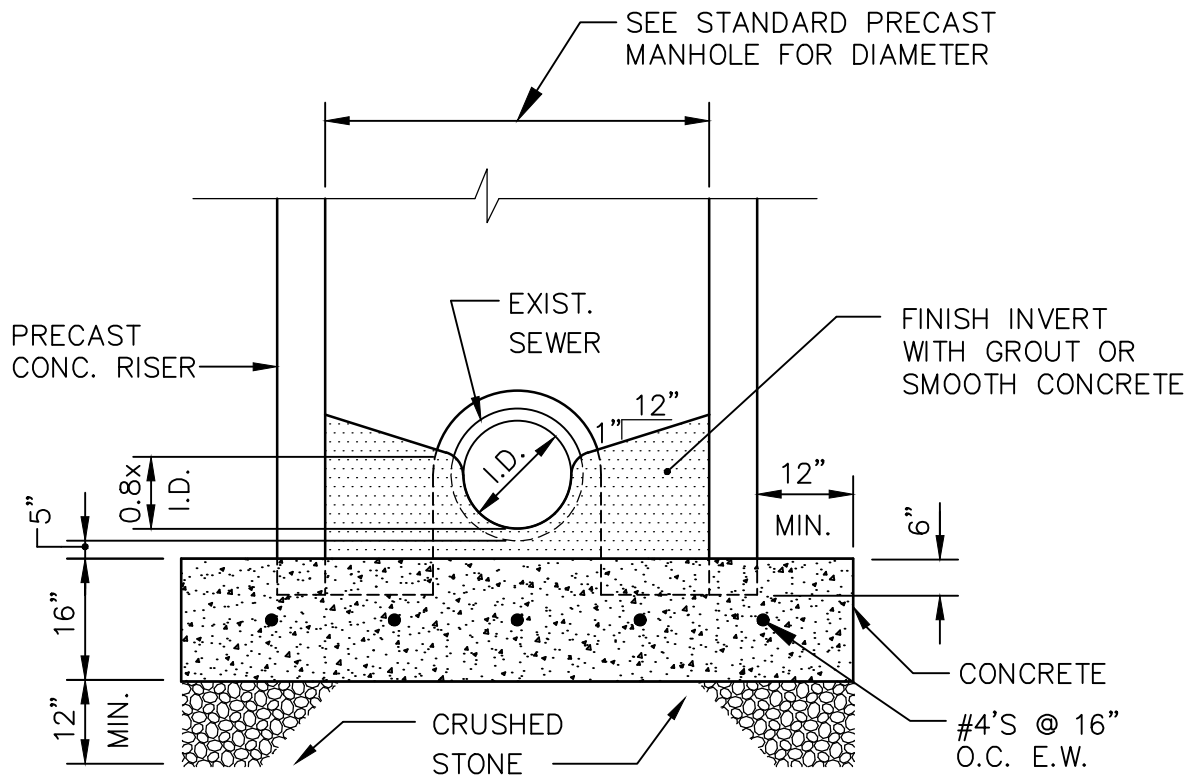
JOINT SEALER

PRECAST CONCRETE OVERSIZED MANHOLE DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-3



DOG HOUSE MANHOLE

PRECAST MANHOLE
OVER EXISTING SEWER
DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-4

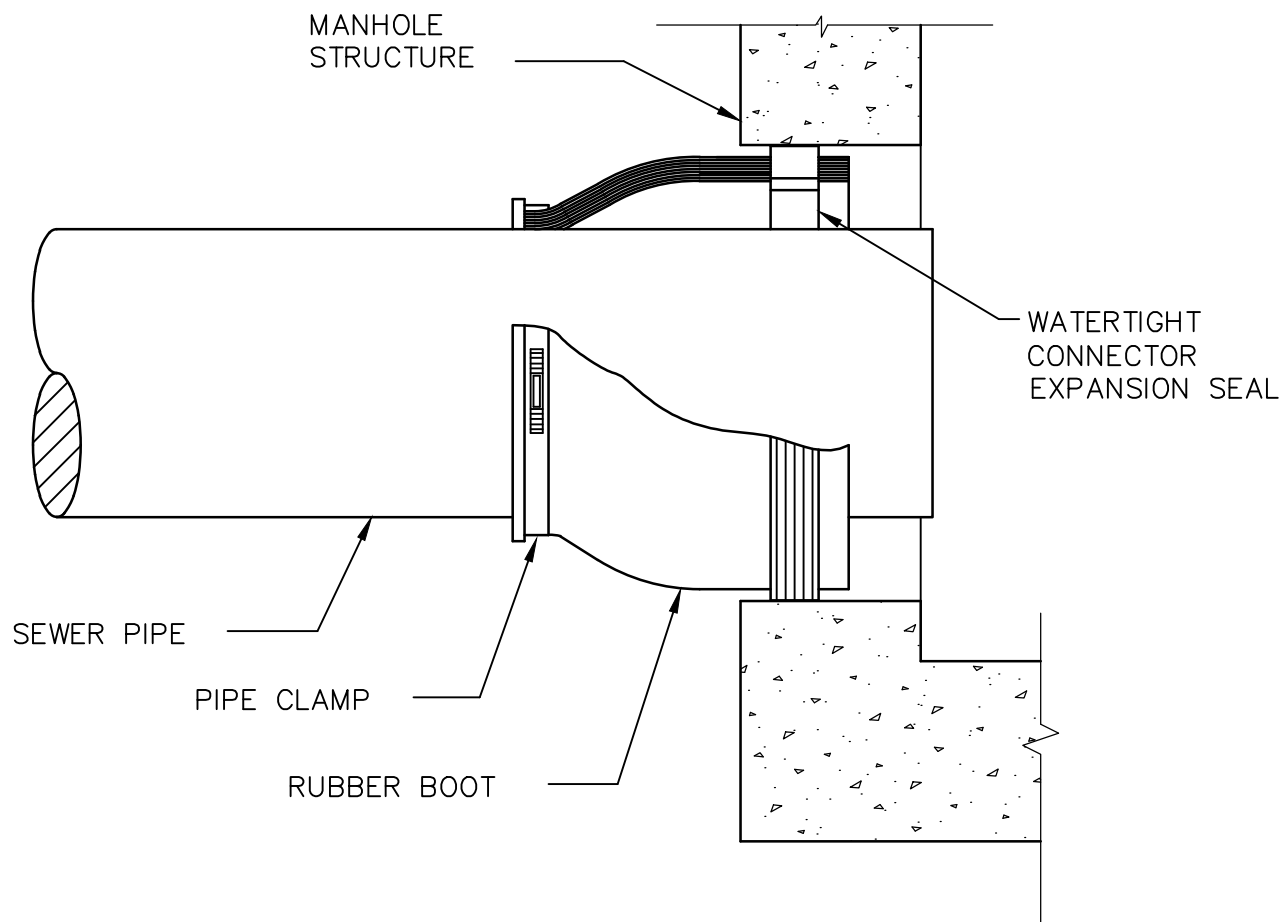
TOP ABOVE GRADE



MANHOLE MINIMUM DEPTHS ARE 5' UNLESS APPROVED BY COLUMBUS
WATER WORKS FOR SHALLOW MANHOLE. STANDARD MANHOLE DETAIL TO
BE USED FOR 4' DIAMETER OR GREATER.

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Protecting the Environment*

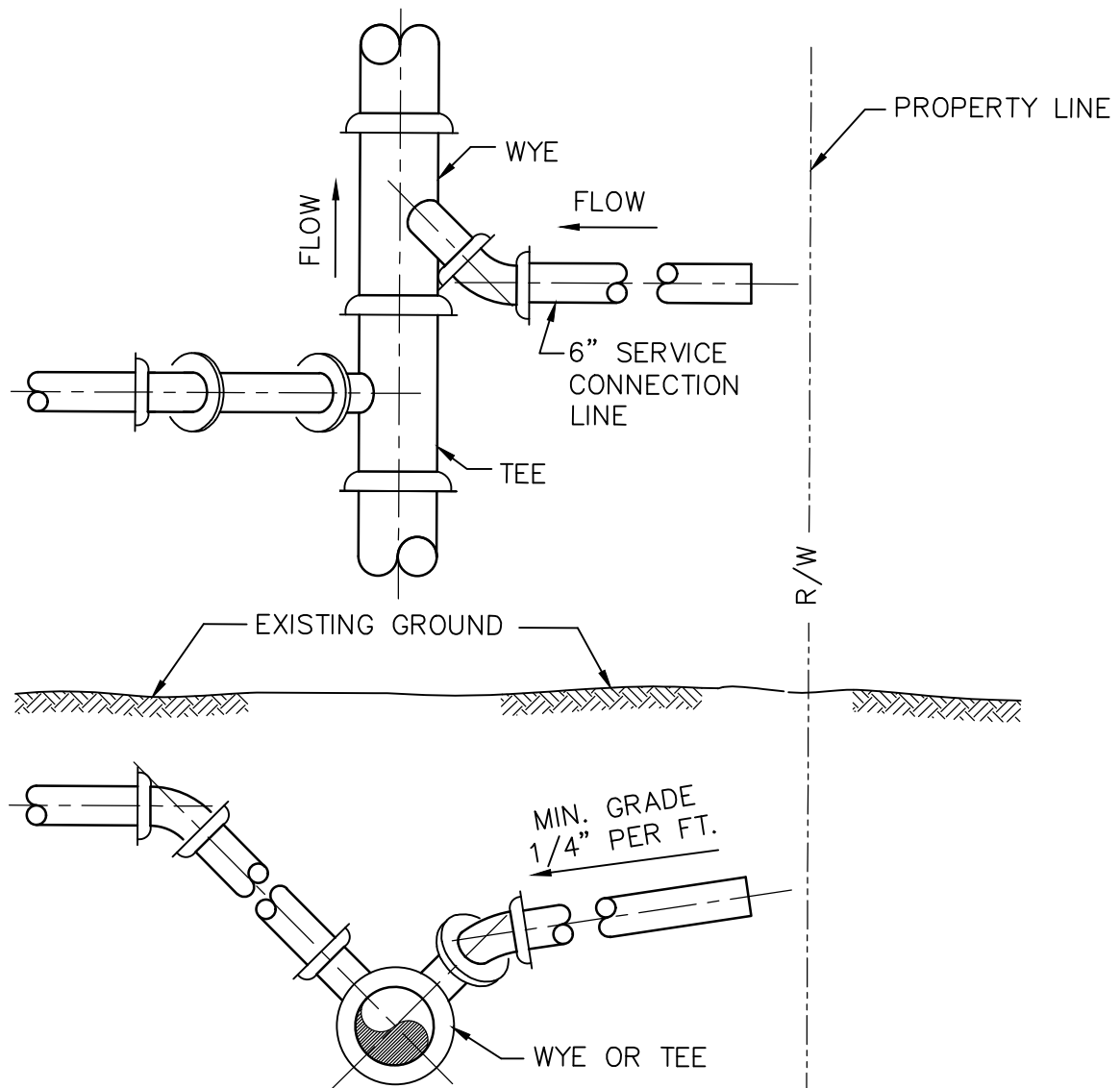


RUBBER BOOT DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-6

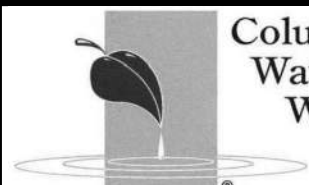


SERVICE CONNECTION DETAIL

SCALE: N.T.S.

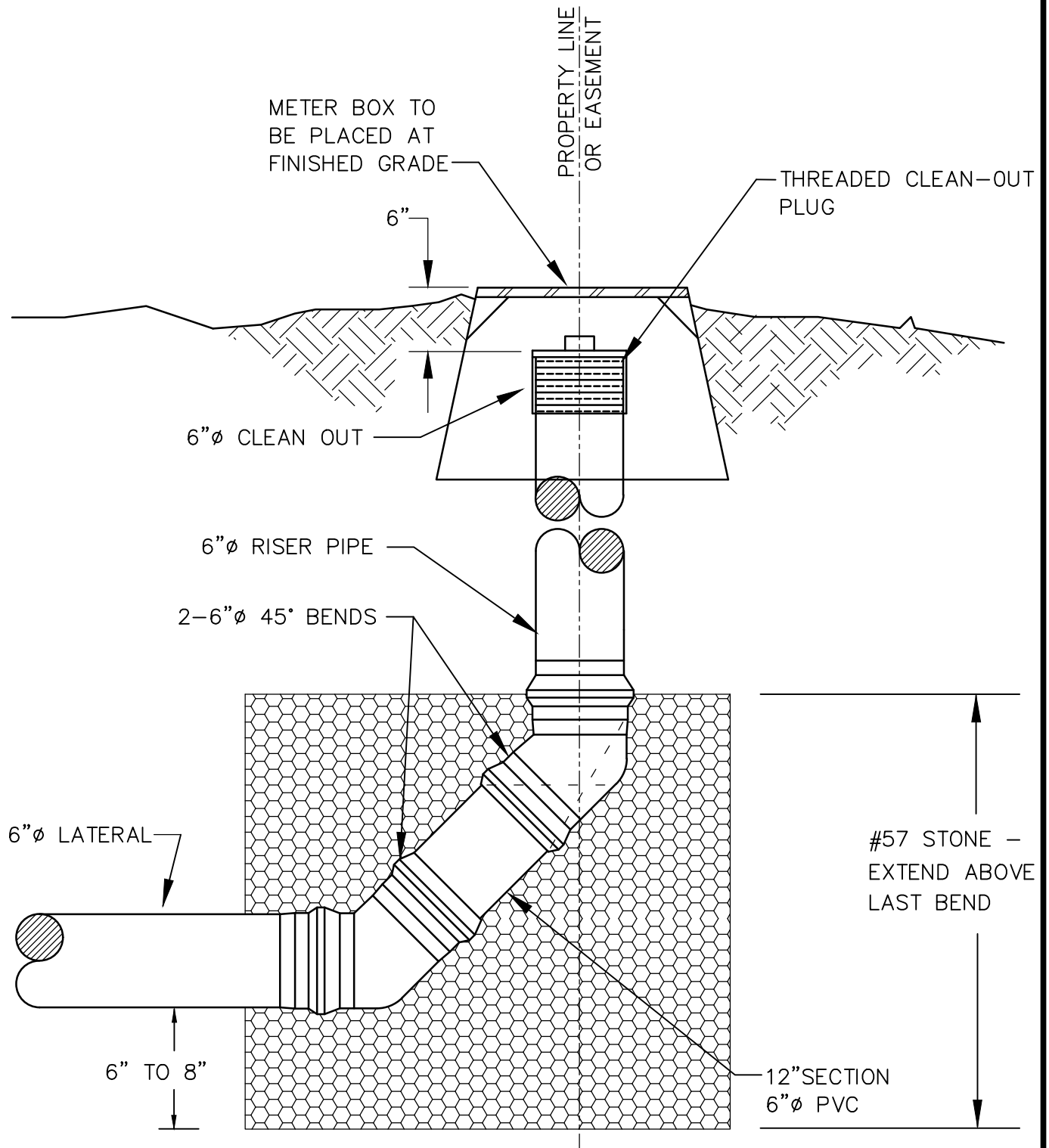
DATE: NOVEMBER 2019

S-7



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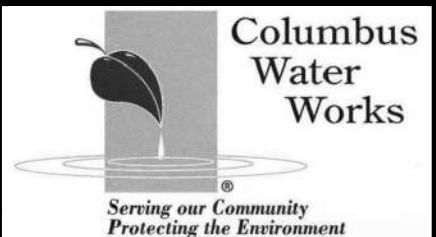
- NOTE:** 1. DEVELOPER/CONTRACTOR SHALL EXTEND 6"Ø PIPE TO 6" BELOW FINISHED GRADE AND PLUG WITH A C/O.
 2. USE THIS DETAIL ONLY WHEN THE SEWER LATERAL IS DEEPER THAN 5'.

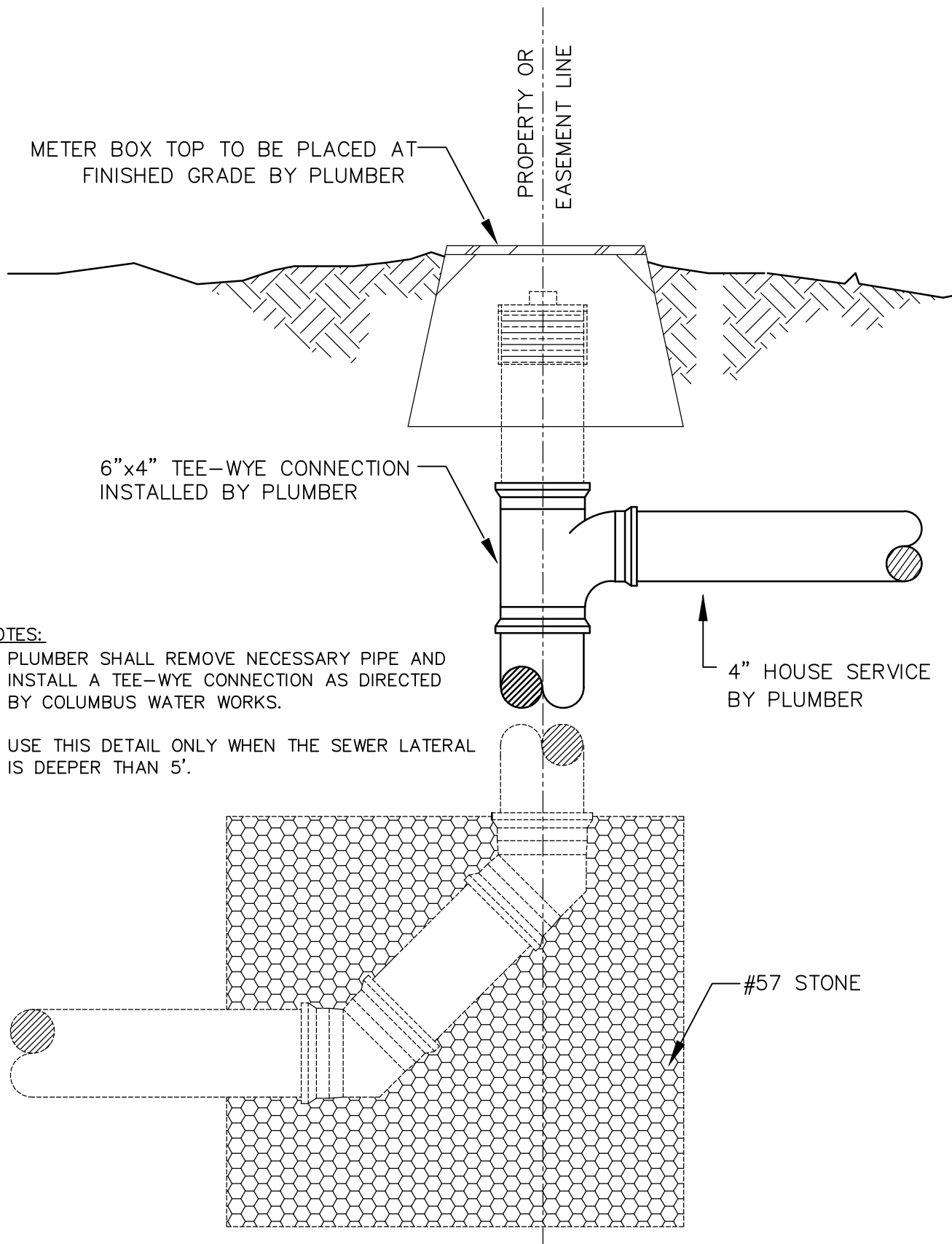
SEWER LATERAL RISER

SCALE: N.T.S.

DATE: NOVEMBER

S-8





NOTES:

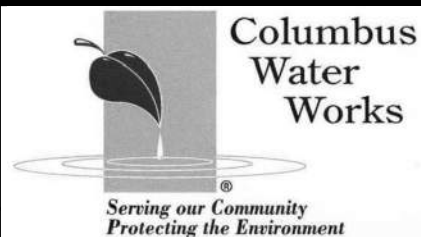
1. PLUMBER SHALL REMOVE NECESSARY PIPE AND INSTALL A TEE-WYE CONNECTION AS DIRECTED BY COLUMBUS WATER WORKS.
2. USE THIS DETAIL ONLY WHEN THE SEWER LATERAL IS DEEPER THAN 5'.

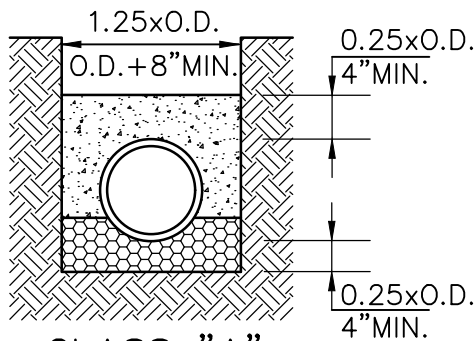
CONNECTING SERVICE TO SEWER LATERAL RISER

SCALE: N.T.S.

DATE: NOVEMBER 2019

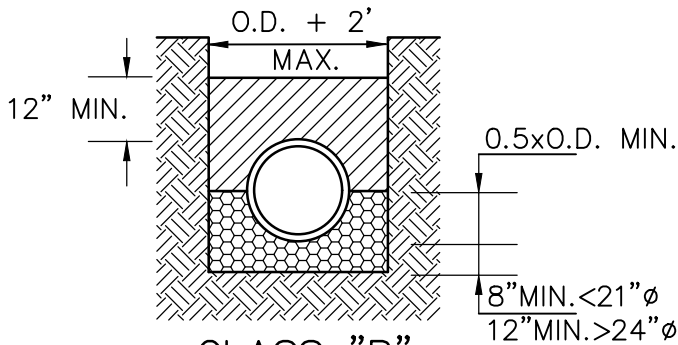
S-9





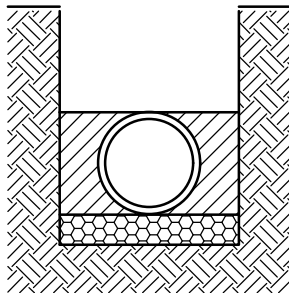
CLASS "A"

PIPE BEDDED IN SAND, GRAVEL OR CRUSHED STONE TO A DEPTH OF 1/4 PIPE DIAMETER OR 4" MINIMUM. PLACE 1500 psi (MIN.) CONCRETE FROM 1/4 OF PIPE DIAMETER ABOVE PIPE INVERT TO 6" ABOVE TOP OF PIPE.



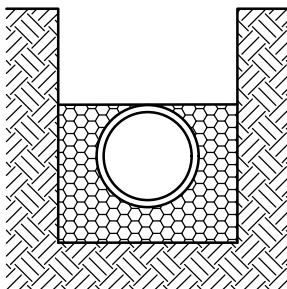
CLASS "B"

PIPE BEDDED TO ITS CENTERLINE IN COMPACTED GRANULAR MATERIAL. COMPACTED GRANULAR OR SELECT MATERIAL++ TO 12" ABOVE TOP OF PIPE. (APPROXIMATELY 90% STANDARD PROCTOR, AASHTO T-99.)



TYPE 4

PIPE BEDDED IN SAND, GRAVEL OR CRUSHED STONE TO DEPTH OF 1/8 PIPE DIAMETER 4" MINIMUM. BACKFILL COMPACTED TO TOP OF PIPE. (APPROXIMATELY 80% STANDARD PROCTOR, AASHTO T-99).



TYPE 5

PIPE BEDDED TO TOP OF PIPE IN COMPACTED GRANULAR MATERIAL, 4" MINIMUM UNDER PIPE. (APPROXIMATELY 90% STANDARD PROCTOR, AASHTO T-99).

NOTE:

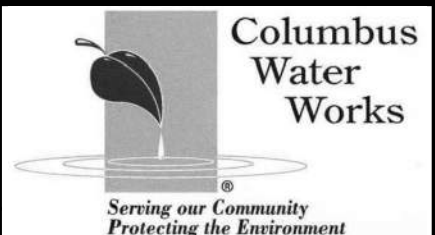
++ "LOOSE SOIL" OR "SELECT MATERIAL" IS DEFINED AS NATIVE SOIL EXCAVATED FROM THE TRENCH, FREE OF ROCKS, FOREIGN MATERIAL AND FROZEN EARTH.

STANDARD PIPE LAYING CONDITIONS

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-10



METER BOX TOP TO BE PLACED AT
FINISHED GRADE BY PLUMBER

6"

5 FT FROM OUTSIDE
WALL OF STRUCTURE

THREADED CLEAN-OUT
PLUG

6"Ø CLEAN OUT

NOTES:

1. PLUMBER WILL REMOVE TEMPORARY END CAP AND
INSTALL FERNCO COUPLING OR EQUAL .
2. USE THIS DETAIL ONLY WHEN THE SEWER LATERAL
IS LESS THAN 5'.

6"Ø 45° BENDS

12"SECTION
6"Ø PVC

6"Ø RISER PIPE

6" WYE CONNECTION

6"Ø LATERAL

#57 STONE

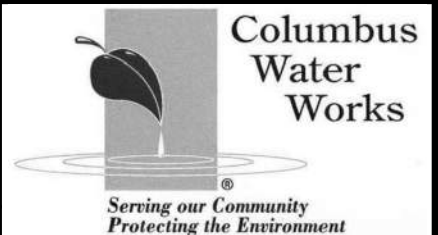
6"X4" FERNCO
BY PLUMBER

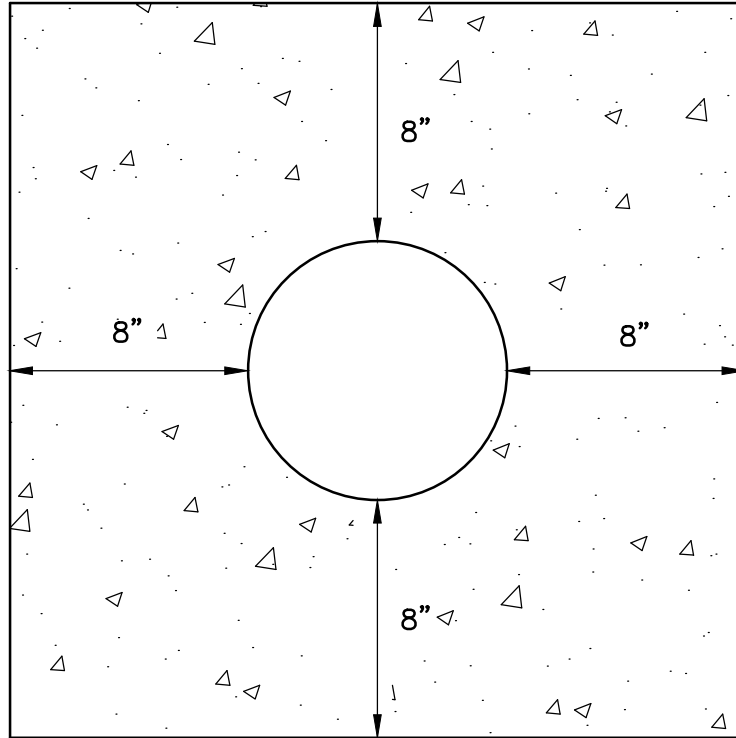
SEWER LATERAL RISER
WHEN CONNECTION IS
LESS THAN 5 FT DEEP

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-11





CONCRETE ENCASEMENT DETAIL

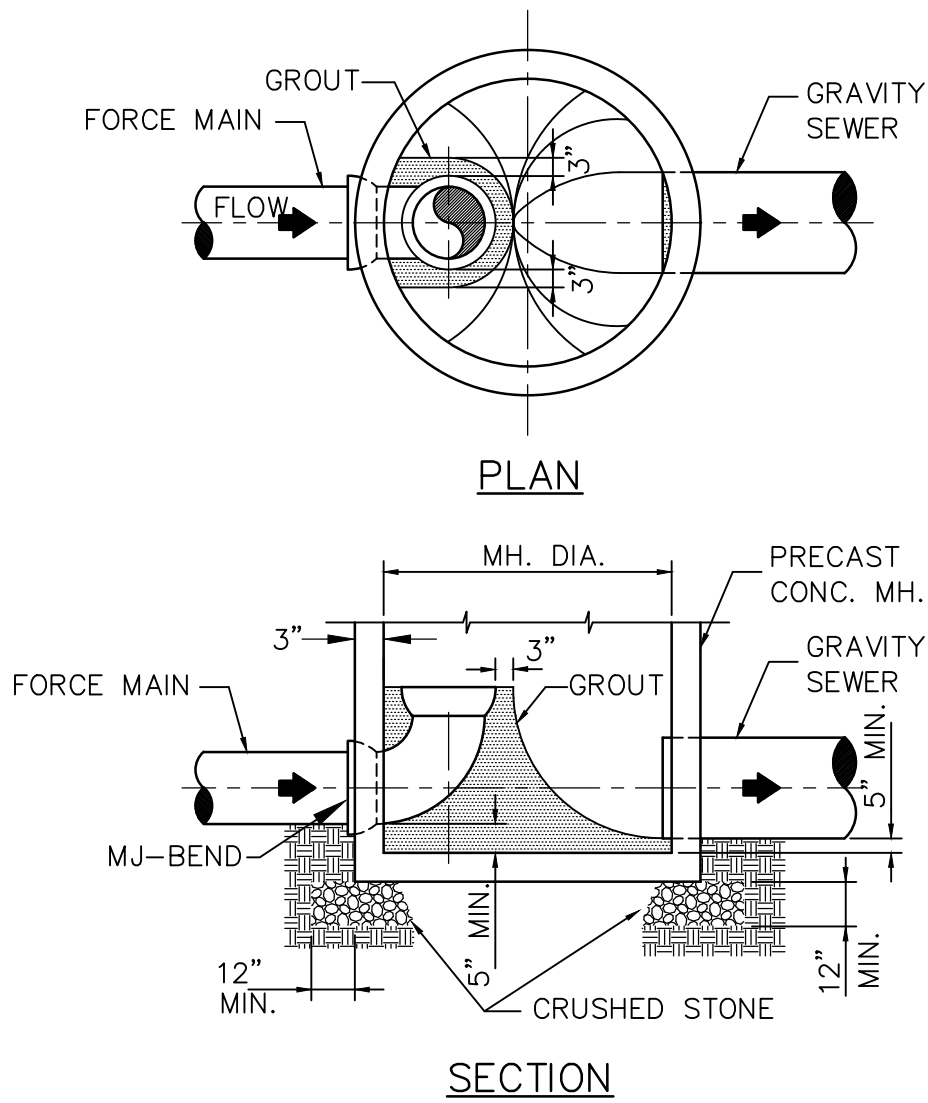
SCALE: N.T.S.

DATE: NOVEMBER 2019

S-12



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Protecting the Environment*



FORCE MAIN END OF LINE CONNECTION

FORCE MAIN
DISCHARGE
MANHOLE

SCALE: N.T.S.

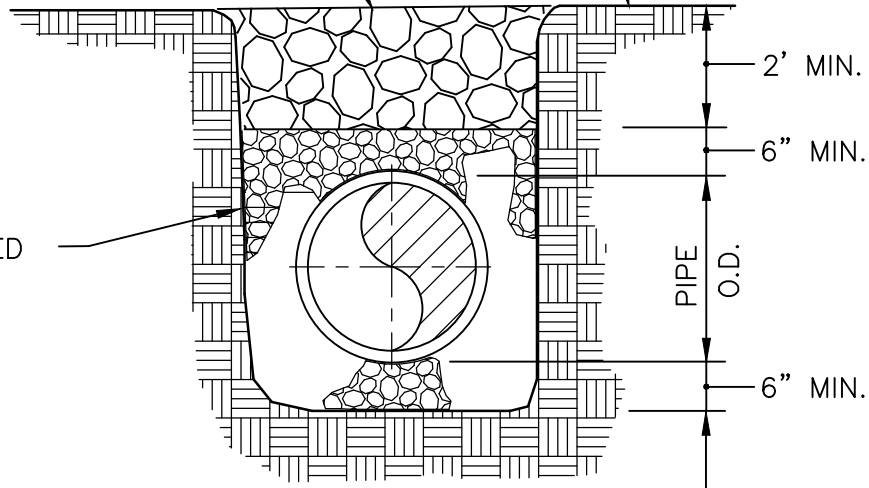
DATE: NOVEMBER 2019

S-13

75 LB. GDOT TYPE 1 RIPRAP
OR CONCRETE CAP

CREEK
BED

CRUSHED
STONE



PIPE BEDDING AT CREEK CROSSING

SCALE: N.T.S.

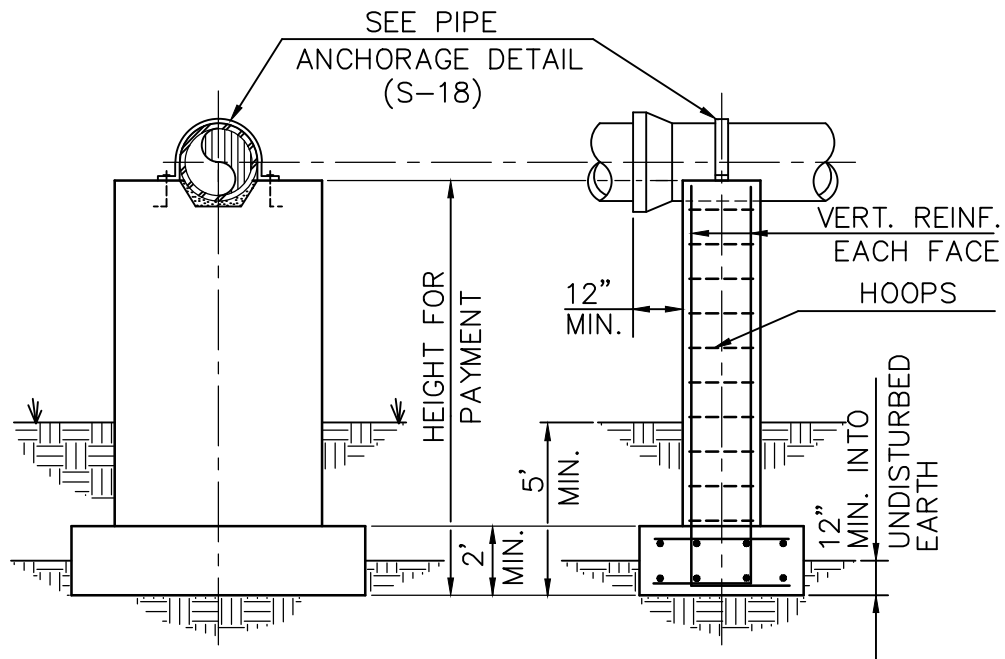
DATE: NOVEMBER 2019

S-14

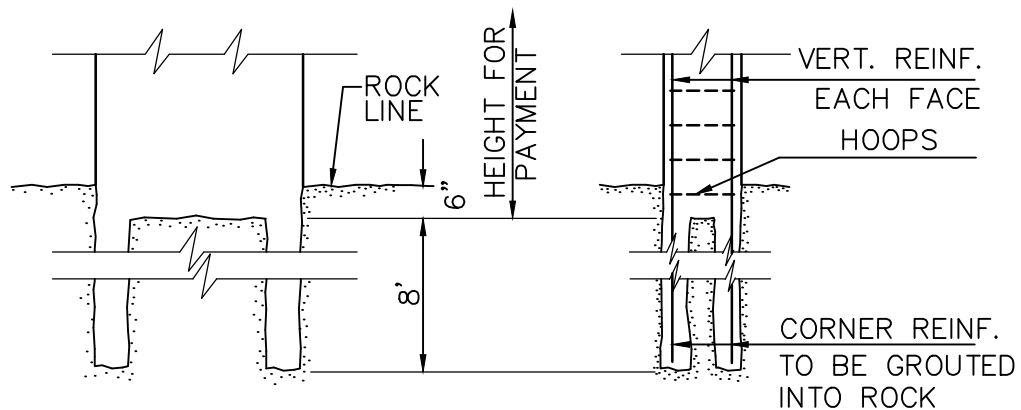


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FOOTING IN EARTH



FOUNDATION IN ROCK

NOTE:

SEE ASSOCIATED DETAILS S-16, S-17,
S-18, AND S-19.

CONCRETE
PIER
DETAILS

SCALE: N.T.S.

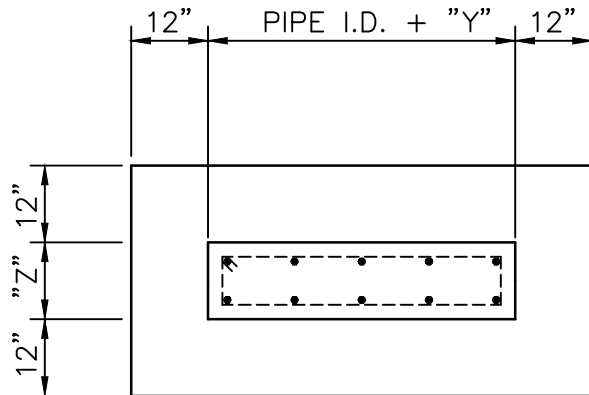
DATE: NOVEMBER 2019

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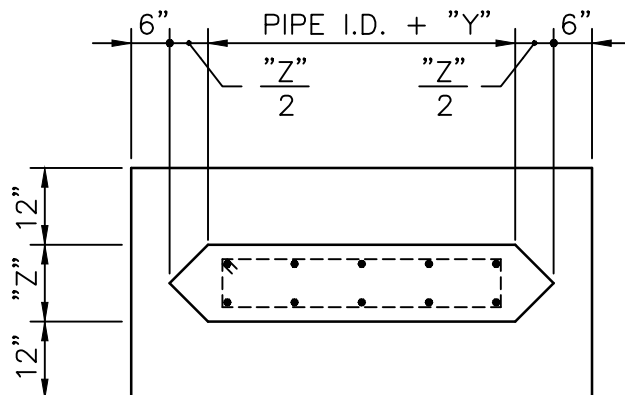
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PLAN — OVERLAND

PIPE I.D.	"Y"	"Z"	VERT. REINF. @12" O.C.	HOOPS @12" O.C.
8"—24"	24"	12"	#5	#3



PLAN — IN STREAM

NOTES:

1. FOOTING REINF. SAME AS VERT. REINF. EA. WAY TOP & BOTTOM WITH 3" MINIMUM CLEARANCE.
2. WHEN BASE IS IN ROCK OMIT FOOTING & GROUT VERTICAL CORNER BARS 8" INTO ROCK.

CONCRETE PIER DETAILS

SCALE: N.T.S.

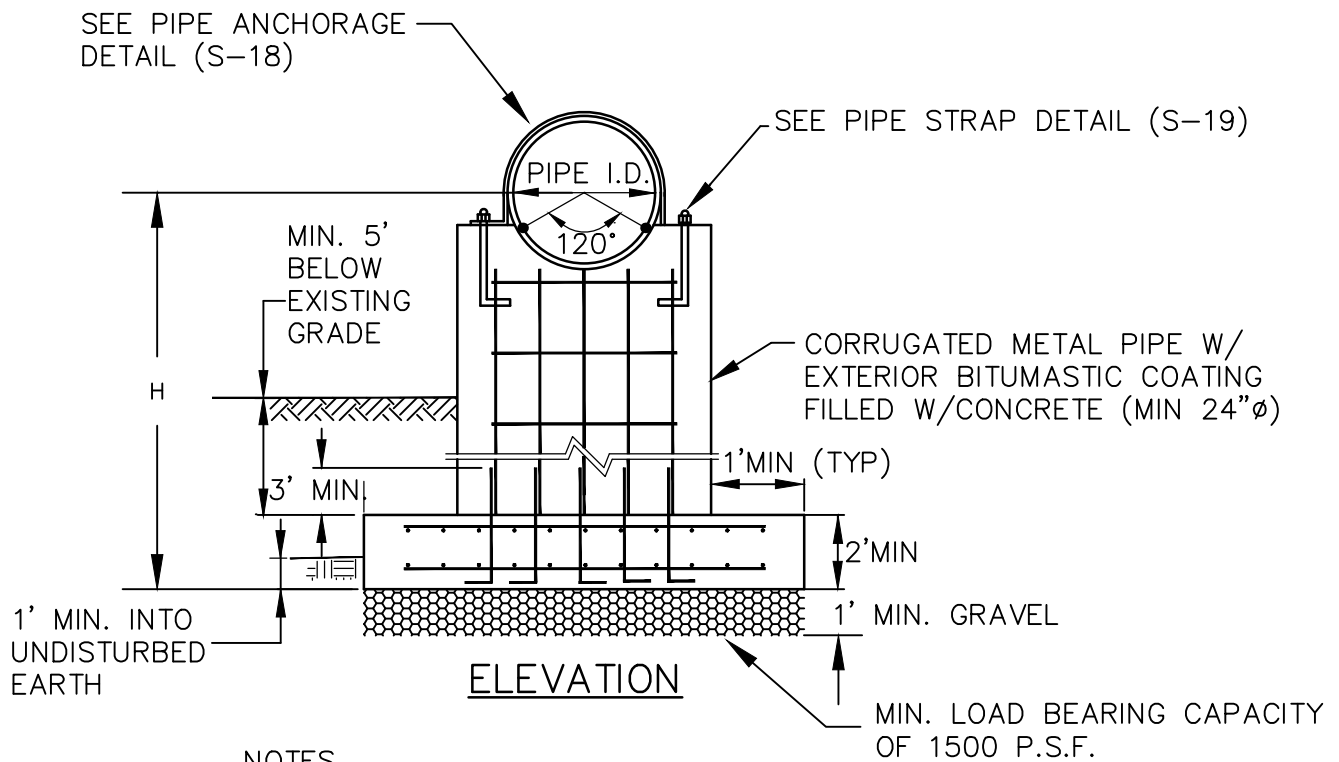
DATE: NOVEMBER 2019

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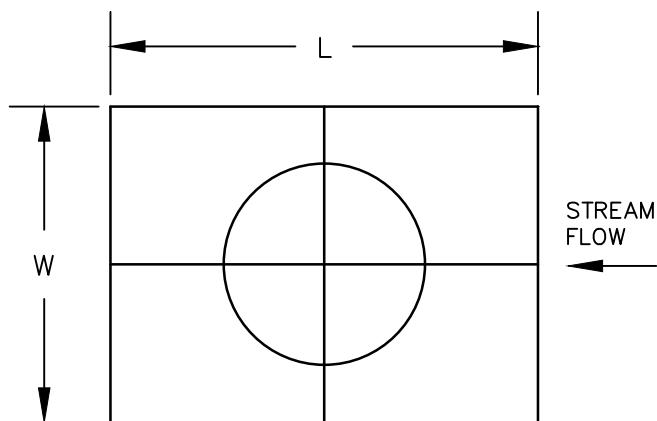
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NOTES

1. VERTICAL REINFORCEMENT @ 6" O.C. - #6 REBAR 2" MIN. CL.
2. HOOPS @ 12" O.C. - #4 REBAR.
3. FOOTING REINFORCEMENT #6 REBAR 12" O.C.E.W.
4. 3" MIN. CLEARANCE ON FOOTING REBAR.



FOOTING

	H < 8'		8' ≤ H ≤ 12'		H > 12'	
PIPE I.D.	W	L	W	L	W	L
12" <	4'	6'	5'	7'	SUBMIT DESIGN FOR REVIEW	
12" ≤ I.D. ≤ 18"	5'	6'	6'	8'		
18" < I.D. ≤ 24"	6'	8'	7'	10'		

FOOTING DIMENSION CHART

CIRCULAR CONCRETE PIER DETAILS

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-17

8" w x 3/8" thk GALV. STEEL
STRAP W/BITUMASTIC COATING
AFTER INSTALLATION

6" x 3/8" NEOPRENE
STRAP AROUND
PIPE (360°)

SEE PIPE STRAP
DETAIL (S-19)

3" MIN.

PIPE I.D.

120°

NEOPRENE PAD

GROUT AFTER PIPE
IS BROUGHT TO
LINE & GRADE

2" TYP.

1/8" BEFORE
NUT IS TIGHTENED

NOTE:

ANCHOR BOLT DIAMETER AND STEEL STRAP
THICKNESS MUST BE DESIGNED TO SUIT
CONDITIONS FOR SPECIFIC INSTALLATION.

PIPE ANCHORAGE DETAIL

SCALE: N.T.S.

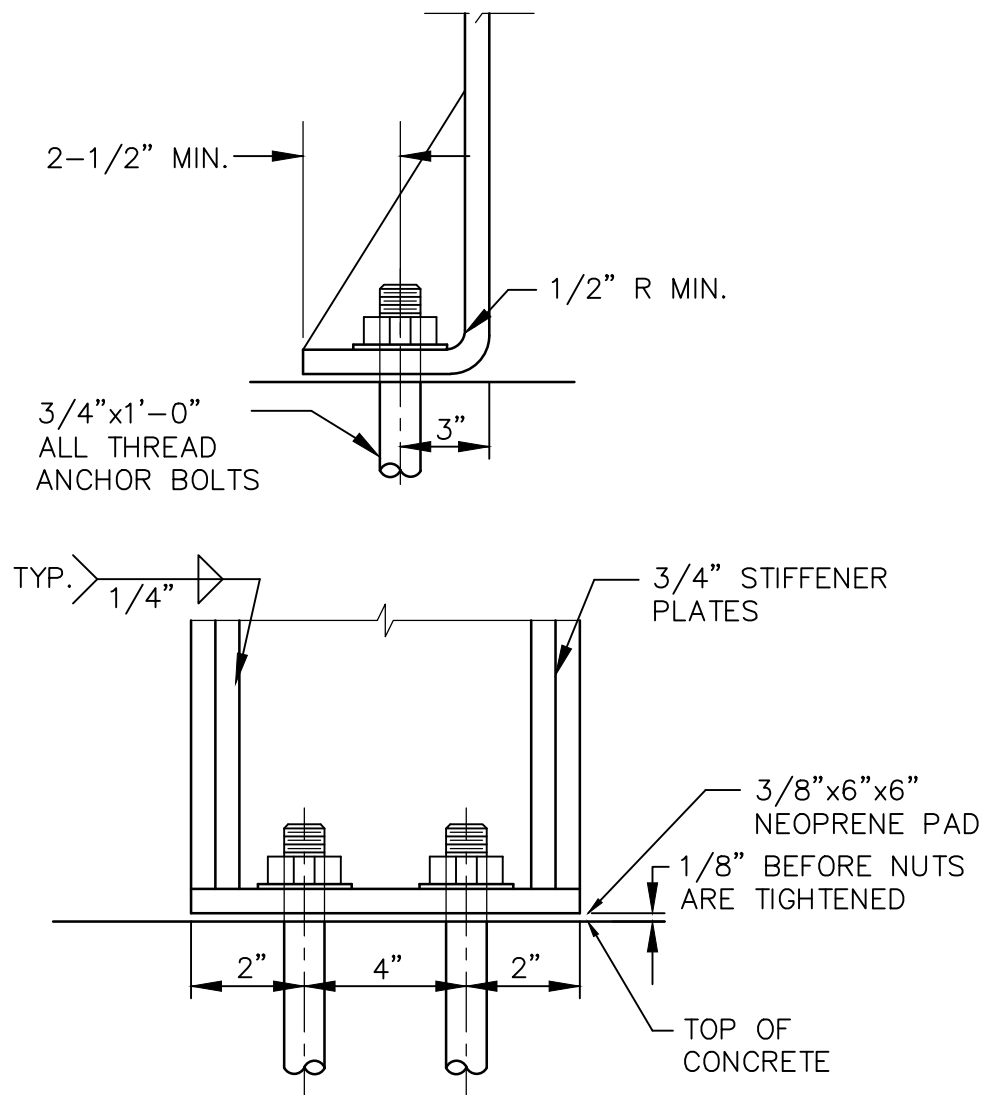
DATE: NOVEMBER 2019

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NOTE:

ANCHOR BOLT DIAMETER AND STEEL STRAP
THICKNESS MUST BE DESIGNED TO SUIT
CONDITIONS FOR SPECIFIC INSTALLATION.

PIPE STRAP DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

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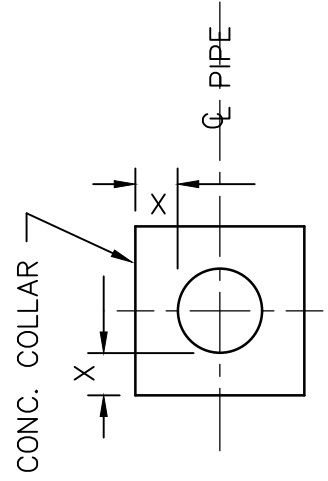
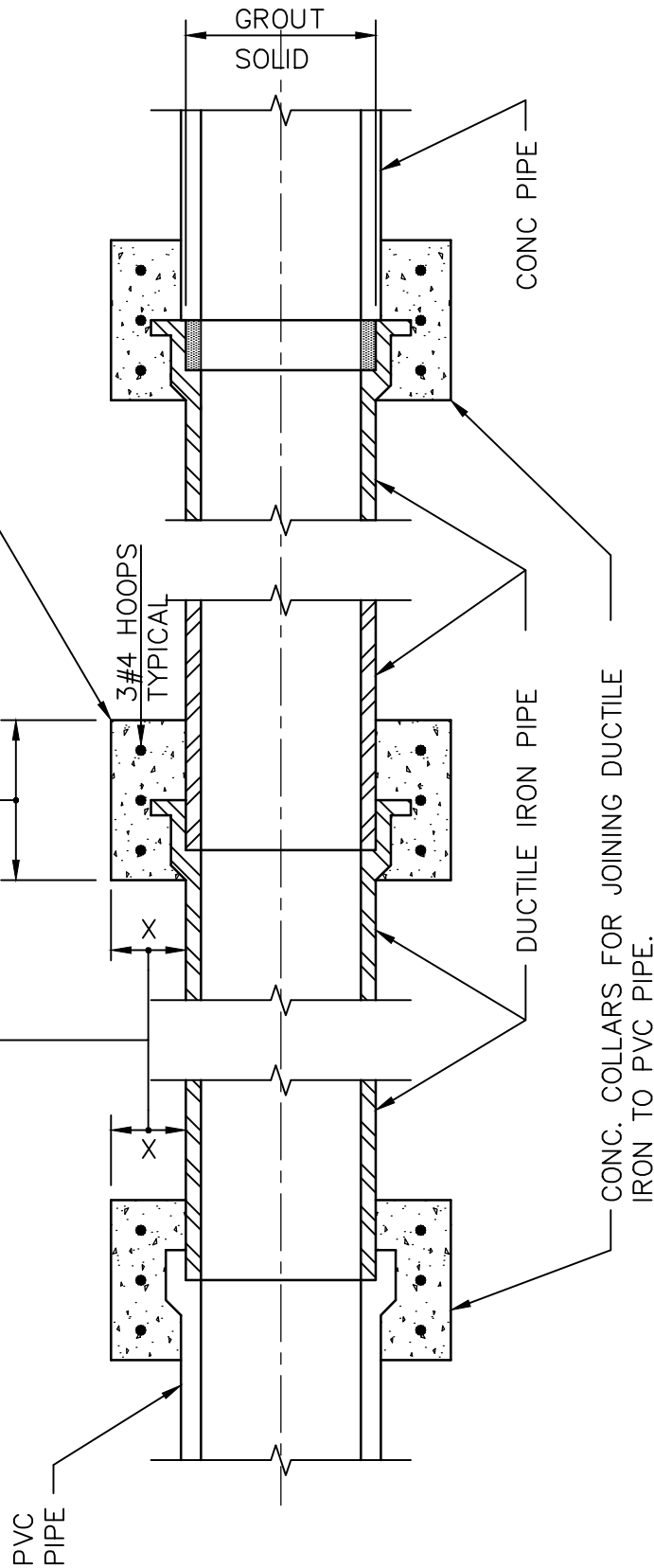
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8" FOR 8" THRU 16" PIPE
12" FOR 18" PIPE
16" FOR 24" & 30" PIPE

12" FOR 10" & 12" PIPE
2' FOR 16" THRU 24" PIPE

ANTI-FLOTATION CONC.
COLLARS TYPICAL AT ALL
JOINTS AND AT ALL CREEK
CROSSINGS. SEE A-21



CROSS-SECTIONAL VIEW

CONCRETE COLLAR DETAILS

SCALE: N.T.S.

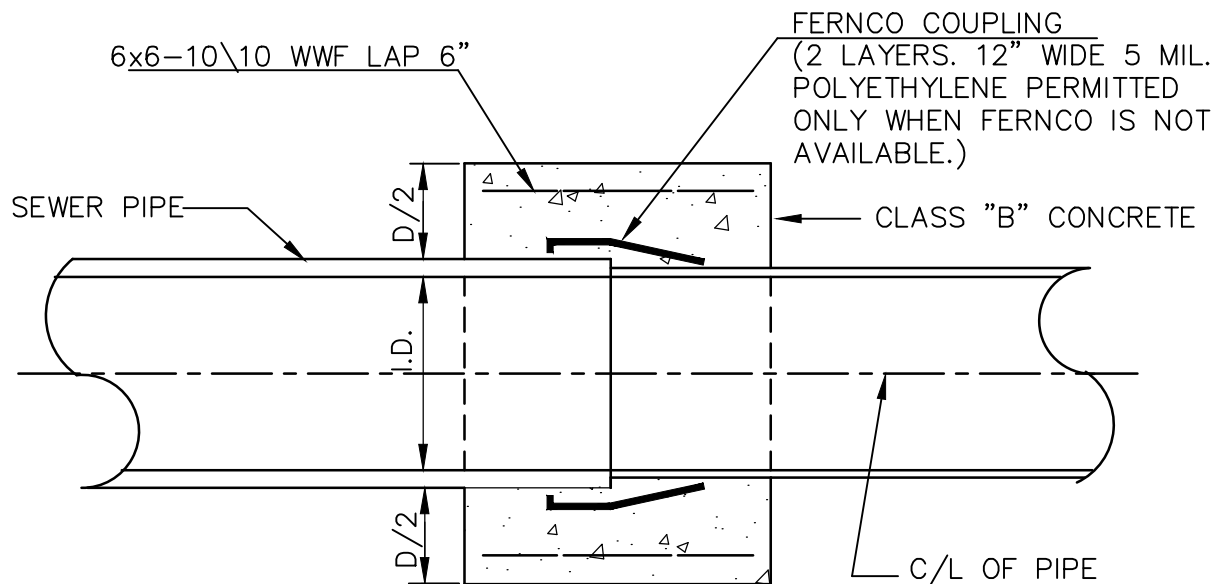
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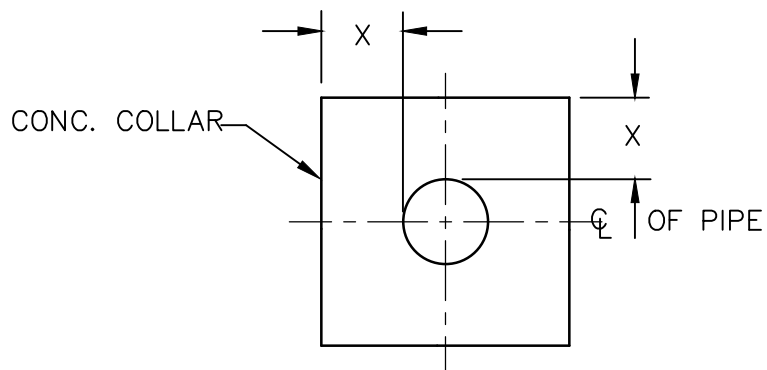
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TRANSITION COLLAR

NOTES

1. TRANSITION JOINTS FROM DUCTILE IRON PIPE TO P.V.C. PIPE FOR PIPE SIZES 12" DIAMETER OR LESS SHALL UTILIZE WATER MAIN TYPE COMPRESSION COUPLINGS (WITH ADAPTER GASKETS IF NEEDED).
2. USE A "FERNCO" TYPE COUPLING ENCASED IN CONCRETE (IF IT IS AVAILABLE IN THE APPROPRIATE SIZE). THE USE OF POLYETHYLENE WRAP WILL GENERALLY BE PERMITTED ONLY FOR CONNECTIONS INVOLVING LARGE DIAMETER PIPES.



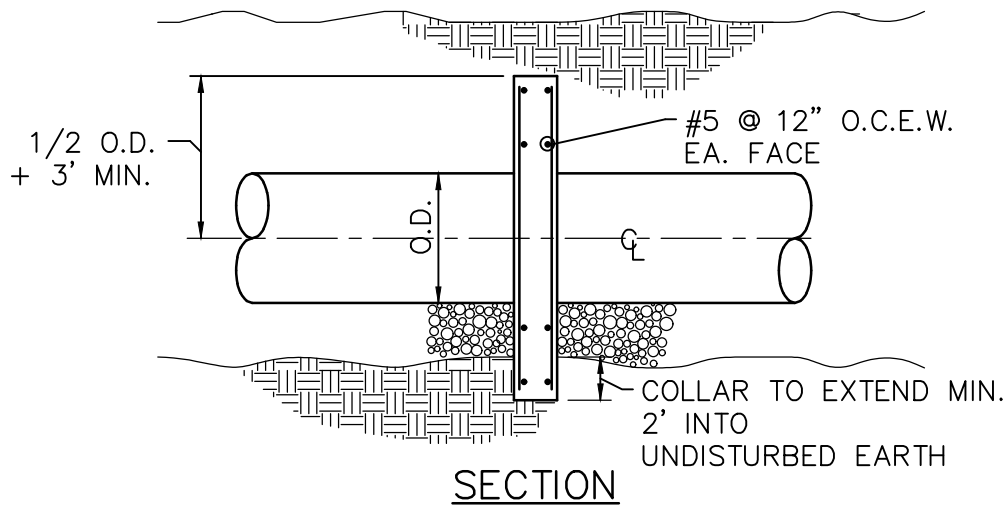
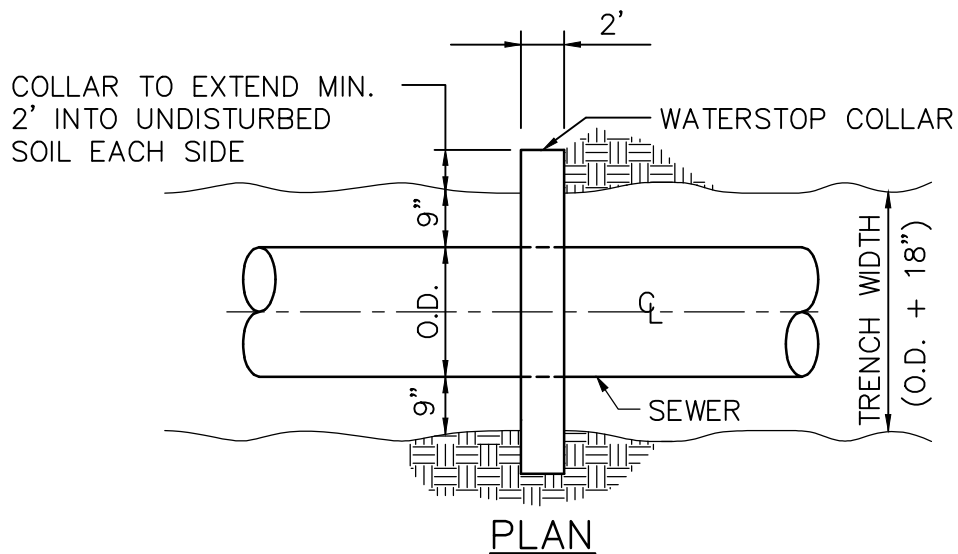
CROSS-SECTION VIEW

CONCRETE TRANSITION COLLAR DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

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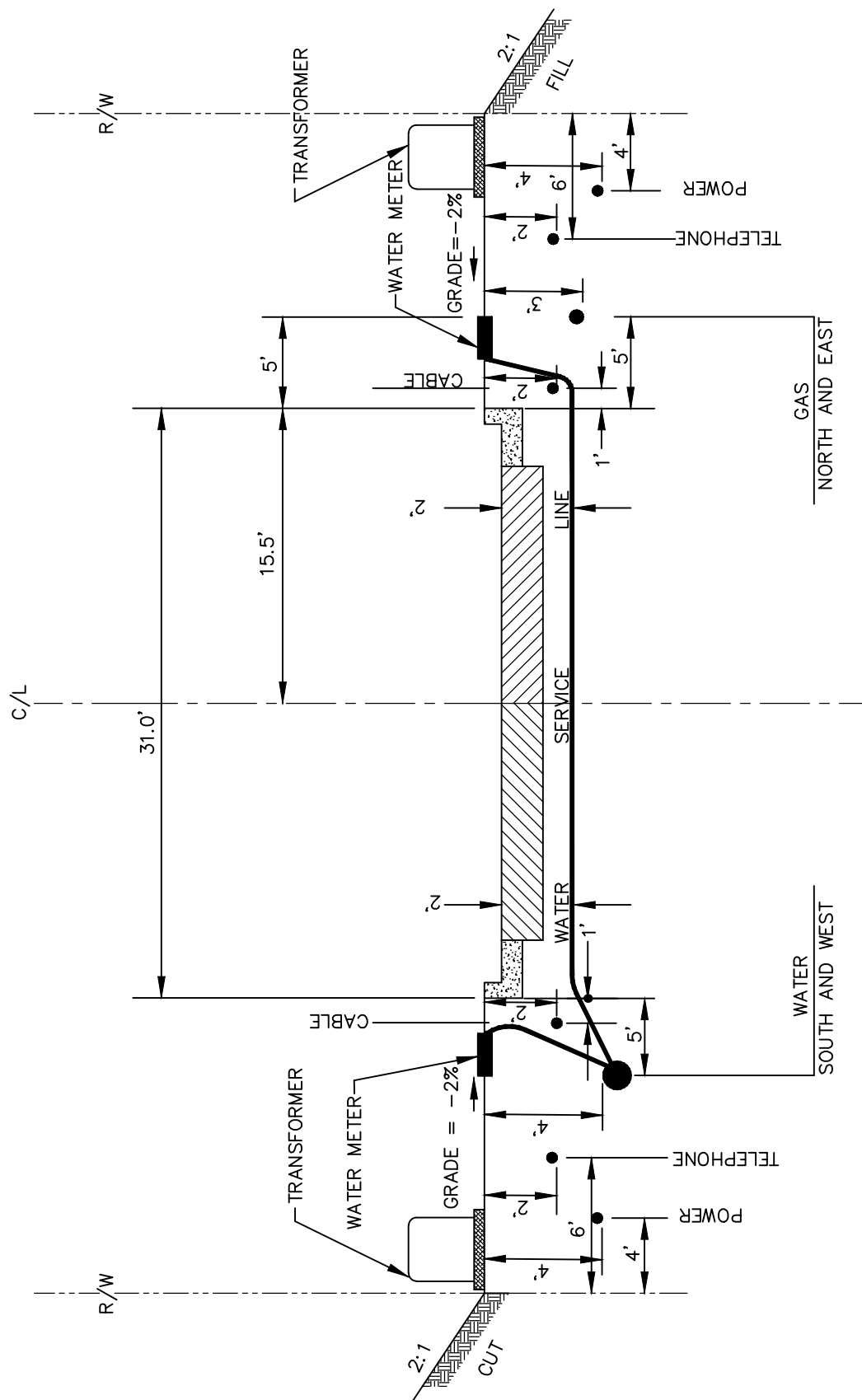


WATERSTOP COLLAR DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

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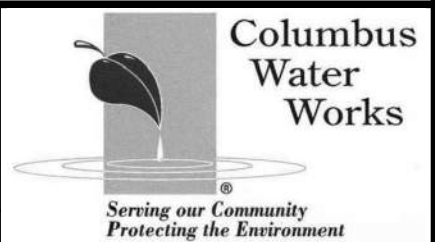


UTILITY LOCATIONS FOR 60' RIGHT-OF-WAY

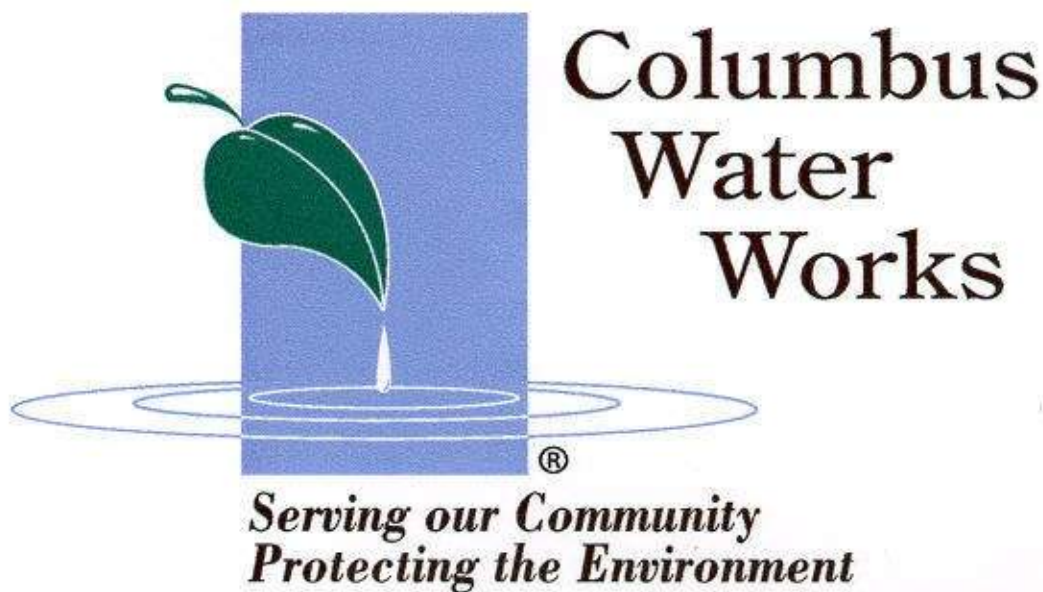
SCALE: N.T.S.

DATE: NOVEMBER 2019

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Specifications and Details for the Design and Construction of Water Systems



Columbus/Muscogee County

2020

**SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF WATER
SYSTEMS-COLUMBUS/MUSCOGEE COUNTY**

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SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF WATER SYSTEMS- COLUMBUS/MUSCOGEE COUNTY

Section 1.01 – Purpose:

This section of the Specifications describes materials to be incorporated into water lines and requirements for installation and use of these materials. The Contractor/Developer shall furnish all materials and perform all labor necessary to fulfill the requirements of these Specifications. **When public water service is desired in a development, the main(s) and other system upgrades necessary to support the development with an acceptable level of service, i.e. main line taps, road bores, booster stations, check valves, pressure reduction, monitoring equipment, or any other upgrades necessary to meet CWW standards, will be at the Developer's expense.**

Compliance with these specifications by the Contractor/Developer is required to ensure a safe potable public drinking water system free from potential sources of contamination and constructed with materials approved by Columbus Water Works (CWW). Compliance with these specifications by the Contractor/Developer is a condition of acceptance of the water main into the maintenance program and creates no contractual relationship between CWW and the Contractor. CWW reserves the right to reject any installed items not in compliance with these specifications. *Columbus Water Works also reserves the right to accept exceptions to these standards if conditions warrant changes. Any proposed changes must be clearly indicated on drawings and addressed in a cover letter to CWW. Only changes approved by CWW Engineering will be acceptable.* Latent indications of deficient installation or materials of the water main and/or appurtenances will be the responsibility of the Developer to rectify at his expense.

Section 1.02 – Definitions:

Unless the context specifically indicates otherwise, the meanings of terms used in these Specifications for the Design and Construction of Water Mains shall be as follows:

- A. "Columbus Water Works" (CWW) shall mean the operating organization working under the policies and direction of the Board of Water Commissioners.
- B. "Engineer" shall mean Owner's/Developer's engineer that is a licensed Professional Engineer (PE) in the state of Georgia.
- C. "Division of Engineering" shall mean CWW Engineering office, which is authorized to have jurisdiction over the water system design and construction.
- D. "Owner/Developer" shall mean any individual, firm association, syndicate, partnership, corporation, trust, or any other entity proposing to subdivide land or provide water for him or for another.

- E. "Contractor" shall mean the constructor or his representative, whether doing work on a contract basis with CWW or working directly for the Owner/Developer.
- F. "Shall" is mandatory; "May" is permissive.

Section 1.03 – General:

A. Applicable Standards:

Supply all materials and perform all work in accordance with CWW standards, American Society for Testing and Materials (ASTM) and American Water Works Association (AWWA) standards, latest edition, and standards referenced therein.

B. Laws and Regulations:

The Contractor's/Developer's attention is directed to the fact that all applicable federal, state, county, and city law, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the project throughout. The Contractor shall keep fully informed of all laws, ordinances, and regulations of the federal, state, county, city and municipal governments or authorities in any manner affecting those engaged or employed in the work or the materials used in the work and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency should be discovered in these specifications herein referred to, in relation to any such law, ordinance regulation, order or decree, the Contractor shall herewith report the same, in writing, to CWW.

For all water systems installed within Columbus/Muscogee County, contractors shall possess a valid Georgia Utility Contractor's License and GSCWW Level IA certification. The Contractor shall at all times observe and comply with all such existing and future laws, ordinances, and regulations, and shall protect and indemnify CWW, and their agents against the violation of any such law, ordinance, regulation, order or decree, whether by the Contractor or by the contractor's employees.

The Contractor/Developer is responsible for enforcing safety in accordance with all OSHA and other regulations. CWW assumes no responsibility for the Contractor's/Developer's job site safety program.

C. Lands and Rights of Way:

In order for the water distribution to be accepted by CWW, the Developer shall provide all necessary easements to insure full ingress and egress for the purpose of maintaining said system. Easements will be a minimum of twenty (20) feet wide and in the name of Columbus Water Works.

Any easement which is intended to be dedicated to Columbus Water Works must be included on the as-built. The easement must be recorded at the county clerk's office by at least one of the two following ways:

1. A CWW Water easement agreement form and two (2) drawings shall be recorded with the county clerk. The engineer shall furnish easement drawings on 8 ½" x 11" or 8 ½" x 14" sheet size. The drawing must be clear and legible for printing and at a reasonable scale. The drawing must show property lines, the name of property owners with length of line encroaching on each property owner, size of line, width of easement, scale of drawing, north arrow, land lot and district numbers. Any street names or other existing easements shall also be shown. All easement plats shall utilize a title block.
2. The following verbiage can be included on the final recorded plat: "Water and sanitary sewer easements are granted for the purpose of constructing and maintaining water mains and sanitary sewers and for no other purpose, and the duly authorized agents and employees of the Columbus Water Works shall have the right of access to the said strip of land for the purpose of constructing said water and sewer mains and for inspecting and maintaining the same in good serviceable condition, and for said purposes they shall have the right to cut and remove any trees or vegetation which may interfere with proper construction and maintenance; and during construction the Columbus Water Works may use any additional adjacent ground which may be necessary for temporary storage of excavated dirt or materials required for construction."

D. Testing, Inspection and Acceptance of Work:

1. Testing of Materials:

Unless otherwise specifically provided for in the Specifications, the inspection and testing of products to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by CWW; the cost of such inspection and testing shall be paid by the Contractor. The Contractor shall furnish evidence, satisfactory to the Owner, that the products have passed the required tests prior to their incorporation into the work. The Contractor shall promptly segregate and remove rejected products from the site of the work.

2. Inspection:

The Contractor/Developer shall furnish CWW with every reasonable facility for ascertaining whether or not the work performed and products used are in accordance with the requirements and intent of the Specifications. No work shall be done or products used without suitable inspection by CWW. Failure to reject any defective work or product shall not in any way prevent later rejection when such defects are discovered, or obligate CWW to final acceptance.

3. Authority and Duties of CWW Inspector:

The Inspector will be authorized to inspect all work done and all products furnished, including preparation, fabrication and manufacture of the products to be used. The Inspector may reject material and workmanship or suspend the work until any question at issue can be referred to and decided by CWW and/or the Contractor/Engineer. The responsibility of the Contractor is not lessened by the presence of the Inspector.

4. Acceptance of Work and Materials:

All products furnished and all work done that is not in accordance with the approved drawings or specifications or that is defective will be rejected. All rejected products or work shall be removed. All unacceptable products or work shall be replaced with other products or work that conforms to the approved drawings and specifications. Service will not be allowed until installation is acceptable to CWW.

5. Contractor's/Developer's Responsibility:

Inspection of the work will not relieve the Contractor/Developer of any obligations to meet the requirements of the Specifications and defective work shall be made good regardless of whether such work has been previously inspected and accepted. The failure of CWW to reject improper work shall not be considered a waiver of any defect that may be discovered later.

Section 1.04 - Sequence of Activities:

The following is the sequence of steps which will be required for preliminary activities as well as construction and final acceptance activities for successful acceptance of the water system by CWW:

- Submit to CWW Division of Engineering electronic (PDF) of construction drawings for water and sewer review.
- CWW review of drawings.
- CWW returns marked up drawings back to Engineer and keeps a file copy.
- Engineer's review (transpose CWW mark-ups onto construction drawings).
- Engineer returns five (5) transposed drawings (3 full sets, plus 2 additional site plan sheets) for approval.
- CWW reviews, stamps and sends back one (1) approved set of drawings with the Approved for Construction letter and fee sheet for any commercial development. The "Approved for Construction" status is valid for one (1) year from date of approval. The fees listed on the commercial fee sheet, as-builts, and sewer documents are due before water and/or sewer service will be provided. Meters three (3) inches and larger are not kept in stock and will be ordered after receipt of fees.
- At the pre-construction conference, the CWW Inspector will give the Contractor an approved set of plans and go over the approved plans, discuss the dates of construction, and review anticipated procedures.
- One (1) copy of the CWW stamped approved plans shall be maintained on site by the Contractor at all times.
- Notify CWW Inspector forty-eight (48) hours before construction begins.
- CWW Inspector checks and approves all stockpiled materials prior to construction.
- To coordinate flushing of a new line, call the CWW Inspector and give at least a forty-eight (48) hour notice.
- Give twenty-four (24) hours' notice to the CWW Inspector to pressure test the system.

- Contractor will disinfect the line and CWW will take water samples. Lab results will be provided in seventy-two (72) hours. This information will be given to the Contractor.
- Contractor/Developer shall submit as-built drawings to CWW for approval. See Section 1.20.
- CWW final acceptance is based upon receipt of approved water sample and all as-built drawings.

The following is a more in-depth explanation of the above steps and should be thoroughly studied:

A. Construction Drawings:

1. The Engineer will be required to furnish two (2) full sets of preliminary construction plans to CWW Engineering Department for review and comment. The plan must include the Engineer's water system design. Additional copies needed by the Contractor/Developer will be submitted as required. *The Engineer will need to show all proposed easements with widths on the first submittal. Typical easements are twenty (20) feet wide and should be dedicated easements. The first submittal should also include any phase lines for subdivisions.*
2. CWW Division of Engineering will review the submitted construction plans and make changes as necessary to indicate to the Contractor/Developer any changes which need to be made prior to construction activity. *CWW will indicate the disinfection tap location on the submittal plans.* CWW Engineering will review the plans, but the responsibility for the design will be with the Engineer. Any plans marked "Amend and Resubmit" or "Rejected" will require a resubmittal prior to construction. Plans marked "No Exceptions Taken" or "Make Corrections Noted" may also be stamped approved for construction by CWW Engineering. In this case, a Contractor/Developer is permitted to begin construction activities.
3. All drawings submitted to CWW Engineering shall be stamped by a Professional Engineer registered in the State of Georgia. The Engineer is responsible for checking water pressure and basing his design accordingly. The drawings shall include the following basic information:
 - Engineer's name, address, and phone number.
 - Developer's name, address, and phone number.
 - Subdivision identification or project identification, revision number of the plans, scale, date of latest drawing, north arrow, and sheet number.

B. Submittals Required:

The Contractor/Developer shall furnish drawings and descriptive literature for all manufactured and fabricated products to CWW for review. Additional information such

as special drawings, schedules, calculations, system curves, etc., shall be provided as requested by CWW.

C. Site Plan Drawings:

The Contractor/Developer shall review and check drawings and submittals and shall indicate approval by initials and date. Contractor/Developer shall furnish CWW three (3) full sets and two (2) site plans of construction drawings of all submittals. A transmittal form shall accompany each submittal or group of submittals.

D. Columbus Water Works Review:

All submittals will be reviewed, stamped and dated by CWW before being returned to the Engineer with the following acceptance comments:

1. No Exceptions Taken: Plans are approved without modification.
2. Make Corrections Noted: Comply with comments marked on drawings by CWW. Plans are approved.
3. Amend and Resubmit: Comments are excessive. Make necessary changes and resubmit.
4. Rejected: Drawings are insubstantial and/or non-compliant with Specifications; return to the Engineer.

E. Drawings for Construction:

Drawings or other submittals not bearing the CWW approval stamp shall not be utilized for construction purposes. The Contractor/Developer shall maintain a complete set of construction drawings at the job site bearing the CWW approval color stamp.

F. Construction Notification:

It shall be the responsibility of the Contractor/Developer to notify CWW Division of Engineering of the date of construction and name of the Contractor performing said construction, as well as his address and telephone number.

G. Construction and Inspection Procedure:

Curb and Gutter should be in prior to the water main, unless approved by CWW Inspector. Avoid valve boxes in the curb and gutter. Also, ensure that the meter boxes are installed in the correct horizontal location (at the right of way line) and that water mains are installed at the correct depths according to the approved plans.

The Contractor/Developer will install the water main including all fittings, blockings, etc., along with all service lines, meter boxes or vaults, curb stops, corporation stops, fire hydrant assemblies, etc. A CWW pre-approved Contractor shall make the required

connections to the existing water system. Installation of water mains shall be in accordance with the following procedures:

1. Notify the CWW Inspector forty-eight (48) hours before any pipe is to be laid. Where the waterline is to be within a new road right-of-way, all curbing must be in place. The pipe, fittings, gaskets, etc., must be on the site and ready to be inspected. A pre-construction conference is required with the CWW Inspector on site. *The approved CWW stamped plans will be given to the Contractor at this meeting.*
2. After materials on the site have been approved, installation can begin. Do not backfill over any locations where fittings have been used or thrust blocking is to be placed. The Inspector must approve all tees, bends, reducers, retainer glands, blow-offs, valves, hydrants, taps of any kind, etc., before backfilling. Service locations must be marked on curb or pavement edge with a blue "M".
3. The Contractor shall coordinate with the Inspector which ends of the pipe to leave open for the initial flushing. The Contractor shall supply all materials deemed necessary by the Inspector to facilitate the flushing. Forty-eight (48) hour notice shall be given to the CWW Inspector prior to flushing. CWW will operate all existing valves. The Inspector must approve the initial flushing, including service lines. The Contractor shall leave the corporation stops open until tested.
4. After all meter boxes are installed in their permanent locations at the right of way line to include all short and long-side stub-outs, the pressure test shall be performed by the Contractor. Twenty-four (24) hour notice shall be given to the CWW Inspector prior to pressure testing the system. The Contractor shall provide the pressure gauge and flow meter to be used in the test. If approved by the Inspector, a clean uniformly shaped container may be used to supply water for the test in lieu of a water meter. Refer to Section 1.17 for test procedure and allowable leakage.
5. The approved Contractor shall make all taps to the existing water system in the presence of the CWW Inspector. Connections to dead end lines by Contractor shall be made in presence of CWW Inspector. *CWW does not locate water lines in subdivisions that have not yet been accepted.*
6. Pressure testing shall be done in accordance with Section 1.17 of these specifications. Upon successful completion of the pressure test, the Contractor/Developer shall disinfect the system, in accordance with Section 1.18, and the CWW Inspector will sample the water for the CWW lab to test. Results from the lab test normally take seventy-two (72) hours. After Laboratory approval, the water line may be put into service.
7. After passing results from the water samples have been obtained, sewer availability fees have been received (if applicable), and as-built drawings have been accepted, the Owner/Developer will be notified that the line is accepted for maintenance by CWW. *Note: The new water system must be put into use quickly, or stagnation will occur. In this event, CWW may need to re-chlorinate/flush the system. Any measures necessary*

to disinfect systems after initial disinfection will be charged to the Owner/Developer. The cost for re-disinfection will be based upon time and materials.

8. Field changes may be worked out with an onsite review with the CWW Inspector, Contractor, and Engineer. Agreement to changes shall be noted on the Inspector's drawings, initialed by the parties in attendance, and verified on the as-built drawings.

9. Numbers to Call:

For inspection, testing, or questions, contact the Engineering Department at (706) 649-3478 or (706) 649-3472.

H. As-Built Drawings:

See Section 1.20 – Requirements for As-Built Drawings.

I. Final Acceptance:

Final Acceptance into the water system will take place upon receipt by CWW of passing water samples and as-built drawings. CWW must have a copy of the as-built drawing before water service will be provided. Once the as-built is provided, then the water service will be turned on. CWW will only accept the main line for maintenance when all other utilities are in, the meter box locations are properly set at the right of way line and the as-built drawings have been accepted by CWW.

Section 1.05 – Materials:

Contractor/Developer shall furnish all pipe, fittings, valves, hydrants, and other material required for completion of the work. All material shall be manufactured in the United States, unless approved by CWW. All material must comply with the “Reduction in Lead in Drinking Water Act” as adopted by the Safe Water Drinking Act. Materials will be in accordance with the following:

A. Description:

This section includes requirements for furnishing ductile iron pipe and fittings. The term “Manufacturer” shall mean an organization, which has at least ten (10) years’ experience in producing and furnishing ductile iron pipe of the type, size and class specified. All manufacture and testing of ductile iron pipe will be conducted in facilities located in the U.S.A. and operating under laws and regulations of the U.S.A.

B. Quality Assurance:

1. All pipe material suppliers shall be ISO registered or provide the services of an independent inspection agency. Prior to the start of manufacturing, any manufacturer not meeting the ISO registration requirements, shall submit to the CWW the name of an independent inspection agency for approval. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical tests, sample

visual inspection of quality assurance tests performed on in-process pipe and fittings, and a sample visual and dimensional inspection of finished product for this project. Chemical samples shall be taken from each ladle of iron and the Manufacturer's chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus, silicon, magnesium, chromium, manganese, tin, aluminum, cerium, copper, and lead. When chemical values fall outside the Manufacturer's control limits, additional mechanical property tests shall be performed to assure minimum mechanical properties are met.

2. All push on joint pipe four (4) inch to sixteen (16) inch diameter (distribution) shall be gage full length per the following table. However, all distribution mains will be eight (8) inch diameter unless approved by CWW. Fire Hydrant leads will be six (6) inch diameter minimum. If requested by the Owner, the Manufacturer shall provide necessary data supporting compliance with this specification:

Size Inches	Outside Diameter Inches	Tolerance Inches
4	4.80	+/- 0.06
6	6.90	+/- 0.06
8	9.05	+/- 0.06
10	11.10	+/- 0.06
12	13.20	+/- 0.06
14	15.30	+0.05/0.08
16	17.40	+0.05/0.08

3. All push on joint pipe eighteen (18) inches and larger (transmission) shall be subjected to a factory hydrostatic test of at least five hundred (500) psi for a period of not less than ten (10) seconds after which time the pressure is to be elevated to a peak pressure that induces a stress in the pipe wall equivalent to seventy-five (75) percent of the minimum specified yield of ductile iron (42,000 psi) as calculated by the following formula:

$$p = \frac{2f_s t}{D}$$

Where:

p	=	peak hydrostatic pressure
f_s	=	stress in pipe wall during hydrostatic test, which shall be 0.75 times the minimum yield strength of the ductile iron in tension, i.e.: 42,000 psi
t	=	nominal wall thickness, in.
D	=	outside diameter, in.

All transmission pipes shall be furnished gage full length when requested by the Owner/Engineer.

4. Submit affidavits of compliance from the Manufacturer for the following:
 - a. Ductile iron pipe in accordance with the requirements of AWWA C151/ANSI A21.51 and these specifications.
 - b. Cement mortar lining of ductile iron pipe in accordance with the requirements of AWWA C104/ANSI A21.4 and these specifications.
 - c. Rubber gasket joints for push-on or mechanical joints shall be in accordance with the requirements of AWWA C111/ANSI A21.11 and these specifications.
 - d. Manufacturing facility has been producing ductile iron pipe of specified diameter, dimensions and standards for at least ten (10) years.
 - e. Manufacturer's written certification of compliance with NSF 61, NSF 372, and lead-free requirements of U.S. State and Federal laws.
 - f. All pipe shall be certified that it is in compliance with this specification and shall be certified by a Professional Engineer.
5. Within forty-eight (48) hours' notice CWW and its agents shall be allowed a full inspection of the DIP manufacturing operations, testing procedures, and quality compliance documentation.

C. Ductile Iron Pipe:

1. All D.I.P. shall be furnished in lengths eighteen (18) to twenty (20) nominal feet. D.I.P. shall be manufactured by American Cast Iron Pipe Company or U.S. Pipe and shall be made in the U.S.A. unless approved by CWW.
2. Ductile iron pipe shall conform to AWWA/ANSI A21.51. All pipes shall have a minimum pressure rating as indicated below, or as indicated on contract drawings:

<u>Pipe Sizes (inches)</u>	<u>Pressure Class (psi)</u>
04 - 12	350
14 - 20	250
25	200
30 - 64	150

3. Ductile iron pipe shall be lined with cement in accordance with AWWA C104. Pipe shall be furnished with a bituminous outside coating. Manufacturer shall demonstrate ability to produce a high-performance lining. Plans/specifications may call for the exterior of ductile iron pipe to be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be two hundred (200) g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than three (3) mils with a local minimum not less than two (2) mils. All pipe shall be manufactured and coated in the United States at the pipe

Manufacturer's facility. Soil conditions may require a V Bio Poly wrap approved by DIPRA.

4. Push-on joints for ductile iron pipe shall be rubber gasketed joints in accordance with the applicable requirements of AWWA C111/ANSI A21.11. Standard push-on joints shall not exceed the Manufacturer's specifications. Standard and special deflection bells shall not exceed the Manufacturer's specifications.
5. Restrained joints: Where restrained joint pipe (RJP) is shown on the Drawings, restrained joints for pipe diameters 16-inch and less shall be manufactured restrained joint, mechanical joint fitting with retainer gland or restraining gasket joint as specified below.
 - a. Manufactured restrained joints shall be American "Flex-Ring" or "Lok-Ring"; U.S. Pipe "TR FLEX" or "HP LOK"; or Amarillo Fast Grip; or Barracuda Gaskets." No field welding of restrained joint pipe will be permitted.
 - b. Restraining gasket joints shall be assembled with American Fast-Grip gaskets or U.S. Pipe FIELD LOK gaskets but may only be used in lieu of manufactured restrained joints where approved by the Engineer.
 - c. Retainer glands on a mechanical joint may be used as a restrained joint only where retainer glands are specifically shown on the Drawings or where specifically specified.
 - d. Where retainer glands are allowed, in lieu of retainer glands specified elsewhere, the joint may be assembled with US Pipe MJ FIELD LOK gasket.
 - e. No field welding for manufactured restrained joint pipe assembly will be permitted. Where field cutting of restrained joint pipe is required, the joint may be assembled with American Field Flex-Rings, US Pipe TR FLEX GRIPPER Rings, or a mechanical joint fitting with retainer gland may be used.
 - f. All "restrained" bells shall be painted yellow.
6. Mechanical joints for ductile iron pipe shall be rubber gasket joints in accordance with the applicable requirements of AWWA C111/ANSI A21.11. Mechanical joints shall not exceed the Manufacturer's specifications. The pressure rating for mechanical joints shall be a minimum of two hundred and fifty (250) psi.
7. Pipe Manufacturer may be required to provide a Manufacturer's representative for product design and installations seminars and provide on-site review of material as requested by CWW.
8. All fittings thirty (30) inches and larger shall be manufactured in the U.S.A. (unless approved by CWW). Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum working pressure of two hundred and fifty (250) psi. Fittings shall be cement lined in accordance with AWWA C104 and shall be

furnished with a bituminous outside coating. In lieu of cement lining and bituminous coating, fittings may be provided with a fusion bonded coating and lining meeting the requirements of AWWA C116.

D. Gate Valves (GV):

Gate valves shall be resilient seat type conforming to the requirements of AWWA C-515 and shall be American Flow Control, M&H, or Mueller. Gate valves to be placed per detail A-3 and/or Detail A-8. In line valves should be placed at a minimum of two thousand (2,000) L.F. on straight line runs. Valve ends shall be mechanical joint type except equivalent to Romac Alpha, where flanged ends are required. Valves shall open left, have a two (2) inch square operating nut and have "O"-ring type stem seals. Buried valves shall be equipped with valve boxes. If operating nut is not within three (3) feet of finish grade, then Valve Stem Risers are required. Valves, including geared valves, shall be non-rising stem type. Side actuated gate valve may be required by CWW.

E. Butterfly Valves (BV):

Use of butterfly valves will be based on CWW approval. Butterfly valves shall be resilient seat type conforming to the requirements of AWWA C-504 and shall be American Flow Control, M & H, or Muller. Valves sixteen (16) inches and larger shall be gear operated. Valve ends shall be mechanical joint type except where flanged ends are required. Valves shall open left, have a two (2) inch square operating nut and shall have veering stem seals. Buried valves shall be equipped with valve boxes. Provide extension stems where required to bring operating nut to within three (3) feet of finish grade.

F. Flange Joints:

Provide gaskets for flange joints made of one-eighth (1/8) inch thick rubber. Gaskets may be ring type or full-face type. Provide bolts for flange connections. Bolts shall be steel with American regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagon dimensions, all as specified in ANSI B-17.2. All bolts and all nuts shall be threaded in accordance with ANSI B-1.1, Coarse Thread Series, Class 2A and 2B fit.

G. Valve Boxes (VB):

All buried valves shall be equipped with valve boxes. Valve boxes shall be eight (8) inch PVC. A cast iron ring and cover manufactured to CWW Standards shall be used (Drawings A-36). A lockable Valve Box purchased from CWW is required on meter bypass valves and may be required on fire line isolation valves. Location will be shown on the approved plans. Manufactured valve boxes may be used. These valve boxes when under pavement shall be adjustable to six (6) inches up or down from the nominal required cover over the pipe. Typical valve box details are included in Drawings A-7 and A-23.

H. Tapping Sleeves, Valves, and Service Saddles:

1. Tapping sleeves shall be the fabricated type, with all parts of stainless-steel construction or epoxy coated. The tapping sleeve shall be manufactured by JCM Industries, Inc., type 412, 414, 415, 452 or Ford Meter Box Company, Inc., models FTSAS, FAST or FTSC. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve.
2. Tapping valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connections to the tapping sleeve and mechanical joint connection to the branch pipe.
3. CWW reserves the right to select type based on location, age/condition of main or size of branch tap.
4. Install, torque, and hydrostatically test using water to two hundred (200) psi for a minimum of ten (10) minutes. Follow the manufactures instructions and AWWA 223 recommendations for installation. CWW Inspector must be present during install, torque and test.
5. Connections to water main piping shall be by service saddle or by the direct tap method, as shown in the details (See detail A-26), in full accordance with AWWA requirements. Service saddles shall be ductile iron body type with "O"-ring rubber gasket and double alloy steel straps. Saddles shall be manufactured by JCM Industries, Inc., Type 402, Smith-Blair Model 313, or Mueller DR2A series.

I. Fire Hydrants:

1. All fire hydrants shall conform to the requirements of AWWA C-502 for two hundred and fifty (250) psi working pressure. Hydrants shall be the compression type and close with line pressure. The valve opening shall be a minimum five and one quarter ($5 \frac{1}{4}$) inches. Hydrants shall open right, have two (2) two and one half ($2 \frac{1}{2}$) inch hose connections and one (1) four and one half ($4 \frac{1}{2}$) inch pumper connection with N.T.S. threads and equipped with cap and chain. The operating nut shall be a one and one half ($1 \frac{1}{2}$) inch Hex.
2. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.
3. This means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight (8) different directions.
4. Private Sprinkler Lines, Fire Department Connections (FDCs) and Private Hydrants shall be per IAW Chapter 120-3-3, Rules and Regulations for the State Minimum Fire and Safety Standards (Latest version).

5. Hydrants shall be fully bronze-mounted with all working parts made of bronze. The valve seat ring shall be bronze and shall screw into a bronze retainer.
6. Two (2) hose and one (1) pumper connection shall be breech locked, pinned, or threaded and pinned. Hydrants shall be furnished with a mechanical joint connection to the spigot of the six (6) inch hydrant lead equivalent to Romac Alpha.
7. Minimum depths of bury shall be three (3) feet to top of pipe. Provide extension section where necessary for vertical installation and in accordance with Manufacturers' recommendations.
8. All outside surfaces of the barrel above grade shall be painted with Koppers Glamortex 501 enamel with yellow color. Hydrants shall be American-Darling B-84-B type. Typical spacing along water mains is five hundred (500) feet for residential development and three hundred (300) feet for commercial/industrial development. However, some adjustment may be required by the local or state fire Marshall.
9. Refer to detail A-23 for notes on restraint.

J. Couplings:

Couplings shall be Dresser Style 38. Couplings requiring thrust restraint shall be equipped with four (4) steel tie-bolts extending from steel lugs welded on the pipe to lugs welded on the middle ring of the coupling. Lugs shall be shop welded and delivered to the job site ready for installation.

K. Valve Markers (VM):

Concrete valve markers shall be supplied when required by Columbus Water Works.

L. Service Lines:

Type K- Dimensions of Seamless Copper tubes according to ASTM B88							
Nominal Size (inches)	Actual Outside Diameter (inches)		Tolerance on Outside Diameter (inches)		Wall Thickness (inches)		Weight (lb/ft)
			Annealed ¹⁾	Drawn ²⁾	Nominal	Tolerance	
3/4	7/8	0.875	0.003	0.001	0.065	0.006	0.641
1	1 1/8	1.125	0.0035	0.0015	0.065	0.006	0.837
1 1/2	1 5/8	1.625	0.0045	0.002	0.072	0.007	1.36
2	2 1/8	2.125	0.005	0.002	0.083	0.008	2.06

Service lines shall be type "k" soft copper and a minimum three quarters (¾) inch inside diameter, maximum two (2) inch with six hundred twenty-five ten thousandths (0.0625) inch wall thickness. Unions shall be cast bronze and not be used under pavement. Service

lines larger than two (2) inches will be Ductile Iron. Fittings shall be brass with compression connection inlet and outlets per ANSI B16.26.

M. Backflow Prevention Devices:

Backflow prevention is required on all new services. The potable water system shall be protected from actual or potential contamination by conforming to the CWW Cross-Connection Control Program and the Georgia Safe Drinking Water Act which includes the “Reduction in Lead Drinking Water Act”. All installations must conform to the guidelines set forth by the SBCCI, AWWA M-14, and EPA guidelines for cross-connection control.

Inquiries related to cross-connection control should be directed to the Program Manager, phone (706)649-3490.

Backflow preventers shall be double check valve for domestic services and shall be Ames/Watts Series 007. For High Hazard service, it shall be an RPZ type. Fire services shall be double detector check valve and shall be manufactured by Ames or Watts.

N. Corporation Stops:

- 3/4” Mueller H-15008, McDonalds 4701-T, or equivalent
- 1” Mueller B-25170R, McDonalds 4701-T, or equivalent
- 1 ½” Mueller B-25008, McDonalds 4701-BT, or equivalent
- 2” Mueller B-25008, McDonalds 4701-BT, or equivalent

O. Curb Stops:

- 3/4” Mueller B-25170, McDonalds 6102-TW, or equivalent
- 1” Mueller B-25170, McDonalds 6102-TW, or equivalent
- 1 ½” Gate Valve, gate thread non-rising stem Stockham B-103 or Milwaukee 5, or equivalent
- 2” Gate Valve, gate thread non-rising stem Stockham B-103 or Milwaukee 105, or equivalent

P. Meters, Vaults and Boxes:

- 5/8” meter goes in a Carson 1015-12 or D-1200, or equivalent
- 1” meter goes in a Carson 1015-12 or D-1200, or equivalent
- 1 ½” meter goes in a Carson 1730-18, or equivalent
- 2” meter goes in a Carson 1730-18, or equivalent

Contractor/Developer shall provide a vault for meter sizes three (3) inch and above, as well as banks of meters. The vault design shall be as shown on drawing A-1 or A-2, or approved submittal. Vaults shall have positive drainage or water tight lids. All meters shall be manufactured by Neptune.

Q. Combined Residential Domestic and Fire Service:

Combined domestic and fire must comply with latest version of the NFPA and specifically NFPA-13R. Plans must be submitted to CWW for review but must be approved by the local or state Fire Marshal. The only approved meter for this type of service is the two (2) inch TRU-FLOW Neptune meter. See detail A-28.

R. Thrust Restraint:

See Section 1.13 – Thrust Restraint.

S. Line Stop (Plugging Device):

Usage to be determined by CWW Engineering Department. This method is to ensure minimal customer service outages on existing mains within the CWW Water Distribution System. Hydra-Stop, Inc., Flowserve, TDW services, or Rangeline are the only CWW approved plugging devices for Cast Iron and Ductile Iron materials.

T. Pressure Reducing Valves (PRV):

Pressure Reducing Valve is required on all private services if static pressure is eighty (80) psi or greater per International Plumbing Code (2009). CWW is not responsible for the installation and maintenance of PRV. Pressure reducing valves shall be Watts Series LF25AUB-23 or Apollo 36LF Series.

U. Blow Off Assembly:

Blow Off Assembly shall be per CWW Detail A-11.

V. Detection Tape:

1. Detection tape is required for all water mains and service lines.
2. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Blue, “Caution: Water Line Buried Below”. Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum two (2) inches when buried less than ten (10) inches below the surface. Tape width shall be minimum three (3) inches when buried greater than ten (10) inches and less than twenty (20) inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

Section 1.06 – Handling Materials:

Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading.

Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

A. Handling:

Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift or front loader. Do not use material damaged in handling.

B. Distribution:

Distribute and place pipes and materials so as to not interfere with traffic. Do not string pipe more than one thousand (1,000) feet beyond the area where pipe is being laid. Do not obstruct drainage ditches or create a traffic hazard.

C. Storage:

Store all pipes, which cannot be distributed, along the route. Make arrangements for the use of suitable storage areas with CWW Inspector.

Section 1.07 – Construction along Highways, Streets and Roadways:

Install pipe lines and accessories along highways, streets, and roadways in accordance with the applicable regulations of the Georgia Department of Transportation and Columbus Consolidated Government with reference to construction operations, safety, traffic control, road maintenance and repair. Refer to sections 1.15 and 1.16 for additional roadway requirements. Water mains will generally be located on the south and west sides of roads, unless otherwise approved by CWW.

A. Protection of Traffic:

Provide and maintain suitable signs, barricades and lights for protection of traffic. Removal of highway signs for construction shall be under permission of the Georgia Department of Transportation or the Columbus Consolidated Government. Do not close or block any highway, street or roadway without first obtaining permission from the proper authorities. Traffic control shall conform to the Manual on Uniform Traffic Control Devices for Streets and Highways. Manuals may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington DC., 404 Publication Number FHWA-SA-89-006 (or latest revision). Flagmen shall be certified by a GDOT approved flagman training program.

B. Construction Operations:

In accordance with Georgia law, the Contractor shall call 811 to request marking of utilities in all areas in which construction activities are scheduled. Perform all work along highways, streets and roadways to minimize interference with traffic.

1. Clearing and Grubbing:

Erosion control measures shall be installed in accordance with approved drawings and all applicable regulations prior to clearing and grubbing and shall be properly maintained during the life of the project.

2. Trenching, Laying and Backfilling:

Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day maintaining positive drainage, which does not impact traffic.

3. Shaping:

Reshape damaged slopes, side ditches and ditch lines immediately after completing backfill operations. Replace topsoil if necessary to re-establish sod and other landscaping removed from shoulders.

C. Excavated Materials:

Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered and excavated material off the pavement. Wash the street if necessary.

D. Drainage Structures:

Keep all ditches, culverts, cross drains and other drainage structures clear of excavated material and free to drain at all times.

E. Maintaining Highways, Streets, Roadways and Driveways:

Maintain streets, highways and roadways in suitable condition for movement of traffic until completion and final acceptance of the work. Use street running plate to maintain traffic until pavement replacement is completed.

F. Piping Location:

Piping shall be installed at a minimum of five (5) feet behind the roadway curbing or pavement edge. Where possible, pipe will be located on the south or west side of roadways.

G. Easements:

Contractor/Developer will be responsible for providing any necessary easement agreements. See Section 1.03 (c).

H. Water Meter Locations Along Roadways:

Final meter locations will be within the right-of-way as indicated on Drawing A-29. No meter boxes will be located in driveways, sidewalks, pedestrian pathways or ditches. Corporation stops and curb stops shall not be installed under pavement unless allowed by the Inspector. The location of the water meter along the property frontage is up to the Developer, but it is recommended that meters be placed near the property corners. Meters that must be relocated by CWW after acceptance will be moved by CWW at the Owner's/Developer's expense. Dual services are recommended at the property lines so that meters can be grouped together.

Section 1.08 – Existing Underground Utilities and Obstructions:

It is the responsibility of the Contractor/Developer to locate all existing utilities along the path of construction. Drawings shall indicate underground utilities or obstructions that are known to exist. Where these or unforeseen underground utilities are encountered, the location and alignment may be changed, upon written approval of CWW, to avoid interference. Such changes will be marked up on Contractor's/Developer's as-built plans. No water mains will be accepted that are installed through or in close proximity to an abandoned landfill site or any other site used for waste disposal.

Section 1.09 – Water and Sewer Separation:

Water mains shall maintain a minimum ten (10) foot edge to edge separation from sewer lines, whether the sewer operates by gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the ten (10) foot horizontal separation, the water main must be separated a minimum of eighteen (18) inches above the top of the sewer. Where the water main crosses a sewer line, an eighteen (18) inch vertical separation shall be maintained and a full joint of water pipe shall be centered over the sewer line. Adjustments to this shall be made by CWW.

No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

Section 1.10 – Connection to Existing Pipe Lines:

CWW or their approved Contractor will make connections to existing pipe lines with tapping sleeves, valves, and other necessary materials. Service lines two (2) inches in diameter or less shall be by service saddle or direct tap based on Detail A-26. CWW will operate all existing valves and new valves that directly connect a new system to the existing distribution system.

A. Location:

Before laying pipe, locate the points of connection to existing pipe lines and uncover as necessary for CWW to confirm the nature of the connection to be made.

B. Interruption of Services:

CWW or their Contractor will make connections to existing pipe lines only when system operations permit. Operation of existing valves will be the sole responsibility of CWW. Tampering with valves is illegal according to city ordinances and fines may be levied.

Section 1.11 – Excavation:

Excavate all material encountered and dispose of excess excavated material not required for backfilling in accordance with applicable local, state and federal regulations.

A. Depth of Trenches:

Excavate trenches to provide a minimum cover of three (3) feet to the top of pipe. Within the proximity of highways, streets, or roadways, excavate to place the top of the pipe at a minimum of four (4) feet below the nearest pavement edge, and at least two (2) feet below the bottom of the drainage ditch.

B. Width of Trenches:

Excavate trenches wide enough to allow proper installation of pipe, fittings, and other materials, and not less than six (6) inches clear of the outside barrel of the pipe on any side at any point.

C. Bell Holes:

At each joint, excavate bell holes to a depth and width which will permit the joint to be made properly and to relieve any stresses on the pipe bell.

D. Earth Excavation:

Excavate and prepare the trench bottom to support the pipe uniformly throughout its length. For ductile iron pipe, the trench shall meet the requirements of Standard Laying Condition Type 2 in accordance with AWWA C-151. If the trench is excavated to excessive width or depth, provide sand or gravel to achieve Standard Laying Condition Type 4 in accordance with AWWA C-151. (See Detail A-30).

E. Bracing and Sheeting:

When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities, or trees which are specifically required to remain, provide bracing and sheeting. 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 CWW it cannot be safely removed. Cut off sheeting left in place at least two (2) feet below the surface.

1. Timber:

Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.

2. Steel Sheet Piling:

Continuous lock joint steel sheet piling may be substituted for timber sheeting when approved by CWW. Steel piling may be removed, without cutting, provided the rate of removal is kept in pace with the tampering and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where ordered to be left in place by CWW for reasons of safety, will be cut off where directed.

F. De-Watering Trenches:

Maintain a water level two (2) feet below the bottom of the trench by pumping out water continuously. Continue to de-water running sand by using well pointing. Where soil conditions do not permit the use of well pointing, construct trench drains of crushed stone or gravel to conduct water to sumps.

G. Trench Stabilization:

Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, CWW will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with crushed stone bedding material. Place and compact this material to bring the trench to the required grade. No pipe shall be laid directly on excavated rock. Trench stabilization shall be in accordance with Detail A-30.

Section 1.12 – Laying and Jointing Pipe and Fittings:

Lay all pipe and fittings to accurately conform to the lines and grades approved by CWW as follows:

A. Handling:

Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe and the cement lining. Examine all pipes carefully for cracks and other defects as it is laid. Do not use pipe or other materials which are known to be defective. Lower all pipe, fittings, valves and accessories into the trench by suitable means. Do not drop or dump pipe or accessories into the trench. If any pipe or other material is discovered to be defective or damaged after being laid, remove and replace it. Clean pipe and fittings thoroughly before laying. Keep the pipe line clean until final acceptance.

B. Alignment and Gradient:

Lay pipe straight in alignment and gradient or follow true curves as nearly as practical. Do not deflect any joint more than two-thirds (2/3) the maximum deflection recommended by the Manufacturer. Maintain suitable equipment along with competent personnel on the job to lay out angles and ensure that deflection allowances are not exceeded.

C. Expediting Work:

Do all of the following promptly: excavate the trench, call for inspection, install the pipe, fittings and hydrants, and backfill as soon as possible. Notify CWW Engineering Department twenty-four (24) hours before backfilling is to commence. All thrust restraint must be in place at time of inspection. The contractor must receive approval to backfill by the Inspector. Any deficiencies noted by the Inspector must be brought into compliance and a second inspection must be scheduled, as directed by CWW.

Do not leave un-jointed pipe in the trench. Backfill and compact as soon as possible after laying and jointing is completed. Plug the exposed end of the installed pipe each day at the close of work with an approved plug and at all other times when work is not in progress, pipe must be sealed with an approved plug. If necessary to backfill over the end of an uncompleted pipe, close the end with an approved plug.

D. Laying Pipe in Trenches:

Lay the pipe with solid bearing throughout its length. All Pipe bedding shall be done as specified in AWWA C-151 or last revision. Refer to typical Detail A-30.

1. Earth Trenches:

Grade the bottom of the trench to a true line. Lay the pipe in clean bedding material, free of rock, organics and other unsuitable materials.

2. Wet Trenches:

Do not lay pipe in water. Provide de-watering equipment to maintain a ground water level two (2) feet below the bottom of the pipe while the pipe is being laid.

3. Blasted Rock Trenches:

Do not lay pipe directly on to blasted rock. Keep a minimum six (6) inch layer of crushed stone underneath the pipe at the highest peak of the blasted rock as in Detail A-30.

E. Cutting:

Cut ductile iron pipe using an abrasive wheel saw. Remove all burrs and smooth the end before jointing.

Section 1.13 – Thrust Restraint:

Provide restraint at all points where hydraulic thrust may develop. All thrust restraint systems must be approved by CWW. See Details A-13 thru A-22. Gaskets shall meet the requirements of AWWA/ANSI/A21.11 and shall be ANSI/NSF Standard 61 certified. In conjunction with the Details, below are the only current approved methods of thrust restraint:

A. Concrete Blocking:

Provide concrete blocking for all bends, tees and other points where thrust may develop. Concrete blocking shall have a compressive strength of not less than three thousand (3,000) psi, with no less than five and one half (5.5) bags of cement per cubic yard and a slump between three (3) and five (5) inches. Ready mixed concrete shall be mixed and transported in accordance with ASTM C-94. Concrete blocking shall be placed against undisturbed earth.

B. Harnessing:

Install harness rods with eyebolts only where specifically directed by the Columbus Water Works. Harness rods shall be manufactured in accordance with ASTM A-36 or A-307 and shall have an allowable tensile stress not less than twenty-two thousand (22,000) psi. Harness rods shall be stainless steel, hot dip galvanized or field coated with bitumastic before backfilling.

C. Restrained Joints:

1. Manufactured restrained joints (bell and spigot) shall be American FLEX-RING or U.S. Pipe TR-FLEX.
2. Restraining gasket joints shall be assembled with American FAST-GRIP, American Amarillo FAST-GRIP or U.S. Pipe FIELD LOK.
3. All pipes with FAST-GRIP joint shall be painted with a yellow band around the pipe bell.

D. Mechanical Joint Retainer Glands:

Mechanical joint retainer glands for joining pipes to mechanical joint fittings shall be Megalug Series 1100, as manufactured by EBAA Iron, Uni-Flange Series 1400, as manufactured by Ford Meter Box Company, Star Pipe Products – Star Grip Series 3000, or Sigma One-Lok Series SLD for restraining fittings.

E. Thrust Collars:

Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements as specified in Section 31 23 33 – Trench Excavation and Backfill; however concrete shall have a compressive strength of not less than 3,000 psi. Welded on collars shall be attached to the pipe by the pipe manufacturer. Where thrust

collars are to be installed on existing pipe, retainer glands shall be used in lieu of a welded-on collar. For use with thrust collars, retainer glands shall be of a split style as specified elsewhere in this Section. The retainer glands, as shown on the Drawings, shall be installed in opposite orientations from each other in order to account for differences in flow direction.

Section 1.14 – Backfilling:

All trenches are to be backfilled and compacted to prevent settlement and displacement of the pipe.

A. Material:

Backfill trenches with earth only. Do not use rock or organic material excavated from trenches in the backfill. If necessary, furnish suitable earth material to backfill the trench. Use select material for initial backfill.

B. Compaction:

Consolidate backfill material in the bottom of the trench and up to two (2) feet above the pipe in six (6) inch layers.

C. Initial Backfill:

1. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
2. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least eighteen (18) inches above the pipe barrel. Layer depths shall be a maximum of six (6) inches for pipe eighteen (18) inches in diameter and smaller, and a maximum of twelve (12) inches for pipe larger than eighteen (18) inches in diameter.
3. Backfill and compact on both sides of the pipe simultaneously to prevent side pressures.
4. Compact each layer thoroughly with suitable hand tools or tamping equipment.
5. Initial backfill shall be compacted to a minimum ninety (90) percent of the maximum dry density based on standard proctor unless shown or specified otherwise. The Contractor will provide the service of an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

D. Final Backfill:

1. Backfill carefully to restore the ground surface to its original condition. Remove all excavated rock from the ground surface and restore the area to a mowable condition, free from rock and deleterious materials.
2. The top six (6) inches shall be topsoil when directed by CWW.
3. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of. The site shall be left in a clean and slightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
4. After initial backfill material has been placed and compacted, backfill with final backfill material. Final backfill shall not contain more than one-third (1/3) broken rock, of which no stone or boulder will be six (6) inches in diameter or weigh more than fifty (50) pounds. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
 - In six (6) inch layers, if using light power tamping equipment such as a “jumping jack”.
 - In one (1) foot layers, if using heavy tamping equipment, use a hammer with tamping feet.
5. Settlement: If the trench settles, refill and grade the surface to conform to the adjacent surfaces. The Contractor will provide the service or an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

Section 1.15 – Removing and Replacing Pavement:

A. Removing Pavement:

Remove existing pavement as necessary for installing the pipeline and appurtenances. When pipeline crosses pavement at an angle other than perpendicular, then the pavement shall be overlaid at ninety (90) degrees to the pavement edge and replaced to the ends of the excavation. Saw cut pavement parallel to pipe as per Details A-4, A-4A and A-4B.

1. Marking:

Before removing any pavement, mark the pavement neatly paralleling pipe. Space the marks to the width of the trench.

2. Breaking:

Break asphalt pavement along the marks using jack hammers or other suitable tools as directed by CWW. Cut Portland cement concrete pavement along the marks by use of pavement saws.

3. Machine Pulling:

Do not pull pavement with machines until completely broken and separated from pavement to remain.

4. Damage to Adjacent Pavement:

Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

5. Sidewalk:

Remove and replace sidewalks for their full width, without installing additional joints.

6. Curbs:

Remove and replace or tunnel under any curb encountered. All pavement and/or curbing repairs or replacement will require City of Columbus Engineering Department's approval as a condition of acceptance.

B. Replacing Pavement:

During backfilling, arrange to have the compaction tested by an approved independent testing laboratory if required by CWW or Local or State DOT. After the compaction testing has been satisfactorily completed, then replace all pavements, sidewalks and curbs in accordance with Georgia Department of Transportation and/or City of Columbus standard details as required. Payment for all costs incurred for testing shall be the Contractor's responsibility. Columbus Consolidated Government requires a two (2) year warranty for all pavement replacement. GA State DOT requires a one (1) year period.

Section 1.16 – Roadway Crossing:

Furnish and install pipe casing and install the pipeline therein in accordance with the drawings and in accordance with Georgia Department of Transportation and City of Columbus specifications.

A. General:

Operate well points or drainage systems in the vicinity of the casing construction to prevent the accumulation of water in the casing and to maintain the ground water table below the casing invert.

B. Pipe Casing:

Furnish all material and equipment and perform all labor required to install steel pipe casing as required by the CWW. Casings need to be placed at all roadway and driveway

crossings by the Contractor for future service connections. All casings shall terminate at a three (3) foot minimum for in-line fitting or connection.

1. Boring:

The steel casing pipe shall be a minimum of Schedule 30 steel pipe manufactured from steel conforming to ASTM A-139, Grade B. Size and minimum wall thickness shall be as follows:

UNDER HIGHWAYS

<u>Pipe Diameter</u> <u>Inches</u>	<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Minimum Inches</u>
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
14	22	0.250
16	24	0.250
18	30	0.312
20	30	0.312
24	36	0.375
30	42	0.375

UNDER RAILROADS

<u>Pipe Diameter</u> <u>Inches</u>	<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Minimum Inches</u>
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.312
14	24	0.344
16	30	0.406
18	30	0.406
20	32	0.469
24	36	0.469
30	42	0.500

The outside of the casing pipe shall be primed and coated with a hot coal tar enamel a minimum of three thirty seconds (3/32) inch thick. Only new primed and coated pipe shall be used.

When casing depth exceeds fifteen (15) feet, it is the responsibility of the Developer's Engineer to calculate the required casing wall thickness.

Install the steel pipe casing by the dry boring method. Bore the hole and install the casing through the soil simultaneously by using a cutting head on a continuous auger mounted inside the casing pipe. Lengths of casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

C. Installation of Pipe:

After installation of the casing is complete, install the pipelines as shown on the Drawings. Close the ends of the casing with four (4) inch brick walls sealed with Portland cement mortar. Leave a four (4) inch by eight (8) inch opening at the bottom of the lowest closure for drainage. Piping inside casings shall be restrained at every joint. See Detail Drawing A-18 for restraining fittings to steel casing pipe.

D. Safety:

Provide all necessary bracing bulkheads and shields to ensure complete safety to all traffic at times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

Section 1.17 – Water Main and Accessory Abandonment:

- A. Pipelines six (6) inches in diameter or greater that are shown on the Drawings or otherwise specified to be abandoned shall be filled completely with flowable fill and plugged at all ends by use of concrete, a plug, a cap or other suitable means approved by the Engineer, in order to prevent flowable fill from escaping the pipe during flowable fill installation.
- B. Pipelines less than six (6) inches but two (2) inches or greater in diameter that are shown on the Drawings or otherwise specified to be abandoned shall be plugged at all ends by use of a plug or cap suitable for the pipe material, as approved by the Engineer, but are not required to be filled with flowable fill.
- C. Pipelines less than two (2) inches in diameter that are shown on the Drawings or otherwise specified to be abandoned shall not require any plugging of ends or filling with flowable fill.

Section 1.18 – Testing:

When a length of pipe approved by CWW is ready for testing, fill the line with water, bleed out all air and conduct a leakage test. CWW will operate all valves.

A. Preparation:

Provide a test pump and all other accessories required to make the test. Provide a corporation stop at each high point on the pipe to bleed off air. Provide and remove all temporary bulkheads, plugs and flanges required to perform the pressure test.

B. Test Pressure and Leakage:

Test the pipeline at two hundred (200) psi measured at the lowest point for at least two (2) hours. Maintain the test pressure within five (5) psi of the specified test pressure for the test duration. Should the pressure drop more than five (5) psi at any time during the test period, the pressure shall be restored to the specified test pressure. An accurate pressure gauge with graduations not greater than five (5) psi will be required. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section to maintain pressure within five (5) psi of the specified test pressure for the test duration, plus water required to the return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter or out of an approved container with a known volume.

C. Allowable Leak in Total Gallons during Water Pressure Test (AWWA C:600):

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

L = Allowable Leakage (Gallons)

S = Length of Pipe Tested (Feet)

D = Nominal diameter (inches)

P = Average Test Pressure (psi)

D. Existing Valves:

All existing valves are to be operated by CWW personnel only. Provide twenty-four (24) hour notice for operation.

Section 1.19 – Disinfecting Pipe Lines:

A. Applicable Standard:

All water mains which are to be connected to the CWW water distribution system shall be disinfected according to Sections 1 through 7 of AWWA C-651, the AWWA Standard for Disinfecting Water Mains.

B. Form of Chlorine Used:

Acceptable forms of chlorine that may be used in the disinfecting operations are granular calcium hypochlorite and liquid sodium hypochlorite. Either material should be stored in a cool, dry and dark environment to minimize deterioration.

C. Method of Chlorination:

The only method approved for general use is the continuous Feed Method as described in the following paragraphs. The tablet method and the slug method are not acceptable alternatives. Please note that the option of placing calcium hypochlorite granules in the pipe during construction is not required.

1. It is of utmost importance that all precautions be taken during the construction phase to ensure that the new water mains are kept clean and dry. The entry of dirt and other contaminants shall be kept to a minimum. Pipe stored at the construction site must be stored with the ends elevated to ensure against entry of mud and dirt. No greater quantity of pipe shall be strung beside or in the trench than can be installed during the current shift. At the close of each day's work, open pipe ends shall be sealed with water-tight and rodent proof plugs.
2. Before being chlorinated, the main shall be flushed to remove particulates. This flushing shall be accomplished at flow rates sufficient to produce a maximum velocity of two and one half (2.5) feet per second in the main. CWW Inspector must be notified twenty-four (24) hours in advance.
3. The chlorination shall be done in accordance with section 4.4 of AWWA C-651 Standard for Disinfecting Water Mains. The major points of this standard are summarized below.
4. Water shall be introduced into the new main from the existing distribution system at a constant, measured rate (or approximated by one of the listed means).
5. A chlorine solution shall be fed into the new main within ten (10) feet of the beginning of the new main. The concentration of the solution and the feed rate shall be adjusted so that the water in the main will have not less than twenty-five (25) mg/L of free chlorine.
6. Once the application of chlorine has begun, it shall not stop until the entire main is filled with heavily chlorinated water. The chlorinated water shall remain in the main for a minimum of twenty-four (24) hours. At the end of the twenty-four (24) hours, the chlorinated water must retain a residual of not less than ten (10) mg/L of free chlorine. Extreme care must be taken during the chlorine application and the following retention period that none of the highly chlorinated water is allowed to migrate into the existing distribution system. Valves at all fire hydrants shall be operated to ensure that every fire hydrant is disinfected.
7. The chlorinated water shall be flushed from the main as soon as practicable after the twenty-four (24) hour retention period to reduce possible corrosion damage to the pipes. All heavily chlorinated water must be dechlorinated prior to discharge to the environment. Acceptable reducing agents for neutralizing the chlorine residual include sulfur dioxide, sodium bisulfate, sodium sulfite and sodium thiosulfate. Recommended application rates vary with the chlorine residual and the chosen reducing agent but are summarized in Appendix B of AWWA C-651. A copy may be

obtained from the CWW Inspector. The CWW Inspector, who will verify the neutralization of the chlorine residual in all discharged water, shall witness all dechlorinating activities.

D. Sampling and Testing:

The CWW Inspector shall obtain and transport the samples to the CWW lab. The samples must be kept on ice (if necessary) to remain below forty (40) degrees Fahrenheit. Typically, there will be one sample point at the end of each main line branch. If the samples fail bacteriological tests, the main may be re-flushed and resampled. If the resultant tests fail, the main shall be re-chlorinated until satisfactory results are obtained.

E. Division of Responsibility:

A summary of the steps to follow and the responsible parties follows:

<u>Steps to follow</u>	<u>Responsible party</u>
1. Initial Washout	Contractor*
2. Pressure Test	Contractor*
3. Disinfect	Contractor*
4. Flush-out and de-chlorinate	Contractor*
5. Water Samples	CWW

* Under CWW Inspector's supervision

Section 1.20 – Protection and Restoration of Work Area:

A. General:

1. The Contractor shall use reasonable care to avoid damaging existing buildings, equipment, and vegetation. If the Contractor's failure to use reasonable care causes damage to any of this property, the Contractor shall replace or repair the damage at no expense to CWW. If the Contractor fails or refuses to make such repair or replacement, the Contractor shall be liable for the cost.
2. Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

B. Man-Made Improvements:

Protect, or remove and replace, with CWW approval, all fences, piers, docks, walkways, mail boxes, pipelines, drain culverts, power, gas, telephone and television lines and cables and other improvements that may be encountered in the work.

C. Cultivated Growth:

Do not disturb cultivated trees or shrubbery unless approved by the CWW. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nursery person. If vegetation is not suitable for replanting, replace in kind.

D. Cutting of Trees:

Do not cut trees for the performance of the work unless specifically approved by CWW and the City of Columbus. Removal and/or replacement of plantings on the City right-of-way must be approved by the City Arborist. Protect trees that remain in the vicinity of the work from damage by equipment. Do not store spoil from excavation against the trunks. Remove excavated material, stored over the root system of trees, within thirty (30) days to allow proper natural watering of the root system.

Repair any damaged tree more than three (3) inches in diameter, not to be removed, under the direction of an experienced nursery person. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, woodpiles, or trash piles will be permitted on the work site.

E. Grassing:

Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of residential areas, plant the entire area disturbed by the work in Fescue, Bermuda, Clover, St. Augustine or mixtures of these or other suitable groundcover upon completion of work in any area. In all areas, promptly establish successful stands of grass. During non-seasonal months for establishment of permanent grassing, temporary grassing is required such as winter rye.

F. Erosion Control:

Plan the excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. Erosion control activities must comply with City of Columbus requirements. Erosion control permitting is the responsibility of the Developer.

G. Disposal of Rubbish:

Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, City, State and Federal.

Section 1.21 – Requirements for As-Built Drawings:

- A. The Developer/Owner is responsible for furnishing as-built drawings to CWW as soon as the water construction work has been completed.

B. As-built drawing guidelines are as follows:

1. It is the Engineer's responsibility to ensure that the necessary information is received from the Contractor to complete the as-built drawings.
2. As-built data must be in NAD 1983 State Plane Georgia West (U.S. feet) and North American Vertical datum of 1988 (NAVD 88).
3. As-built documents shall include horizontal dimensioning to all valves, hydrants, fittings, etc., referenced from permanent monuments such as property corners, right-of-way markers, or other physical and permanent markers.
4. As-built should be prepared on a copy of a recorded plat or on an otherwise prepared drawing with a reference to a recorded plat book and folio number. In this instance, a copy of the recorded plat should be supplied with the as-built submittal.
5. Water line as-builts should be on a separate plan sheet from other utilities.
6. The as-builts shall contain the name of the development.
7. The location of all water mains, Fire Hydrants, valves, meters, caps/plugs, stream crossings and road crossings shall be shown.
8. Land lots and districts shall be shown.
9. All lots are to be numbered and block stated.
10. Road names shall be on plans.
11. The term "As-Built" in large clear print on the plans.
12. The "As-Built" drawings are to be submitted on 22" x 34" paper. Submit one (1) water as-built drawing for the initial review. After all corrections have been made, submit five (5) water as-built drawings, a pdf file containing all as-built documents, and one (1) digital copy. Acceptable digital formats include: DXF or DWG files, ESRI GIS shapefiles, ESRI GIS Geodatabase.
13. Minimum scale is one (1) inch equals one hundred (100) feet. The as-builts may be drawn on more than one sheet if necessary to obtain the minimum scale of one (1) inch equals one hundred (100) feet. If multiple sheets are used, then an overall key map shall be included.
14. When a phase of a subdivision is completed, a location sketch of entire subdivision with said phase outlines shown on plans.
15. Contour lines are acceptable as long as they are faint and do not interfere with or overpower details of the drawing.

16. Out-lots should be so noted.
17. As-built plans shall show by appropriate dimensions to the location of all plugged future connecting fittings to the nearest foot. The dimensions are to be parallel with and perpendicular to the property lines to the nearest foot.
18. No hand drawn or marked up construction plans will be accepted as an as-built drawing.
19. The as-built shall have a north arrow and legend.
20. The as-built shall show all necessary horizontal information in order to locate the system. Label lines with length, material, diameter, and depth.
21. The as-built drawings must be sharp, clear, clean and legible and must be suitable for filming as permanent records.
22. The Easement Agreement Verbiage shall be noted on the final recorded plat. The water system will not be accepted until this verbiage is recorded on the final plat. Submit a copy of the final recorded plat showing this statement.
23. The Sanitary Sewer Availability Fees must accompany the final as-built drawings. The as-built drawings must be approved before any services can be given to the Developer/Builder.

24. The following notes shall be placed on the water as-built drawings and quantities filled in:

"AS-BUILT NOTES":

THIS AS-BUILT PLAT OF THE WATER LINE AND APPURTENANCES IS A FACSIMILE OF THE OFFICIAL RECORDED PLAT. IT IS ON FILE IN THE OFFICE OF THE CLERK OF SUPERIOR COURT OF MUSCOGEE COUNTY, GEORGIA (PLAT BOOK_____, FOLIO_____). THIS PLAT REFLECTS ALL OF THE SAME PERTINENT PROPERTY LINE DATUM AS SHOWN ON THE RECORDED VERSION. PLEASE REFER TO THE RECORDED PLAT FOR OFFICIAL SIGNED CERTIFICATES.

CONTRACTOR FOR THIS JOB WAS _____

ADDRESS _____

PHONE NO. _____

____ LF Main (By Diameter)
____ LF of Service Laterals (By Diameter)
____ Valves
____ Fire Hydrants
____ Meters

**SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF WATER
SYSTEMS-COLUMBUS/MUSCOGEE COUNTY**

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SUBJECT	DETAIL
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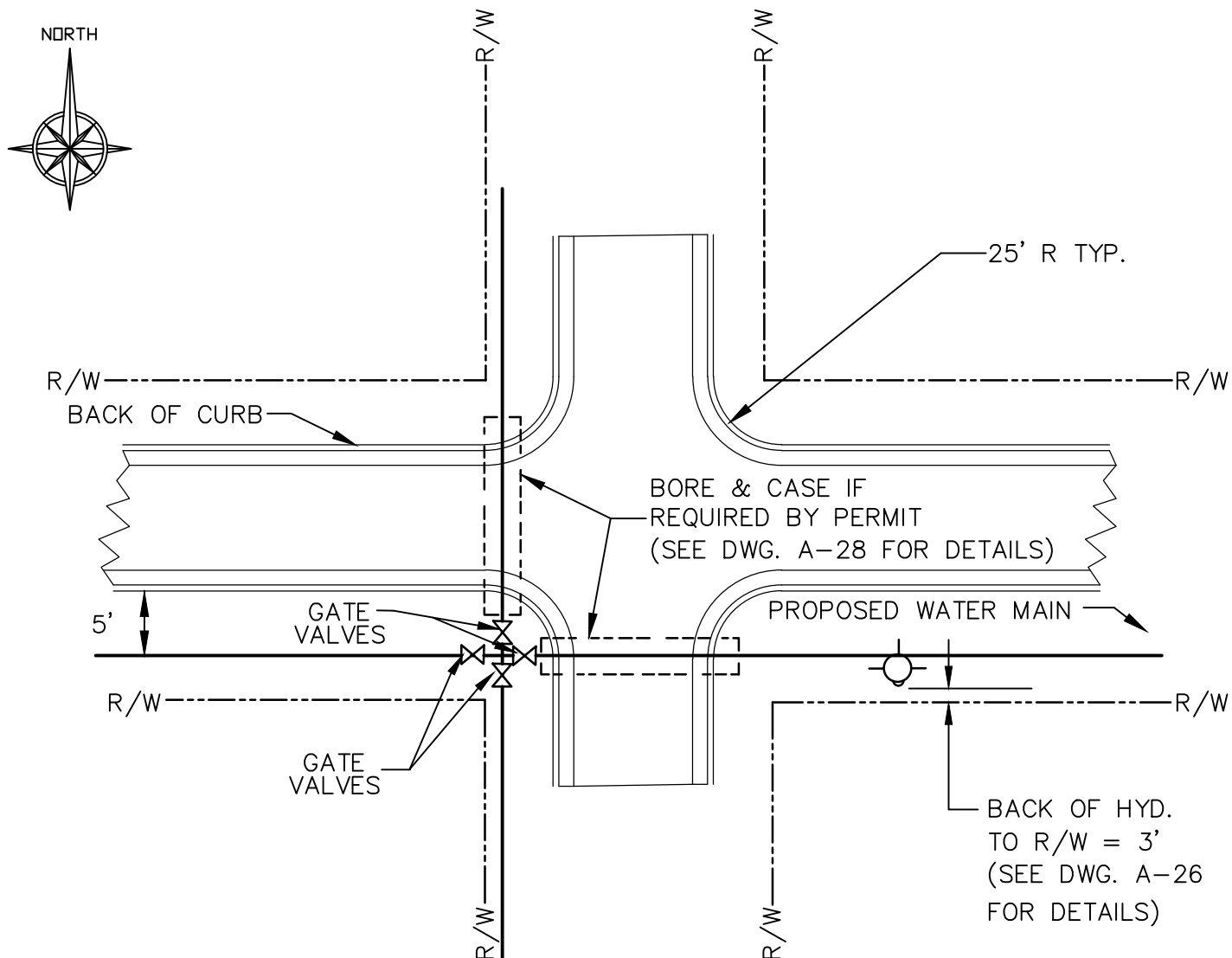
* METER ASSEMBLY DIMENSION WILL VARY WITH SIZE.
STRAINERS AND TEST TEES MAY BE REQUIRED.

1. ALTERNATE INSTALLATIONS MAY BE ALLOWED IF SUBMITTED BY ENGINEER AND APPROVED BY CWW.
2. PROVIDE POURED SOLID BOTTOM WITH DRAIN WHEN GROUND WATER IS PRESENT.

**Columbus
Water
Works**

*Serving our Community
Protecting the Environment*





NOTES:

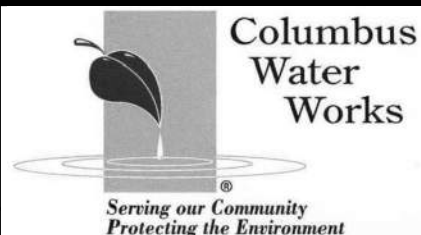
1. DEPTH OF COVER OVER WATER MAINS SHALL BE 4' AS MEASURED FROM TOP OF CURB OR EDGE OF PAVEMENT.
2. MIN. 6" COMPACTED SOIL BETWEEN BOTTOM OF PIPE AND ROCK MIN. 9" COMPACTED SOIL BETWEEN SIDES OF PIPE AND ROCK.
3. NO ROCK IN BACKFILL FOR FIRST 2' ABOVE TOP OF PIPE.
4. BORE AND CASING MAY BE REQ'D BY PERMITTING AGENCY.
5. ALL PIPE TO BE DUCTILE IRON OR STEEL AS REQ'D.
6. IF RADIUS IS NOT 25' ADJUST PIPE LENGTHS SO THAT VALVES ARE NOT IN STREET.

INTERSECTION DETAILS FOR WATER MAINS, VALVES & HYDRANTS

SCALE: N.T.S.

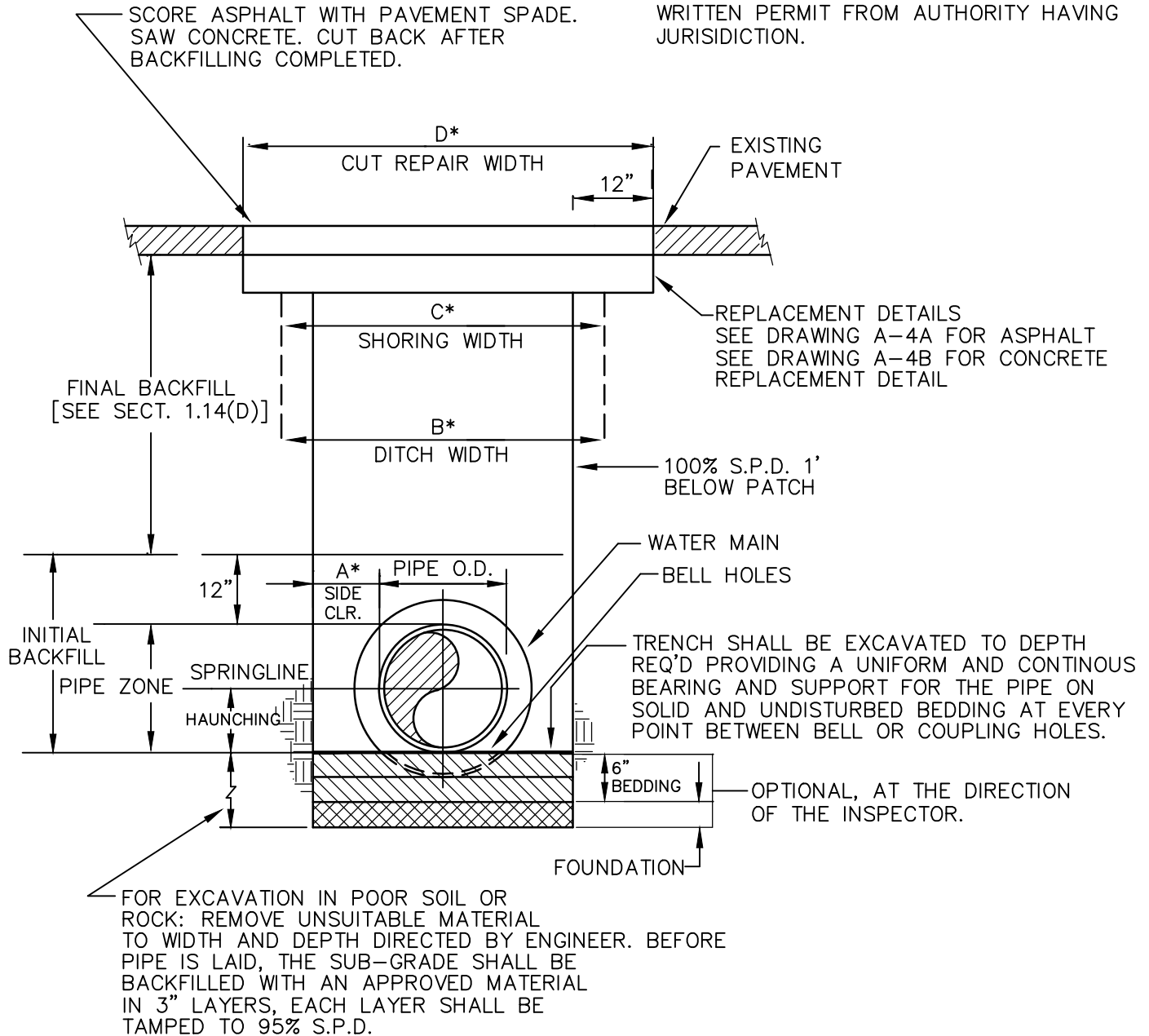
DATE: NOVEMBER 2019

A-3



NOTES:

NO PAVEMENT CUTS PERMITTED WITHOUT APPROVAL OF C.W.W. INSPECTOR AND WRITTEN PERMIT FROM AUTHORITY HAVING JURISDICTION.



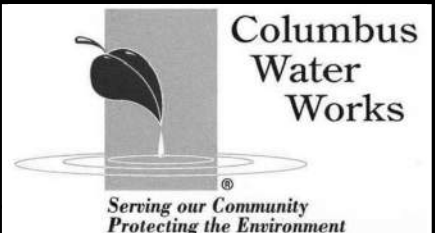
* SEE DRAWING A-5 FOR TRENCH WIDTH DIMENSIONS

ALLOWABLE TRENCH WIDTHS FOR SERVICE LINES & WATER MAINS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-4



PIPE SIZE (NOM)	A SIDE CLEAR- ANCE-INCH.		B DITCH WIDTH -INCH.				C SHORING WIDTH (ADDITIONAL -INCH.)	D CUT REPAIR WIDTH -FEET			
	SOIL	ROCK	SOIL		ROCK			SOIL		ROCK	
			MJ	SJ	MJ	SJ		AS APPROVED	MJ	SJ	MJ
3/4"-2"	2	6	NA	8	NA	14	AS APPROVED	NA	3.00	NA	3.17
4"	9	12	25	23	27	25	AS APPROVED	4.08	3.92	4.25	4.08
6"	9	12	28	28	30	30	AS APPROVED	4.33	4.33	4.50	4.50
8"	9	12	32	30	34	32	AS APPROVED	4.67	4.50	4.83	4.67
10"	9	12	34	32	36	34	AS APPROVED	4.83	4.67	5.00	4.83
12"	9	12	36	34	38	36	AS APPROVED	5.00	4.83	5.17	5.00
14"	9	14	39	36	41	38	AS APPROVED	5.25	5.00	5.42	5.17
16"	9	14	42	38	44	40	AS APPROVED	5.50	5.17	5.67	5.33
20"	9	14	45	44	47	46	AS APPROVED	5.75	5.67	5.92	5.83
24"	9	14	50	48	52	50	AS APPROVED	6.17	6.00	6.33	6.17
30"	9	18	58	54	60	56	AS APPROVED	6.83	6.50	7.00	6.67
36"	9	18	64	61	66	63	AS APPROVED	7.33	7.08	7.50	7.25
42"	9	18	72	64	74	66	AS APPROVED	8.00	7.33	8.17	7.50
48"	9	18	78	73	80	75	AS APPROVED	8.50	8.08	9.34	8.25

NOTES:

1. COMPACTION: BACKFILLS SHALL BE BUILT UP IN LAYERS AND EACH LAYER SHALL BE THOROUGHLY COMPACTED BEFORE BEGINNING ANOTHER LAYER. LAYERS SHALL BE NO MORE THAN 6" TO 1' IN DEPTH. PUDDLING WILL NOT BE PERMITTED, NOR WILL FROZEN OR WET MATERIAL BE PLACED IN TRENCHES.
2. COMPACTION STANDARDS: ALL BACKFILL MATERIALS USED SHALL CONTAIN A SUFFICIENT AMOUNT OF MOISTURE FOR PROPER COMPACTION AND THESE MATERIALS SHALL BE COMPACTED AT NOT LESS THAN 95% OF THEIR OPTIMUM COMPACTION FOR ANY SPECIFIC SOIL CLASSIFICATION AS DETERMINED BY THE MODIFIED PROCTOR TEST. ASTM. D698
3. COMPACTION TESTS: COMPACTION TESTS MAY BE REQUIRED IN EXISTING OR PROPOSED STREETS, SIDEWALKS, DRIVES AND OTHER EXISTING OR PROPOSED PAVED AREAS AT VARYING DEPTHS AND AT INTERVALS AS DETERMINED BY THE CWW WITH A MINIMUM OF ONE TEST ON EACH JOB, AND A MAXIMUM OF ONE REQUIRED TEST FOR EACH 400' OR LESS OF WATER MAIN CONSTRUCTION, UNLESS SOIL CONDITIONS OR CONSTRUCTION PRACTICES, WARRANT THE NEED FOR ADDITIONAL TESTS.
4. REFER TO SECTION 1.13 FOR DETAILED SPECIFICATIONS ON BACKFILLING TRENCHES.
5. NO BOULDERS, LOOSE ROCKS, OR ORGANIC MATERIALS ARE PERMITTED IN THE INITIAL BACKFILL.
6. ALL DESIGNS ARE BASED ON FULLY COMPACTED BACKFILL AND UNIFORMLY SUPPORTED PIPE.
7. FOR SERVICE AND MAIN PAVEMENT CUT REPAIRS SEE DWG. A-4A & A-4B.
8. REFER TO DWG. A-33 FOR BEDDING DETAILS.

TABLE & NOTES FOR ALLOWABLE TRENCH WIDTHS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-5



SIZE (NOM)	PUSH-ON JOINT (20' NOMINAL LAYING LENGTH)		MECHANICAL JOINT (20' NOMINAL LAYING LENGTH)	
	DEGREE	MAX. OFFSET	DEGREE	MAX. OFFSET
6"	5°	21"	7° – 07'	30"
8"	5°	21"	5° – 21'	22"
10"	5°	21"	5° – 21'	22"
12"	5°	21"	5° – 21'	22"
14"	5°	21"	3° – 35'	15"
16"	5°	21"	3° – 35'	15"
18"	5°	21"	3° – 00'	12"
20"	5°	21"	3° – 00'	12"
24"	5°	21"	2° – 23'	10"
30"	5°	21"		
36"	4°	17"		
42"	3°	12"		
48"	3°	12"		

NOTES:

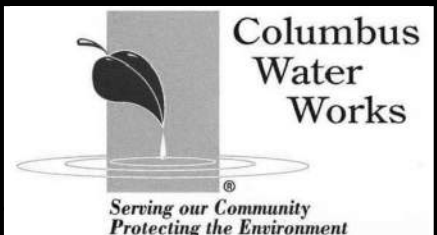
1. WHEN A PIPE IS DEFLECTED, THE PIPE SHALL FIRST BE ASSEMBLED IN A STRAIGHT LINE, BOTH HORIZONTALLY AND VERTICALLY BEFORE THE DEFLECTION IS MADE.
2. FOR MECHANICAL JOINT PIPE, THE BOLTS SHALL BE PARTIALLY TIGHTENED BEFORE THE LENGTH OF PIPE IS DEFLECTED, ANY SUPPORTED PIPE, SHALL BE SO SUPPORTED THAT THERE IS ZERO DEFLECTION EXCEPT WHERE THERE IS A HORIZONTAL OR VERTICAL CURVE ON A BRIDGE OR ANOTHER STRUCTURE IS INVOLVED.
3. THRUST RESTRAINTS MAY BE REQUIRED ON THE DEFLECTED JOINTS.
4. IF PIPE MANUFACTURER DEFLECTION LIMITS DIFFER FROM CWW STANDARDS THE MANUFACTURER RECOMMENDATIONS SHOULD BE USED

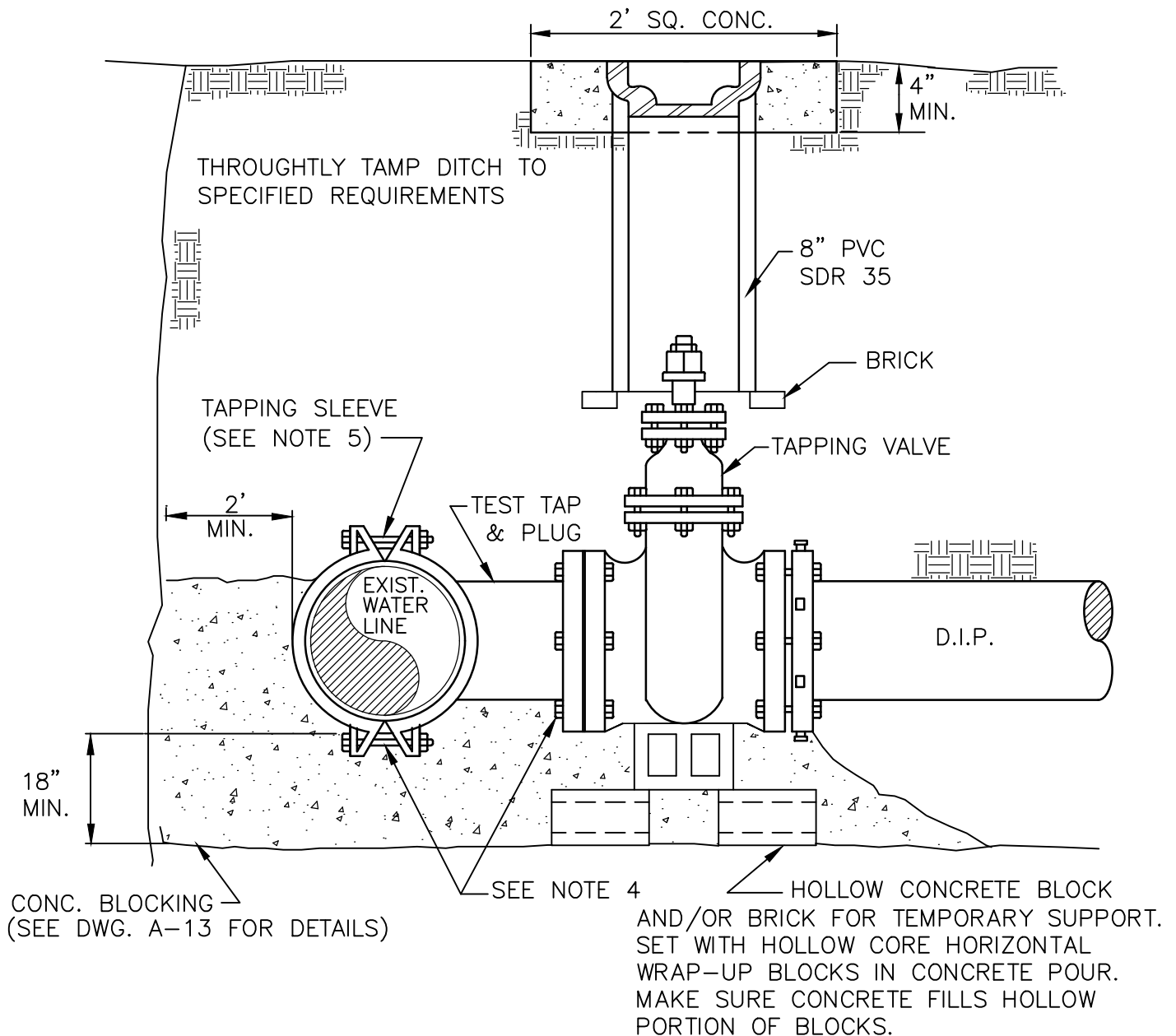
MAXIMUM PERMISSABLE JOINT DEFLECTIONS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-6





NOTES:

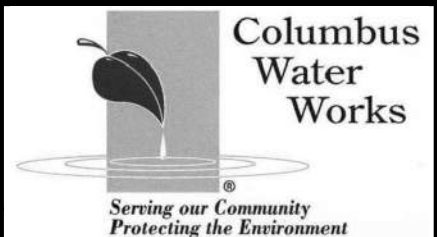
1. TEMPORARILY SUPPORT TAPPING SADDLE AND VALVE, THEN APPLY STANDARD HYDROSTATIC TEST.
2. IF NO LEAKS, POUR INDICATED PERMANENT CONCRETE BLOCK AND SUPPORT PAD.
3. MAKE TAP, LINE EXTENSION AND BACKFILL.
4. COVER GLAND AND BOLTS WITH HEAVY POLYETHELENE SHEETING TO KEEP CONCRETE FROM BONDING. TYPICAL WHENEVER BOLTS OR GLAND MAY BE "WRAPPED-UP" IN CONCRETE.
5. COAT TAPPING SLEEVE AND BOLTS WITH AN APPROVED BITUMASTIC COATING BEFORE POURING CONCRETE. TYPICAL FOR ALL STEEL INCLUDING RODS, COUPLINGS, STRAPS AND OTHER BURIED STEEL, SEE NOTE 5, DWG A-25 FOR COATING REQUIREMENTS.

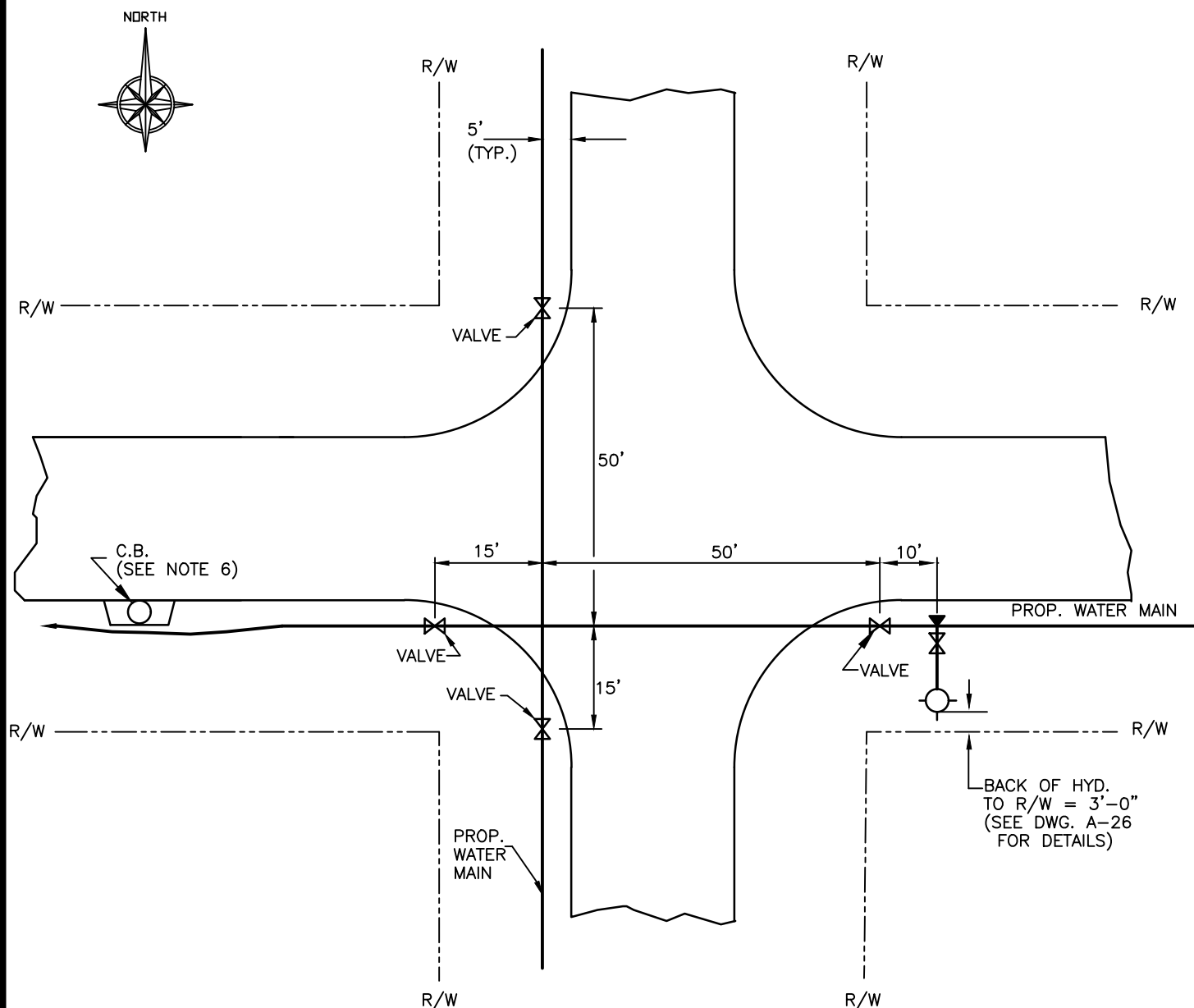
TAPPING SLEEVE & VALVE INSTALLATION

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-7





NOTES:

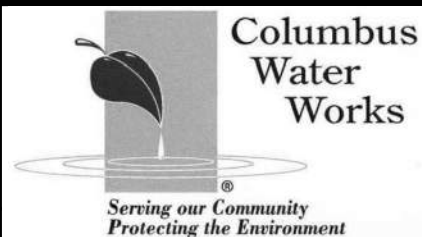
1. DEPTH OF COVER OVER WATER MAINS SHALL BE 4' AS MEASURED FROM TOP OF CURB OR EDGE OF PAVEMENT.
2. MIN. 6" COMPACTED SOIL BETWEEN BOTTOM OF PIPE AND ROCK. MIN. 9" COMPACTED SOIL BETWEEN SIDES OF PIPE AND ROCK.
3. NO ROCK IN BACKFILL FOR FIRST 2' ABOVE TOP OF PIPE.
4. IF RADIUS IS NOT 25' ADJUST PIPE LENGTHS SO THAT VALVES ARE NOT IN STREET.
5. VALVES TO BE A MIN. OF 2' FROM BACK OF CURB.
6. PIPE SHALL CLEAR OUTSIDE WALL OF CATCH BASIN BY 4" MIN.

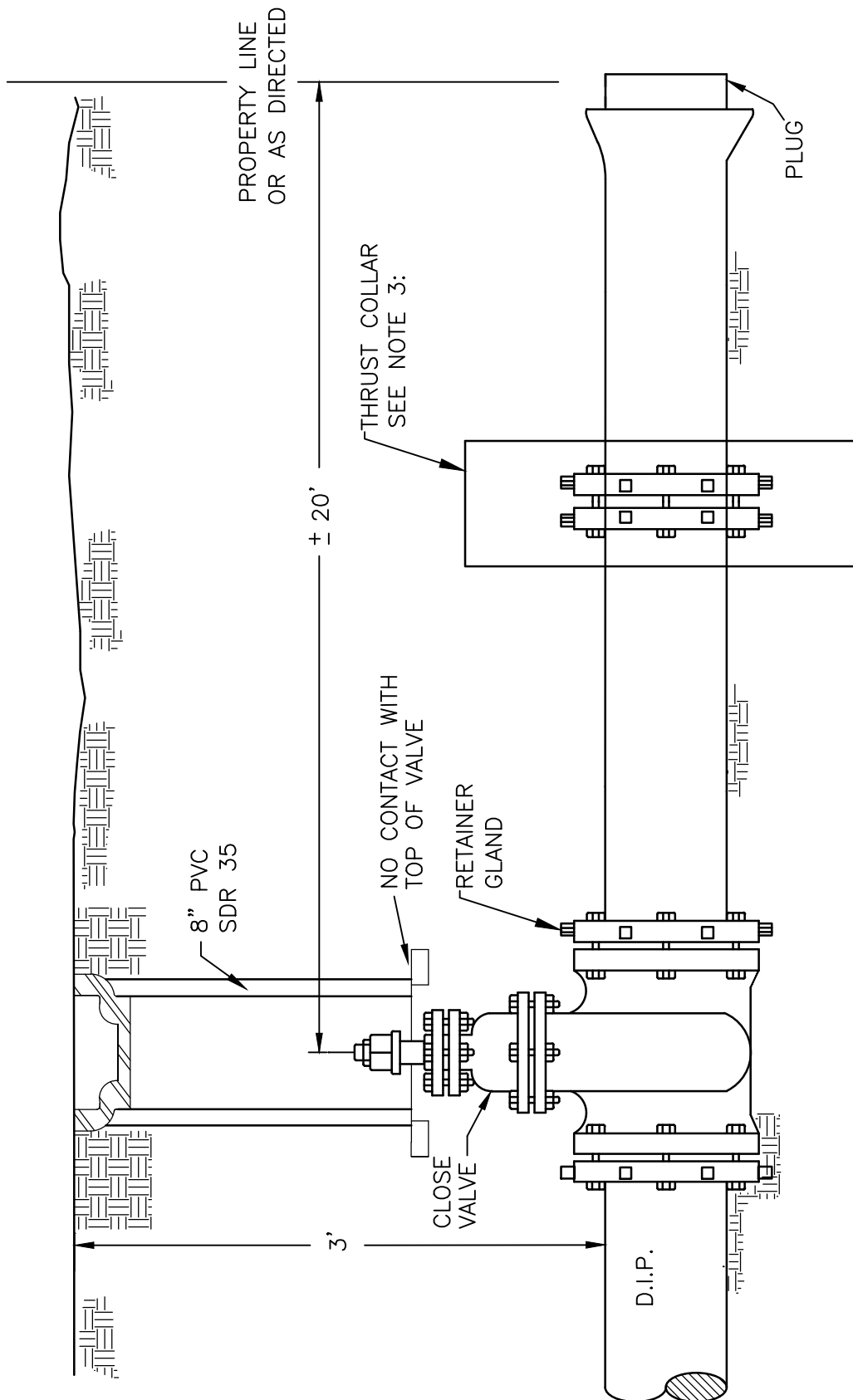
INTERSECTION DETAILS: WATER MAINS, VALVES & FIRE HYDRANTS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-8





NOTES:

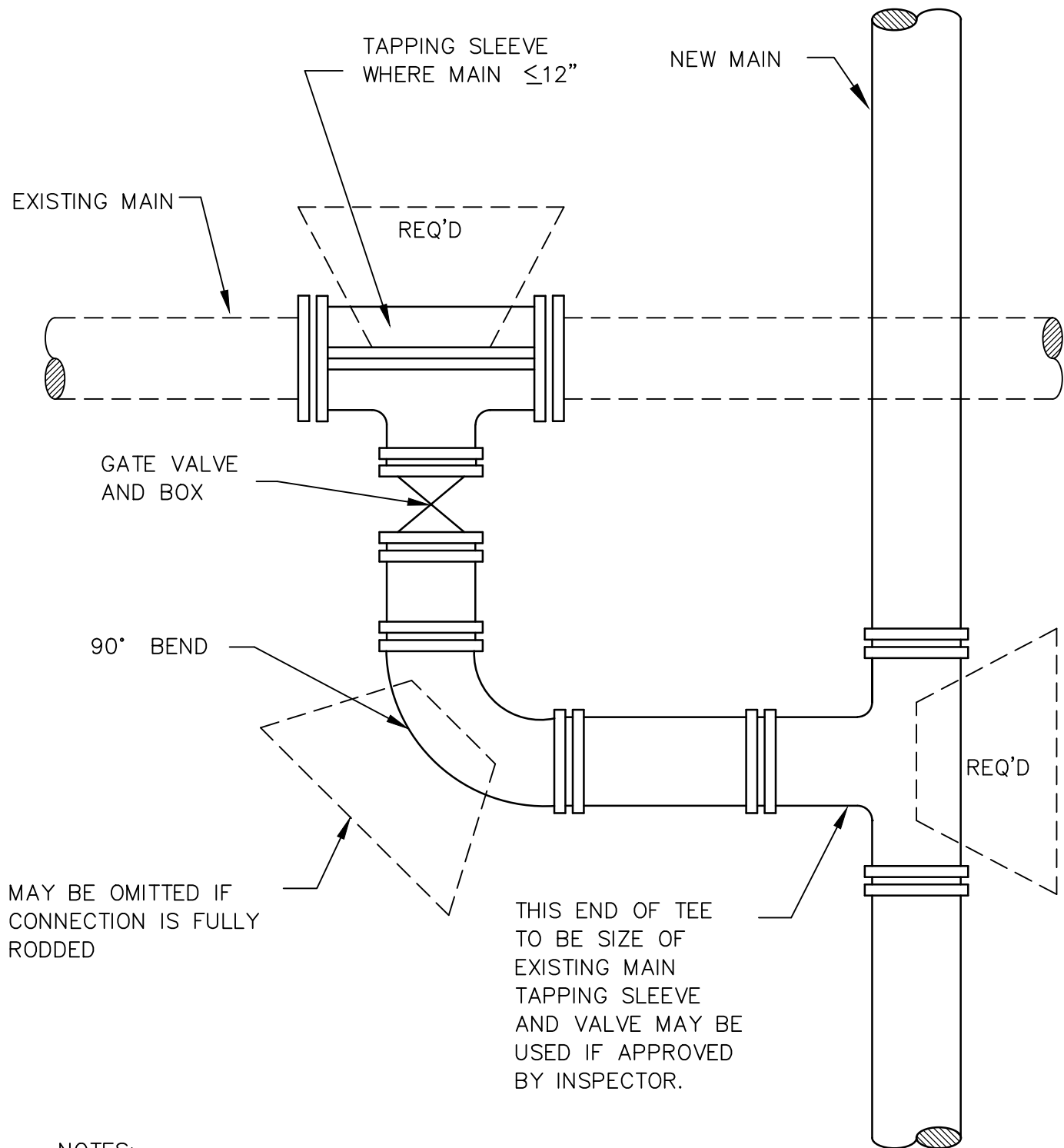
1. IN LIEU OF SLIP-JOINT AND COMPRESSION PLUG,
A M.J. JOINT MAY BE USED WITH A M.J. PLUG.
2. LEAVE VALVE IN CLOSED POSITION.
A M.J. JOINT MAY BE USED WITH A M.J. PLUG.
3. THRUST COLLAR TO BE PROPERLY SIZED PER DETAIL A-19

STUB OUT OR
END DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-9



NOTES:

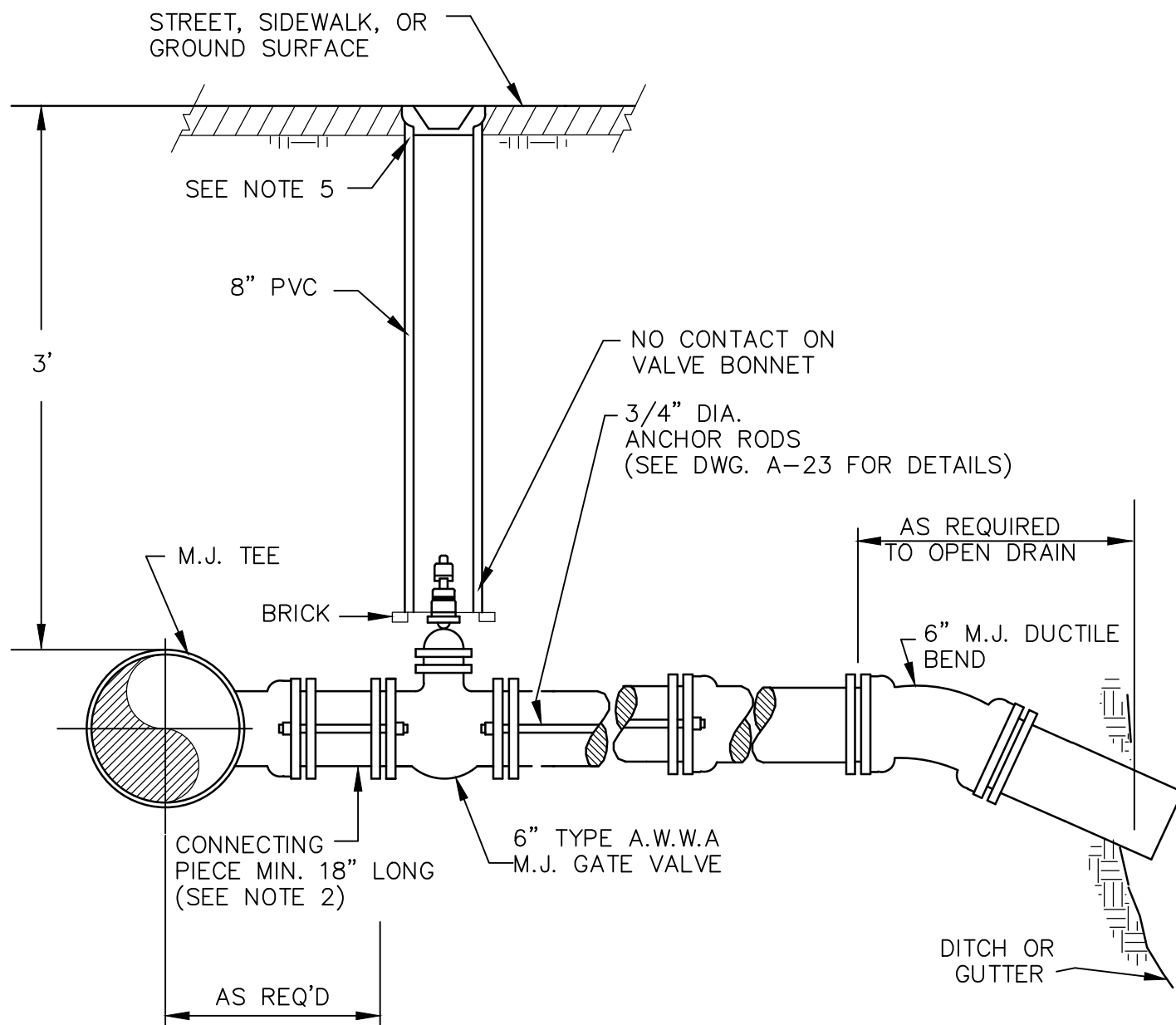
GATE VALVES AND FITTINGS USED IN THIS CONNECTION TO BE SAME SIZE AS EXISTING MAIN WHERE EXISTING MAIN IS 12" OR SMALLER.

ROUND CONNECTION DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-10



NOTES:

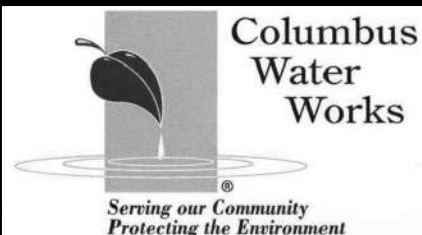
1. FOR MAIN SIZE 6"—16"Ø, USE 6" BLOW-OFF PIPING & VALVE. FOR MAIN SIZE 20"—48"Ø, USE 8" BLOW-OFF PIPING & VALVE.
2. ALL FITTINGS, EXCLUSIVE OF VALVES AND VALVE BOXES, SHALL BE D.I.P.
3. RODS TO BE HIGH TENSILE, HOT ROLLED STEEL WITH TENSILE STRENGTH OF 150,000 P.S.I. AND MIN. YIELD STRENGTH OF 130,000 P.S.I.
4. BLOW-OFF OUTLETS MAY NOT BE SUBMERGED IN ANY STREAM OR GUTTER, NOR DISCHARGE DIRECTLY INTO ANY SEWER.
5. IF NO PAVEMENT OR SIDEWALK, POUR 2' CONCRETE COLLAR AROUND TOP OF VALVE BOX. SEE DWG. A-7 FOR DETAILS.

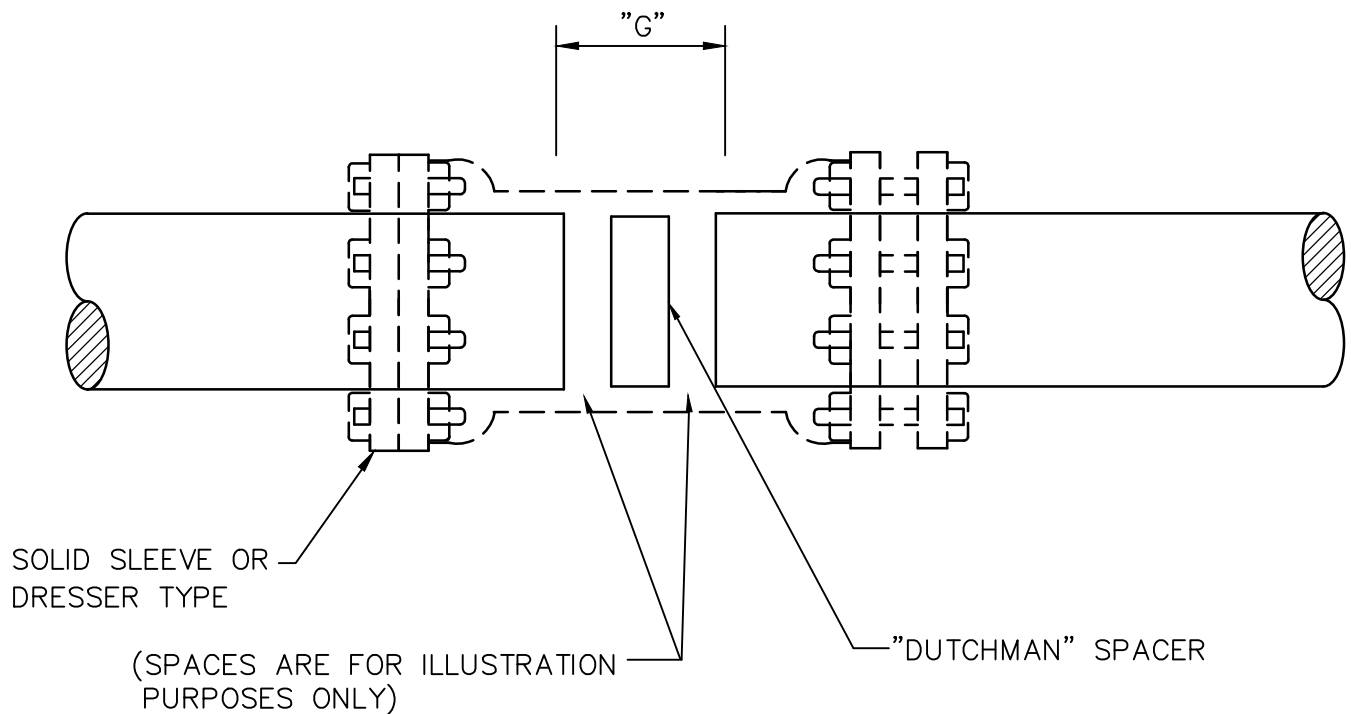
BLOW OFF DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-11





NOTES:

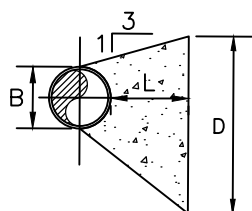
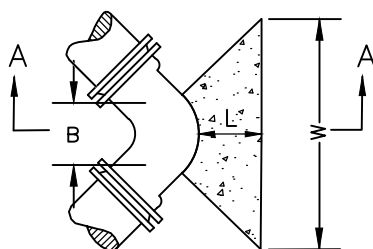
1. IF "G" IS GREATER THAN $1/2$ ", AT ITS NARROWEST POINT, THEN A FULL CIRCLE SPACER OR "DUTCHMAN" MUST BE CUT AND PLACED IN THE GAP BEFORE THE SLEEVE IS USED TO CLOSE THE JOINT.
2. THE "DUTCHMAN" SPACER SHALL BE CUT TO A WIDTH NO LESS THAN $1/4$ " LESS THAN THE NARROWEST WIDTH OF "G".
3. EACH PIPE SPIGOT SHALL BE MARKED TO INDICATE WHERE THE SLEEVE WILL BE PROPERLY CENTERED OVER THE POINT.
4. "FULL-CIRCLE" REPAIR CLAMPS ARE NOT APPROVED FOR JOINING PIPE, SUCH CLAMPS ARE SPECIFICALLY DESIGNED FOR REPAIRS ONLY.
5. IF "STEEL" SLEEVE IS USED, PROPERLY COAT BEFORE BACKFILLING. SEE NOTE 5, DWG. A-25 FOR COATING DETAILS.

PIPE JOINING USING SOLID SLEEVE

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-12



SECTION A-A

NOTES:

1. POUR BLOCKING AGAINST UNDISTURBED EARTH WHEN OVEREXCAVATION OCCURS.

DESIGN DATA:

1. DIMENSION OF THRUST BLOCK IN FEET BASED ON 2000 POUNDS PER SQUARE FOOT SOIL BEARING PRESSURE. ACTUAL OUTSIDE DIA. OF DIP, 250 PSI TEST PRESSURE.
2. UNDER ADVERSE CONSTRUCTION CONDITIONS, CONCRETE SHALL BE "HIGH EARLY" TYPE.

MINIMUM DIMENSIONS IN FEET FOR CONCRETE BLOCKING						
PIPE SIZE	END AREA OF BLOCK AT FITTING (B x B)	FITTING	L	END DIMENSIONS OF BLOCK AGAINST UNDISTURBED SOIL, IN FEET		CU. YDS.
				D	W	
6"	0.25 (6" x 6")	11.25'	0' - 6"	1.0	1.4	0.02
		22.5'	0' - 9"	1.2	2.3	0.04
		45'	1' - 3"	1.6	3.2	0.13
		90'	1' - 6"	2.2	4.4	0.28
		TEE OR DE	1' - 3"	1.8	3.7	0.16
8"	0.44 (8" x 8")	11.25'	0' - 6"	1.1	2.1	0.02
		22.5'	1' - 0"	1.6	3.1	0.10
		45'	1' - 6"	2.2	4.3	0.27
		90'	2' - 0"	2.9	5.9	0.66
		TEE OR DE	1' - 9"	2.5	4.9	0.40
10"	0.69 (10" x 10")	11.25'	0' - 9"	1.4	2.7	0.06
		22.5'	1' - 3"	1.9	3.8	0.18
		45'	1' - 9"	2.6	5.3	0.47
		90'	2' - 6"	3.6	7.1	1.21
		TEE OR DE	2' - 0"	3.0	6.0	0.69
12"	1.00 (12" x 12")	11.25'	0' - 9"	1.6	3.1	0.08
		22.5'	1' - 3"	2.3	4.5	0.26
		45'	2' - 0"	3.1	6.2	0.76
		90'	3' - 0"	4.3	8.5	2.08
		TEE OR DE	2' - 6"	3.6	7.1	1.23
14"	1.36 (14" x 14")	11.25'	1' - 0"	1.8	3.7	0.15
		22.5'	1' - 6"	2.6	5.2	0.41
		45'	2' - 3"	3.6	7.2	1.15
		90'	3' - 6"	4.9	9.8	3.22
		TEE OR DE	2' - 9"	4.1	8.3	1.81
16"	1.78 (16" x 16")	11.25'	1' - 0"	2.1	4.2	0.19
		22.5'	1' - 9"	2.9	5.9	0.62
		45'	2' - 9"	4.1	8.2	1.81
		90'	4' - 0"	5.6	11.2	4.80
		TEE OR DE	3' - 3"	4.7	9.5	2.79
18"	2.25 (18" x 18")	11.25'	1' - 0"	2.2	4.5	0.23
		22.5'	2' - 0"	3.2	6.4	0.83
		45'	3' - 0"	4.5	9.0	2.35
		90'	4' - 3"	6.1	12.2	5.99
		TEE OR DE	3' - 6"	5.9	11.7	4.59
20"	2.78 (20" x 20")	11.25'	1' - 3"	2.6	5.2	0.38
		22.5'	2' - 0"	3.7	7.4	1.10
		45'	3' - 3"	5.1	10.2	3.33
		90'	4' - 9"	7.0	13.9	8.79
		TEE OR DE	3' - 9"	5.9	11.7	4.96
24"	4.00 (24" x 24")	11.25'	1' - 6"	3.1	6.2	0.64
		22.5'	2' - 6"	4.4	8.8	1.96
		45'	4' - 0"	6.1	12.2	5.81
		90'	5' - 9"	8.3	16.7	15.60
		TEE OR DE	4' - 6"	7.0	14.0	8.48
30"	6.25 (30" x 30")	11.25'	1' - 9"	3.8	7.7	1.16
		22.5'	3' - 0"	5.4	10.8	3.62
		45'	4' - 9"	7.6	15.2	10.71
		90'	7' - 0"	10.3	20.7	28.47
		TEE OR DE	5' - 9"	8.7	17.4	16.72
36"	9.00 (36" x 36")	11.25'	2' - 0"	4.6	9.2	1.90
		22.5'	3' - 6"	6.5	13.0	6.05
		45'	5' - 9"	9.1	18.2	18.57
		90'	8' - 3"	12.4	24.7	48.36
		TEE OR DE	6' - 9"	10.4	20.8	28.13

THRUST RESTRAINT:
HORIZONTAL
BLOCKING

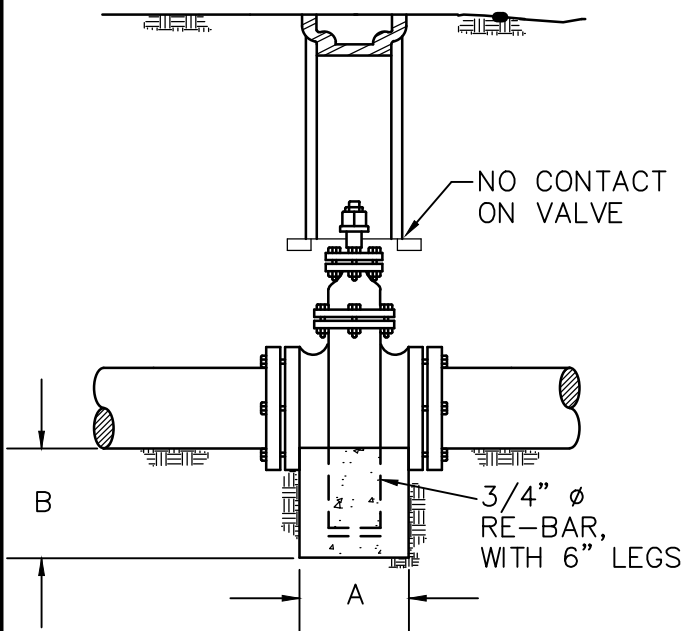
SCALE: N.T.S.

DATE: NOVEMBER 2019

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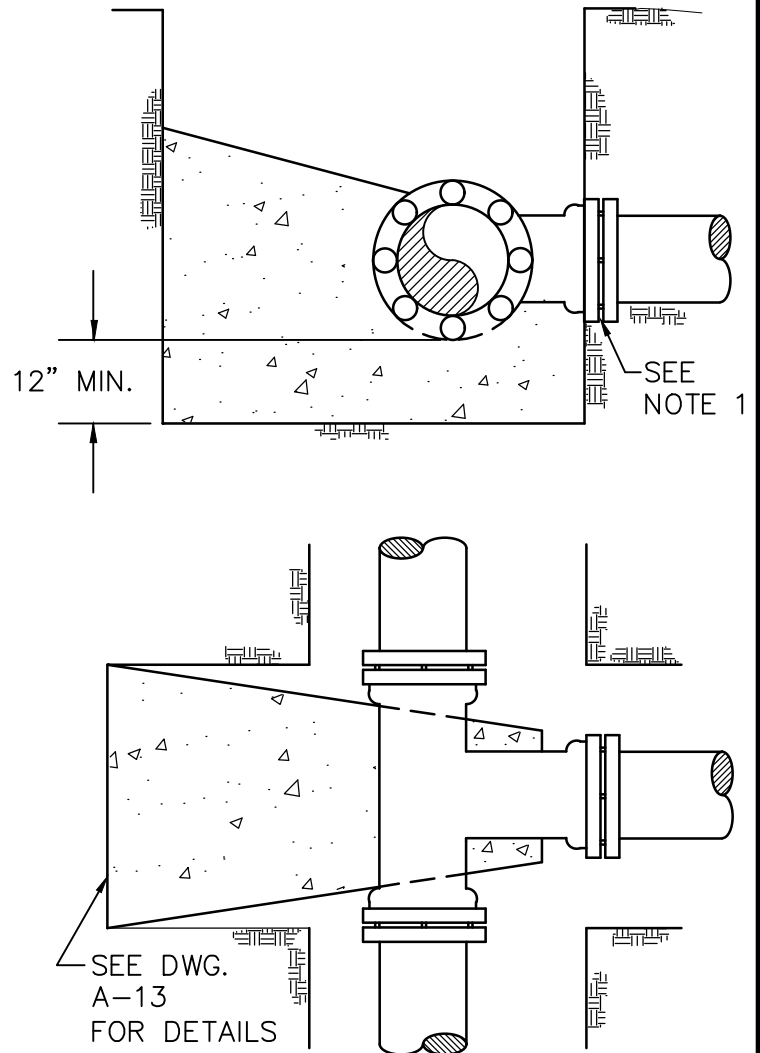


VALVE BLOCKING/SUPPORT



BLOCK DIMENSIONS				
VALVE SIZE	A LENGTH (IN.)	B LENGTH (IN.)	C WIDTH (IN.)	VOLUME CONC. (Q.Y.)
6"	10.50	20.00	24.00	0.11
8"	12.00	20.00	24.00	0.12
10"	13.25	24.00	30.00	0.20
12"	14.75	24.00	30.00	0.23

TEE BLOCKING/SUPPORT



NOTES:

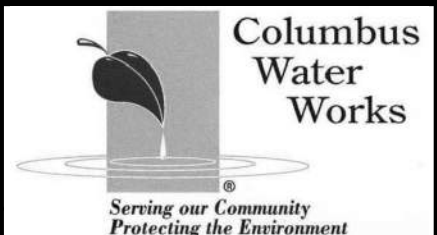
1. COVER GLAND AND BOLTS WITH POLYETHELENE BEFORE PLACING CONCRETE.
2. COAT STRAPS AND RODS WITH AN APPROVED BITUMASTIC COATING BEFORE BACKFILLING. SEE NOTE 5, DWG A-25 FOR COATING DETAILS.
3. ALLOW CONCRETE TO SET UP A MINIMUM OF 6 HOURS BEFORE PLACING BACKFILL.
4. CONCRETE SHALL BE 3000 P.S.I., CLASS A.
5. VERTICAL BENDS WITH AN UPWARD RESULTANT FORCE SHALL BE RESTRAINED AS SHOWN ON DWG. A-15.
6. VERTICAL BENDS WITH A DOWNWARD RESULTANT FORCE SHALL BE RESTRAINED AS SHOWN ON DWG. A-18.

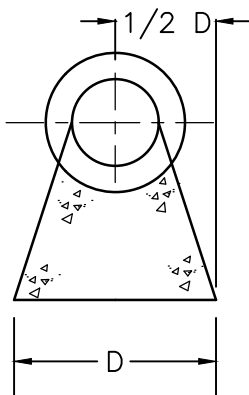
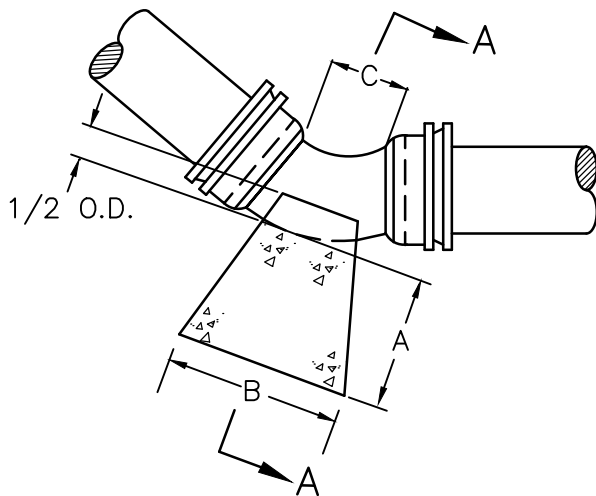
THRUST RESTRAINT:
HORIZONTAL BLOCKING
SUPPORT

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-14





SECTION A-A

NOTE:

ENGINEER SHALL VERIFY SOIL CONDITIONS BEFORE THRUST BLOCK DESIGN IS IMPLEMENTED.

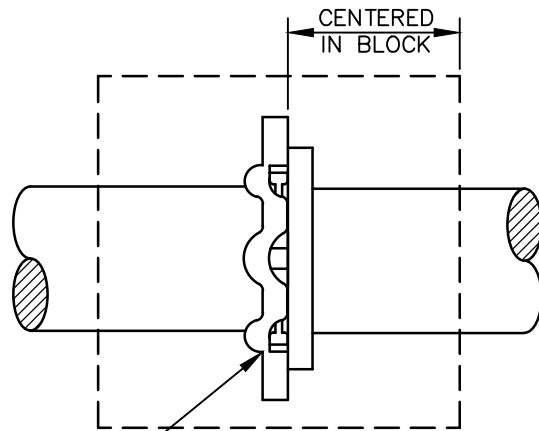
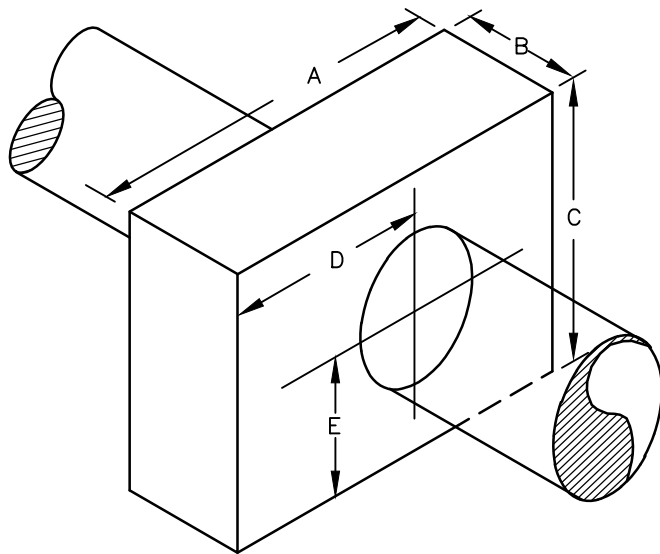
DESIGN DATA

1. DIMENSION OF THRUST BLOCK IN FEET BASED ON 2000 POUNDS PER SQUARE FOOT SOIL BEARING PRESSURE. ACTUAL INSIDE DIA. OF D.I.P., CLASS 51 USED AS STANDARD.
2. CONCRETE SHALL BE CLASS A, 3000 P.S.I. UNDER ADVERSE CONSTRUCTION CONDITIONS, CONCRETE SHALL BE HIGH EARLY.

MINIMUM DIMENSIONS FOR CONCRETE BLOCKING

SIZE (NOM)	SIZE	A (FT.)	B (FT.)	C (IN.)	D (FT.)	VOLUME (CU. YDS.)
11 1/4°	6"	1.0	2.0	6	1.0	0.05
	8"	1.0	2.0	7	1.0	0.05
	10"	1.0	2.0	9	1.0	0.05
	12"	1.0	2.0	11	1.0	0.50
	14"	2.0	2.0	11	1.5	0.16
	16"	2.0	2.0	12	2.0	0.22
	20"	2.0	3.0	15	2.0	0.32
	24"	2.0	3.0	18	3.0	0.50
22 1/2°	6"	1.0	2.0	6	1.0	0.05
	8"	1.0	2.0	7	1.0	0.05
	10"	1.0	2.0	9	1.5	0.08
	12"	1.0	2.0	11	2.0	0.11
	14"	2.0	3.0	11	2.0	0.29
	16"	2.0	4.0	12	2.0	0.37
	20"	2.0	4.0	15	3.0	0.58
	24"	3.0	4.5	18	4.0	1.33
45°	6"	1.0	2.0	6	1.0	0.05
	8"	1.0	2.0	6	1.0	0.05
	10"	2.0	3.0	9	2.0	0.28
	12"	2.0	3.0	11	3.0	0.44
	14"	2.0	4.0	11	3.0	0.55
	16"	3.0	5.0	12	3.0	1.00
	20"	4.0	6.0	15	4.0	2.15
	24"	4.0	7.0	18	5.0	3.15
90°	6"	1.0	2.0	12	2.0	0.11
	8"	2.0	3.0	13	2.4	0.37
	10"	2.6	3.7	18	3.0	0.72
	12"	2.0	4.0	20	4.0	0.84
	14"	3.0	5.0	24	4.4	1.71
	16"	4.0	6.0	26	4.7	2.84
	20"	4.0	7.0	32	6.8	4.51
	24"	5.0	8.0	40	8.0	5.40
TEES AND PLUGS	6"	1.0	2.0	12	1.5	0.08
	8"	1.7	2.5	14	2.0	0.23
	10"	2.0	4.0	18	2.0	0.23
	12"	2.5	3.7	20	3.0	0.75
	14"	3.0	5.0	24	3.0	1.17
	16"	3.0	5.0	26	4.0	1.59
	20"	4.0	6.0	32	5.0	3.21
	24"	6.0	9.0	40	5.0	6.85

THRUST RESTRAINT:
DOWNWARD THRUST



TORQUE SET SCREWS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. INSPECTOR MUST WITNESS INSTALLATION.

MINIMUM DIMENSIONS IN FEET FOR CONCRETE COLLAR
ON DUCTILE IRON PIPE TO BE USED WITH EMBEDDED DUCTILE IRON RETAINER GLAND

PIPE SIZE	A	B	C	D	E	VOLUME CU. YDS.	CONC. WT.	THRUST
4"	3'-6"	3'-0"	1'-5"	1'-6"	1'-0"	0.55	2230	3,150
6"	4'-0"	3'-0"	2'-7"	2'-0"	1'-0"	1.15	4650	7,070
8"	4'-6"	3'-0"	3'-0"	2'-3"	1'-3"	1.50	6075	12,570
10"	5'-2"	3'-0"	3'-2"	2'-7"	1'-3"	1.81	7330	19,635
12"	5'-9"	3'-0"	3'-8"	2'-10 1/2"	1'-8"	2.34	9475	28,775
14"	6'-6"	3'-0"	4'-0"	3'-3"	1'-9"	2.89	11,700	38,490
16"	6'-9"	3'-0"	4'-9"	3'-3"	2'-3"	3.56	14,410	50,270

NOTES

- ALL WATER MAINS GREATER THAN 16" I.D. SHALL BE INDIVIDUALLY CALCULATED BY ENGINEER.
- SOIL CONDITIONS SHALL BE VERIFIED BY THE ENGINEER BEFORE THRUST RESTRAINT DESIGN IS IMPLEMENTED.
- PIPE MUST BE DUCTILE IRON.

DESIGN DATA:

- DIMENSION OF THRUST RESTRAINT IN FEET BASED ON 2000 POUNDS PER SQUARE FOOT SOIL BEARING PRESSURE AND 250 P.S.I. TEST PRESSURE. ACTUAL INSIDE DIAMETER OF DUCTILE IRON PIPE, CLASS 51, USED AS STANDARD.
- CONCRETE SHALL BE CLASS A, 3000 P.S.I.
- UNDER ADVERSE CONSTRUCTION CONDITIONS, CONCRETE SHALL BE "HIGH EARLY" TYPE.

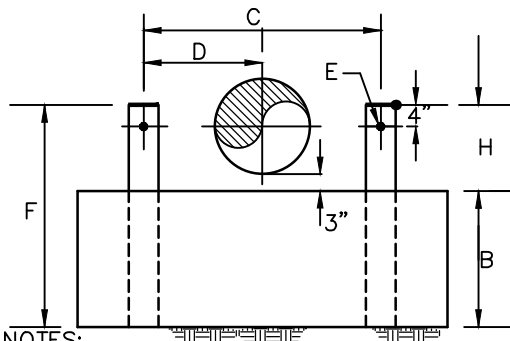
THRUST RESTRAINT: CONCRETE COLLAR

SCALE: N.T.S.

DATE: NOVEMBER 2019

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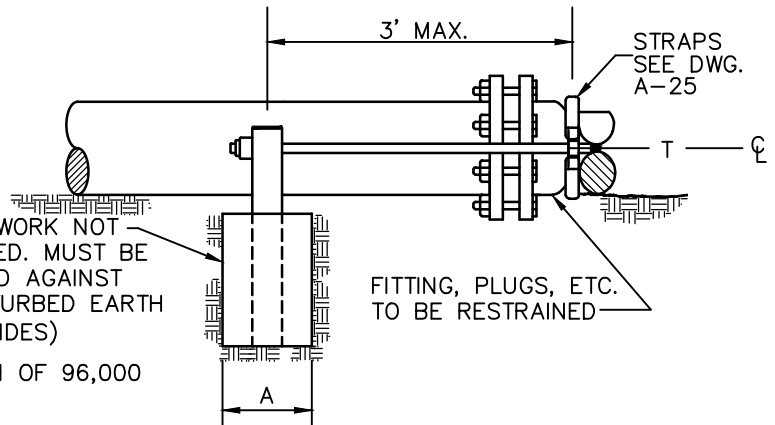
BEND	SIZE	A	B	C	D	VOL. YDS ³	N	T	ROD. DIA.	E (IN.)	F
TEES PLUGS & VALVES	6"	2'-0"	3'-0"	3'-0"	1'-0"	0.67	0'-10"	5,700	3/4"	6X6X3/8	3'-10"
	8"	3'-0"	3'-0"	5'-0"	1'-1"	1.67	0'-11"	10,000	3/4"	6X6X3/8	3'-11"
	10"	4'-0"	3'-0"	5'-0"	1'-2"	2.67	1'-0"	16,000	3/4"	6X6X3/8	4'-0"
	12"	5'-0"	4'-0"	6'-0"	1'-5"	4.44	1'-1"	22,650	3/4"	10X10X1/2	5'-1"
	14"	6'-0"	4'-0"	7'-0"	1'-6"	6.22	1'-2"	31,000	3/4"	10X10X1/2	5'-2"
	16"	7'-0"	4'-0"	8'-0"	1'-8"	6.30	1'-3"	40,250	3/4"	10X10X1/2	5'-3"
	20"	9'-0"	4'-8"	9'-0"	1'-11"	13.50	1'-5"	62,850	3/4"	W12X190	5'-11"
	24"	11'-0"	4'-8"	10'-0"	2'-2"	18.33	1'-7"	90,500	3/4"	W14X136	6'-1"
	30"	14'-8"	5'-6"	10'-0"	2'-6"	26.85	1'-10"	141,375		W14X398	6'-10"
11 1/4°	36"	18'-0"	5'-6"	10'-0"	2'-9"	36.67	2'-1"	203,575		W14X665	7'-7"
	6"	2'-0"	3'-0"	3'-0"	1'-0"	0.67	0'-10"	1,110	3/4"	6X6X3/8	3'-10"
	8"	2'-0"	3'-0"	3'-0"	1'-1"	0.67	0'-11"	2,000	3/4"	6X6X3/8	3'-11"
	10"	2'-0"	3'-0"	3'-0"	1'-2"	0.67	1'-0"	3,100	3/4"	6X6X3/8	4'-0"
	12"	2'-0"	3'-0"	3'-6"	1'-5"	0.78	1'-1"	4,450	3/4"	10X10X1/2	4'-1"
	14"	2'-0"	3'-0"	3'-6"	1'-6"	0.78	1'-2"	6,050	3/4"	10X10X1/2	4'-2"
	16"	3'-6"	3'-0"	4'-0"	1'-8"	1.56	1'-3"	7,900	3/4"	10X10X1/2	4'-3"
	20"	4'-0"	3'-0"	5'-6"	1'-11"	2.44	1'-5"	12,350	3/4"	W12X190	4'-5"
	24"	5'-0"	3'-6"	6'-0"	2'-2"	3.89	1'-7"	17,750	3/4"	W14X136	5'-1"
22 1/2°	30"	6'-0"	4'-0"	8'-0"	2'-6"	7.11	1'-10"	27,750	1"	W14X398	5'-10"
	36"	7'-6"	4'-0"	9'-0"	2'-9"	10.00	2'-1"	40,000	1"	W14X665	6'-1"
	6"	2'-0"	3'-0"	3'-0"	1'-0"	0.67	0'-10"	2,250	3/4"	6X6X3/8	3'-10"
	8"	2'-0"	3'-0"	3'-0"	1'-1"	0.67	0'-11"	4,000	3/4"	6X6X3/8	3'-11"
	10"	2'-0"	3'-0"	3'-0"	1'-2"	0.78	1'-0"	6,150	3/4"	6X6X3/8	4'-0"
	12"	3'-6"	3'-0"	3'-6"	1'-5"	1.56	1'-1"	8,850	3/4"	10X10X1/2	4'-1"
	14"	4'-0"	3'-0"	3'-6"	1'-6"	2.22	1'-2"	12,050	3/4"	10X10X1/2	4'-2"
	16"	4'-0"	3'-6"	4'-0"	1'-8"	3.11	1'-3"	15,700	3/4"	10X10X1/2	4'-9"
	20"	5'-0"	4'-0"	5'-6"	1'-11"	5.19	1'-5"	24,550	3/4"	W12X190	5'-3"
45°	24"	6'-6"	4'-0"	6'-0"	2'-2"	8.19	1'-7"	35,400	3/4"	W14X136	5'-7"
	30"	9'-0"	4'-0"	8'-0"	2'-6"	12.00	1'-10"	55,200	1"	W14X398	5'-10"
	36"	11'-0"	4'-0"	9'-0"	2'-9"	16.30	2'-1"	80,000	1"	W14X665	6'-1"
	6"	2'-0"	3'-0"	3'-0"	1'-0"	0.67	0'-10"	4,350	3/4"	6X6X3/8	3'-10"
	8"	2'-0"	3'-0"	4'-0"	1'-1"	0.89	0'-11"	7,700	3/4"	6X6X3/8	3'-11"
	10"	4'-0"	3'-0"	5'-0"	1'-2"	2.22	1'-0"	12,050	3/4"	6X6X3/8	4'-0"
	12"	4'-0"	4'-0"	5'-6"	1'-5"	3.26	1'-1"	17,350	3/4"	10X10X1/2	5'-1"
	14"	5'-6"	4'-0"	6'-0"	1'-6"	4.89	1'-2"	23,600	3/4"	10X10X1/2	5'-2"
	16"	6'-0"	4'-0"	7'-6"	1'-8"	6.67	1'-3"	30,000	3/4"	10X10X1/2	5'-3"
90°	20"	7'-0"	4'-6"	9'-0"	1'-11"	10.50	1'-5"	48,100	3/4"	W12X190	5'-11"
	24"	9'-6"	4'-6"	9'-6"	2'-2"	15.04	1'-7"	70,000	3/4"	W14X136	6'-1"
	30"	12'-6"	4'-6"	10'-0"	2'-6"	20.83	1'-10"	108,250	1"	W14X398	6'-4"
	36"	15'-8"	5'-0"	10'-0"	2'-9"	28.70	2'-1"	155,850		W14X665	7'-1"
	6"	2'-6"	3'-0"	4'-0"	1'-0"	1.11	0'-10"	8,000	3/4"	6X6X3/8	3'-10"
	8"	4'-0"	3'-0"	5'-6"	1'-1"	2.44	0'-11"	14,250	3/4"	6X6X3/8	3'-11"
	10"	5'-0"	3'-0"	7'-6"	1'-2"	4.17	1'-0"	22,250	3/4"	6X6X3/8	4'-0"
	12"	6'-0"	3'-0"	8'-0"	1'-5"	5.33	1'-1"	32,000	3/4"	10X10X1/2	4'-1"
	14"	7'-6"	3'-0"	9'-0"	1'-6"	7.50	1'-2"	43,550	3/4"	10X10X1/2	4'-2"
	16"	9'-0"	3'-6"	9'-0"	1'-8"	10.50	1'-3"	56,900	3/4"	10X10X1/2	4'-9"
	20"	12'-0"	3'-6"	9'-0"	1'-11"	14.00	1'-5"	88,900	3/4"	W12X190	4'-11"
	24"	14'-0"	4'-0"	10'-0"	2'-2"	20.74	1'-7"	128,000		W14X136	5'-7"
	30"	18'-0"	4'-6"	10'-0"	2'-6"	30.00	1'-10"	200,000		W14X398	6'-4"
	36"	22'-0"	5'-0"	10'-0"	2'-9"	40.74	2'-1"	287,900		W14X665	7'-1"



NOTES:

1. BASED ON ROD AND NUT HAVING YIELD STRENGTH OF 96,000 P.S.I.
2. SOIL BEARING CAPACITY OF 2000 P.S.F.
3. RODS TO HAVE 6" OF THREAD ON ENDS.
4. ALL METAL TO BE CLEANED AND COATED WITH APPROVED PROTECTIVE COATING FOLLOWING INSTALLATION AND PRIOR TO BACKFILLING. (SEE NOTE 5, DWG A-25 FOR COATING DETAILS)

FORM WORK NOT ALLOWED. MUST BE POURED AGAINST UNDISTURBED EARTH (ALL SIDES)

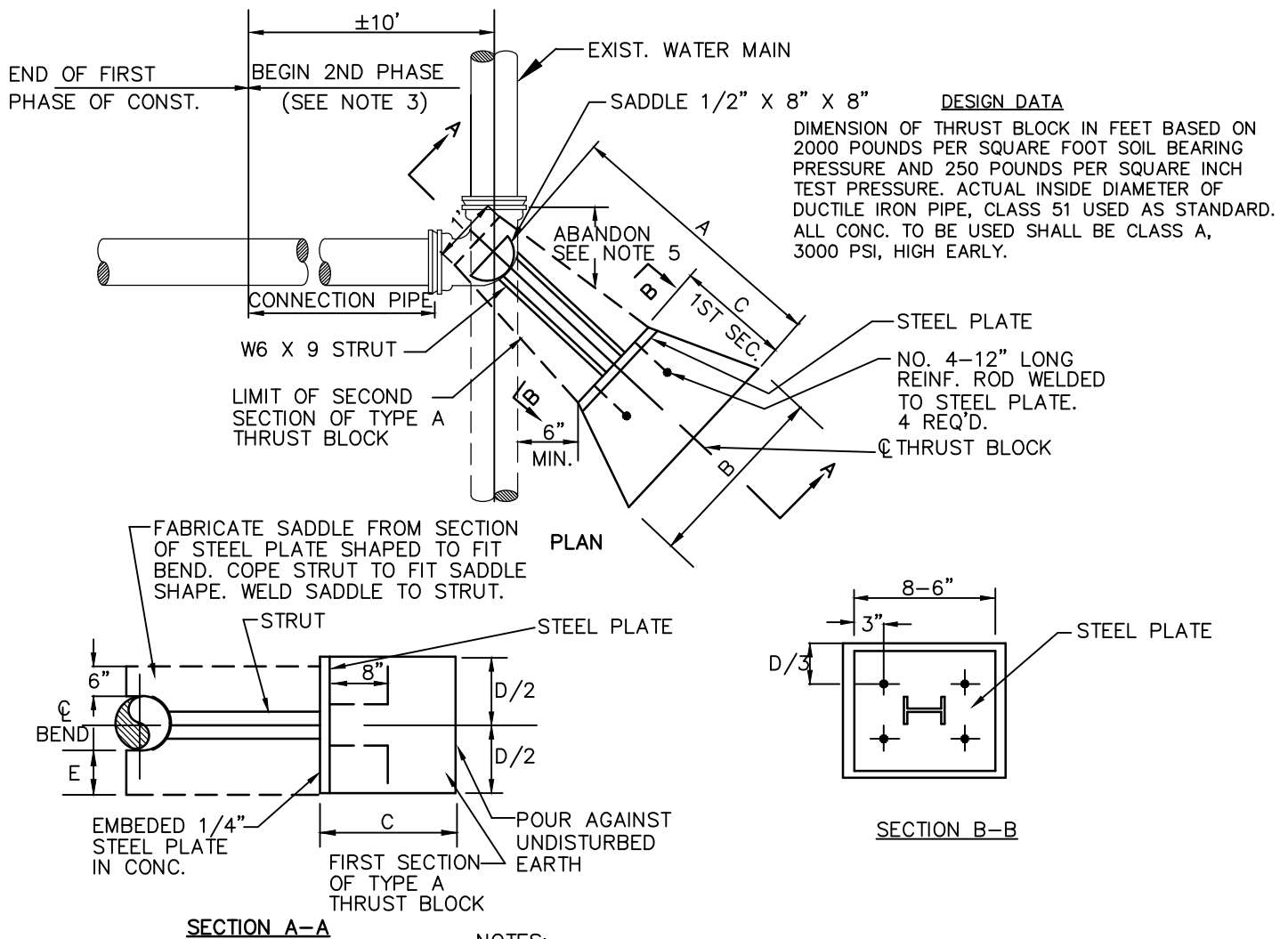


THRUST RESTRAINT:
HORIZ. BLOCK SUPPORT
AT PLUG ANCHOR

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-17



NOTES:

1. TYPE A THRUST BLOCK SHALL ONLY BE USED IN SITUATION WHERE NEW WATER MAIN CONSTRUCTION IS TO BE CONNECTED TO AN EXISTING WATER MAIN AND SHUT DOWN TIME ALLOWED WILL NOT PERMIT CONCRETE TO PROPERLY CURE FOR STANDARD THRUST BLOCK CONSTRUCTION.
2. CONTRACTOR WILL INSTALL NEW WATER MAIN TO A POINT APPROXIMATELY 10' FROM THE POINT OF CONNECTION TO THE EXISTING WATER MAIN AND INSTALL THE FIRST SECTION OF THRUST BLOCK. AFTER THE NEW WATER MAIN HAS BEEN SATISFACTORILY TESTED FOR HYDROSTATIC PRESSURE, BACTERIOLOGICALLY CHECKED AND ALL TEMPORARY THRUST BLOCKING HAS BEEN REMOVED, THE CONNECTION WILL BE COMPLETED.
3. ALL SECOND PHASE WORK IS TO BE COMPLETED BY THE C.W.W., EXCEPT EXCAVATING, BACKFILLING, REPAVING THE CONSTRUCTION AREA AND CONSTRUCTION OF FIRST SECTION OF TYPE A THRUST BLOCK.
4. INSTALLATION OF NEW BEND AND WIDE FLANGE STRUT SHALL BE PERFORMED AFTER THE FIRST SECTION OF THRUST BLOCK IS PROPERLY CURED.
5. CUT AND REMOVE PORTION OF EXISTING WATER MAIN AS REQ'D. TO ALLOW FOR INSTALLATION OF STEEL STRUTS AND SECOND SECTION OF TYPE A THRUST BLOCK. REMAINING UNUSED SECTION OF EXISTING WATER MAIN TO BE ABANDONED.
6. WATER MAY BE TURNED ON AFTER WIDE FLANGE STRUTS HAVE BEEN SECURELY WELDED TO THE BEARING PLATE EMBEDDED IN THE FIRST SECTION OF THRUST BLOCK AND TO THE BEND SADDLE.
7. SECOND SECTION POUR OF CONCRETE TO PROTECT STEEL STRUTS TO BE COMPLETED BEFORE BACKFILL.
8. PIPE SADDLES AND STRUTS MAY BE FIELD FABRICATED.
9. SOIL CONDITIONS SHALL BE VERIFIED BY THE ENGINEER BEFORE THRUST BLOCK DESIGN IS IMPLEMENTED.

DIMENSIONS IN FEET FOR CONCRETE BLOCKING-HORIZONTAL THRUST

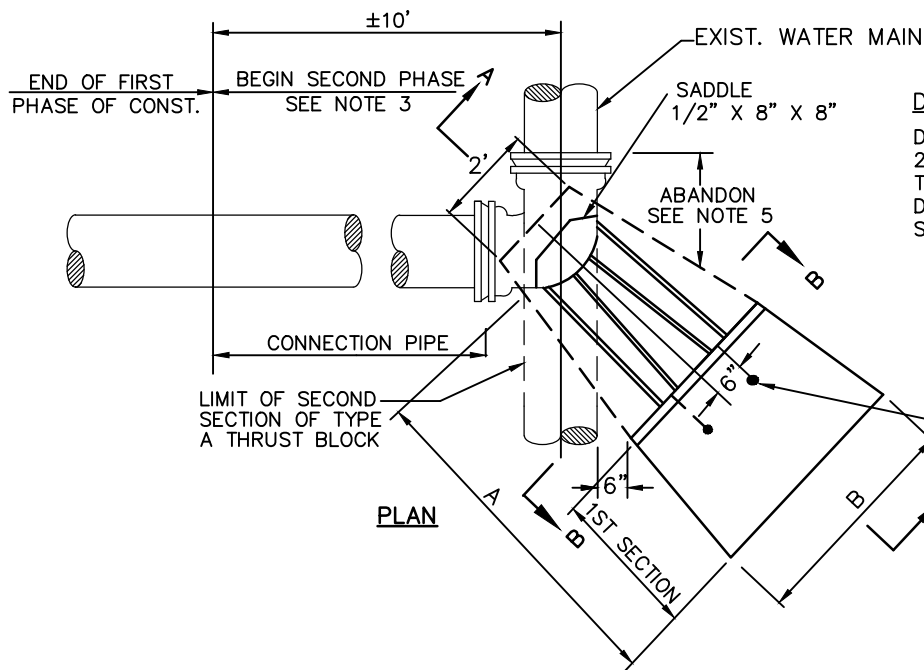
BEND	SIZE	A	B	C	D	E
45°	6"	3'-6"	2'-0"	1'-6"	1'-6"	0'-6"
	8"	4'-0"	2'-6"	2'-0"	2'-0"	0'-8"
	10"	4'-6"	3'-0"	2'-0"	2'-0"	0'-7"
	12"	5'-0"	4'-0"	2'-6"	3'-0"	1'-0"
	14"	5'-6"	4'-0"	2'-6"	3'-0"	0'-10"
90°	6"	3'-6"	2'-6"	1'-6"	2'-0"	0'-9"
	8"	4'-0"	3'-6"	2'-0"	2'-6"	0'-11"
	10"	4'-6"	4'-0"	2'-6"	3'-0"	1'-0"
	12"	5'-0"	5'-0"	2'-6"	4'-0"	1'-6"
	14"	5'-6"	5'-6"	3'-0"	4'-0"	1'-4"

**THRUST RESTRAINT:
 HORIZONTAL 6"-14"
 MAINS (TYPE A)**

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-18

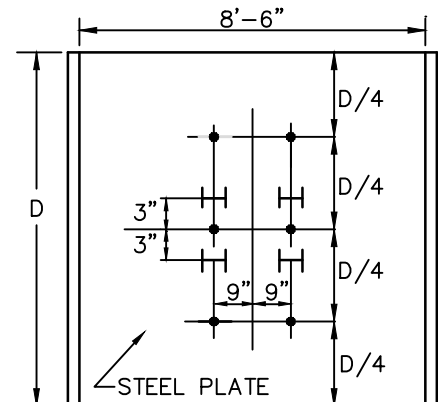
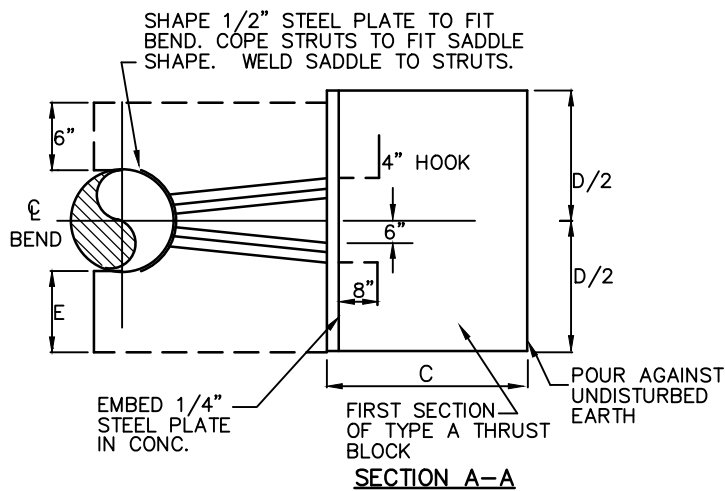


DESIGN DATA:

DIMENSION OF THRUST BLOCK IN FEET BASED ON 2000 PSF SOIL BEARING PRESSURE AND 250 PSI TEST PRESSURE. ACTUAL INSIDE DIAMETER OF D.I.P. CLASS 51 USED AS STANDARD. ALL CONC. SHALL BE 3000 PSI, HIGH EARLY TYPE.

DIMENSIONS FOR CONCRETE BLOCKING HORIZONTAL THRUST

BEND	SIZE	A	B	C	D	E
45°	16"	7'-0"	5'-0"	3'-0"	4'-0"	1'-5"
	20"	7'-6"	6'-0"	3'-6"	5'-0"	1'-7"
	24"	9'-0"	8'-0"	4'-6"	5'-6"	1'-9"
90°	16"	7'-0"	6'-6"	3'-0"	5'-6"	2'-0"
	20"	7'-0"	8'-0"	3'-6"	7'-0"	2'-9"
	24"	9'-0"	9'-0"	4'-9"	9'-0"	3'-5"



SECTION B-B

NOTES:

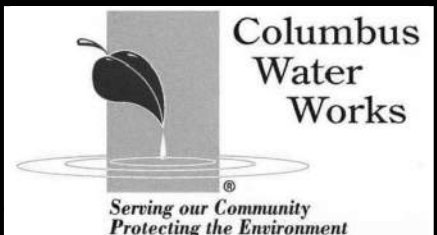
1. TYPE A THRUST BLOCK SHALL BE USED IN SITUATIONS WHERE NEW WATER MAIN CONSTRUCTION IS TO BE CONNECTED TO AN EXISTING WATER MAIN AND SHUT DOWN TIME ALLOWED WILL NOT PERMIT CONCRETE TO PROPERLY CURE FOR STANDARD THRUST BLOCK CONSTRUCTION.
2. CONTRACTOR WILL INSTALL NEW WATER MAIN TO A POINT APPROXIMATELY 10' FROM THE POINT OF CONNECTION TO THE EXISTING WATER MAIN INSTALL THE FIRST SECTION OF THRUST BLOCK AFTER THE NEW WATER MAIN HAS BEEN SATISFACTORILY TESTED FOR HYDROSTATIC PRESSURE, BACTERIOLOGICALLY CHECKED AND ALL TEMPORARY THRUST BLOCKING HAS BEEN REMOVED, THE CONNECTION WILL BE COMPLETED.
3. ALL SECOND PHASE WORK IS TO BE COMPLETED BY THE CWW EXCEPT EXCAVATING, BACKFILLING, REPAVING THE CONSTRUCTION AREA AND CONSTRUCTION OF FIRST SECTION OF TYPE A THRUST BLOCK.
4. INSTALLATION OF NEW BEND AND WIDE FLANGE STRUT SHALL BE PERFORMED AFTER THE FIRST SECTION OF THRUST BLOCK IS PROPERLY CURED.
5. CUT AND REMOVE PORTION OF EXISTING WATER MAINS REQ'D TO ALLOW INSTALLATION OF STEEL STRUTS AND SECOND SECTION OF TYPE A THRUST BLOCK. REMAINING UNUSED SECTION OF EXISTING WATER MAIN TO BE ABANDONED.
6. WATER MAY BE TURNED ON AFTER WIDE FLANGE STRUTS HAVE BEEN SECURELY WELDED TO THE BEARING PLATE EMBEDDED IN THE FIRST SECTION OF THRUST BLOCK AND TO THE BEND SADDLE.
7. SECOND SECTION POUR OF CONCRETE TO PROTECT STEEL STRUTS TO BE COMPLETED BEFORE BACKFILL.
8. PIPE SADDLES AND STRUTS MAY BE FIELD FABRICATED.
9. SOIL CONDITIONS SHALL BE VERIFIED BY THE ENGINEER BEFORE THRUST BLOCK DESIGN IS IMPLEMENTED.

THRUST RESTRAINT:
HORIZONTAL 16"-24"
MAINS (TYPE A)

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-19



	PIPE SIZE	ROD DIA.	NO. RODS	TOTAL THRUST (lbs)
TEES, PLUGS & VALVES	6"	3/4"	2	5,655
	8"	3/4"	2	10,055
	10"	3/4"	2	15,710
	12"	3/4"	2	22,620
	14"	3/4"	2	30,800
	16"	3/4"	2	40,215
	20"	3/4"	2	62,835
	24"	3/4"	2	90,480
	30"	1"	4	141,375
	36"	1"	4	203,595
11 1/4° BEND	6"	3/4"	2	1,110
	8"	3/4"	2	1,970
	10"	3/4"	2	3,080
	12"	3/4"	2	4,435
	14"	3/4"	2	6,035
	16"	3/4"	2	7,885
	20"	3/4"	2	12,320
	24"	3/4"	2	17,740
	30"	1"	2	27,720
	36"	1"	2	39,910
22 1/2° BEND	6"	3/4"	2	2,210
	8"	3/4"	2	3,925
	10"	3/4"	2	6,130
	12"	3/4"	2	8,825
	14"	3/4"	2	12,015
	16"	3/4"	2	15,690
	20"	3/4"	2	24,515
	24"	3/4"	2	35,305
	30"	1"	2	55,160
	36"	1"	2	79,435
45° BEND	6"	3/4"	2	4,430
	8"	3/4"	2	7,700
	10"	3/4"	2	12,025
	12"	3/4"	2	17,312
	14"	3/4"	2	23,565
	16"	3/4"	2	30,780
	20"	3/4"	2	48,090
	24"	3/4"	2	69,250
	30"	1"	2	108,205
	36"	1"	4	155,810
90° BEND	6"	3/4"	2	8,000
	8"	3/4"	2	14,220
	10"	3/4"	2	22,214
	12"	3/4"	2	32,000
	14"	3/4"	2	43,540
	16"	3/4"	2	56,870
	20"	3/4"	2	88,860
	24"	3/4"	4	127,960
	30"	1"	4	199,930
	36"	1"	4	287,900

NOTES:

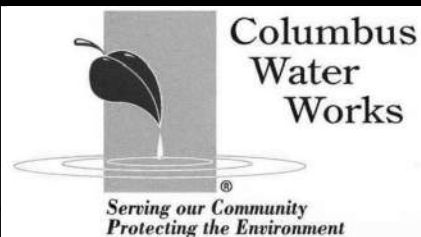
1. BASED UPON ROD & NUT HAVING MIN. YIELD STRENGTH OF 95,000 P.S.I.
2. RODS HAVE 6" OF THREAD ON EACH END.
3. ALL METAL TO BE CLEANED AND COATED WITH AN APPROVED PROTECTIVE COATING FOLLOWING INSTALLATION AND PRIOR TO BACKFILLING. (SEE NOTE 5, DWG. A-25 FOR COATING DETAILS).

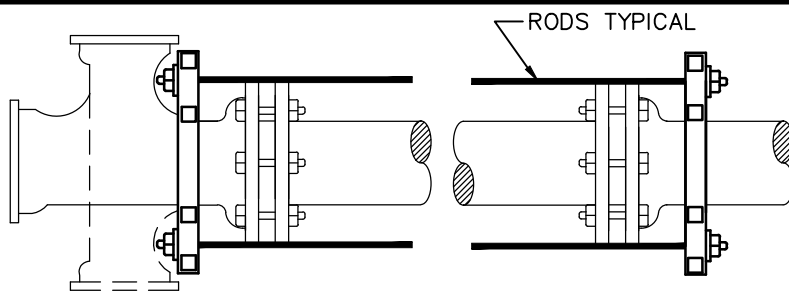
THRUST RESTRAINT: TIE-ROD CHART

SCALE: N.T.S.

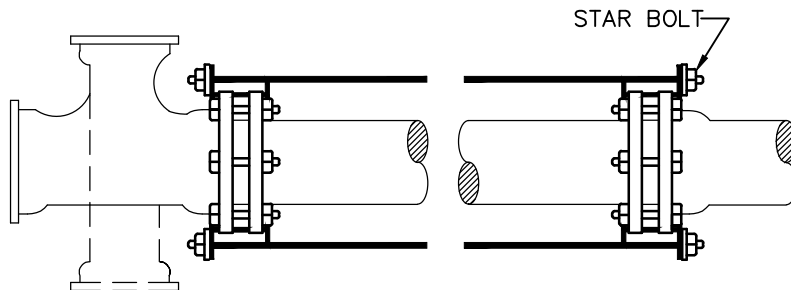
DATE: NOVEMBER 2019

A-20

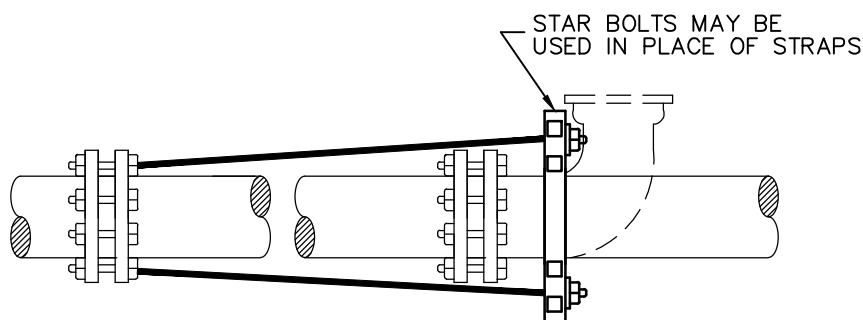




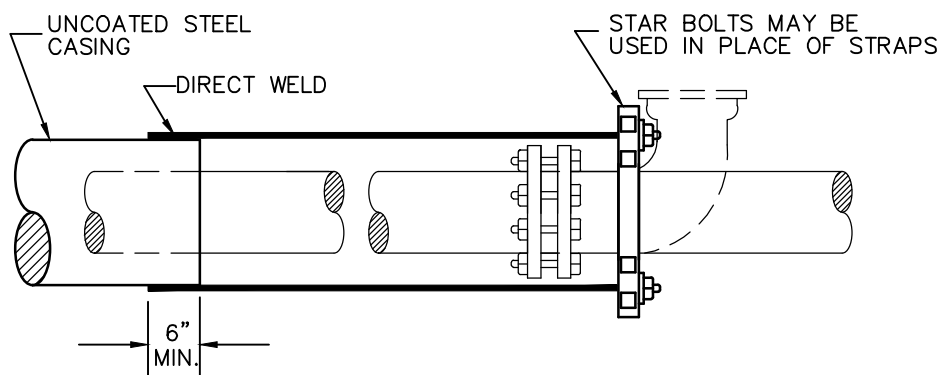
I.
FITTING RESTRAINT
STRAPS & RODS



II.
FITTING RESTRAINT
STAR BOLTS AND RODS



III.
FITTING RESTRAINT
FLANGE-MJ



IV.
FITTING RESTRAINT
DIRECT WELD TO STEEL CASING
(10" OR LESS MAINS, ONLY)

NOTES:

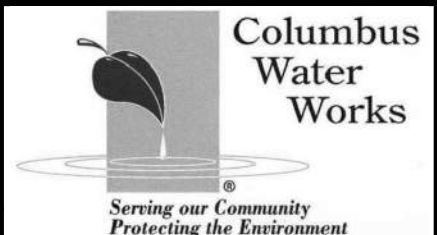
1. SEE DWG. A-23 FOR NUMBER AND DIAMETER OF RODS REQUIRED.
2. NO FLANGED JOINTS ARE TO BE BURIED.
3. AFTER INSTALLATION, TIE-RODS AND CLAMP ASSEMBLIES SHALL BE CLEANED AND THOROUGHLY COATED WITH ROYSTON LABORATORIES, INC. ROSKOTE PLASTIC NO. A939 OR KOPPERS CO. INC. BITUMASTIC SUPERSERVICE BLACK OR APPROVED EQUIVALENT.
4. WHEN RESTRAINING FITTINGS TO STEEL CASING PIPE, THE TIE-RODS MUST BE DIRECT WELDED TO THE CASING. USE OF STAR BOLTS PROHIBITED. CASING MUST BE FULLY WELDED THROUGHOUT ITS LENGTH AND BE A MINIMUM OF 30' IN LENGTH. AREA TO BE WELDED MUST BE COMPLETELY BARE AND FREE OF ANY COATING MATERIAL.

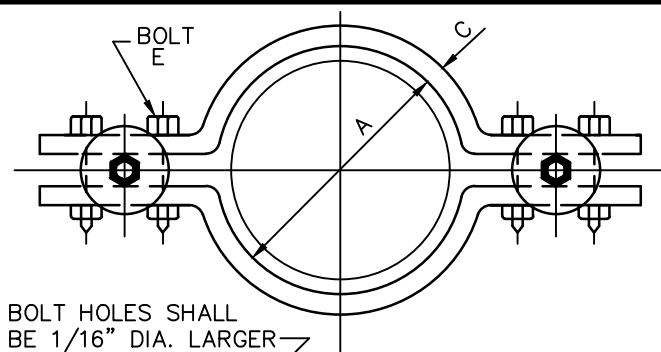
THRUST RESTRAINT: TIE-ROD INSTALLATION

SCALE: N.T.S.

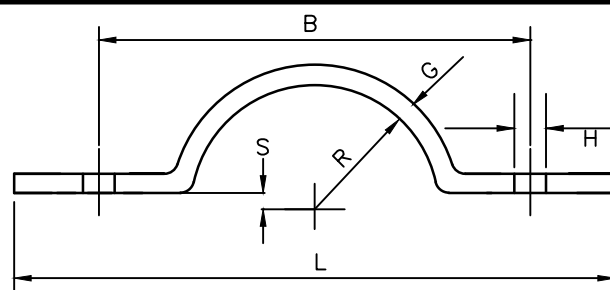
DATE: NOVEMBER 2019

A-21

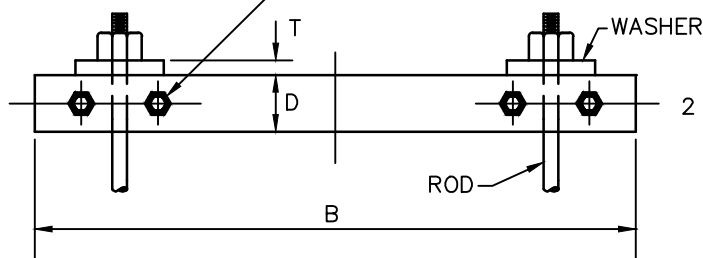




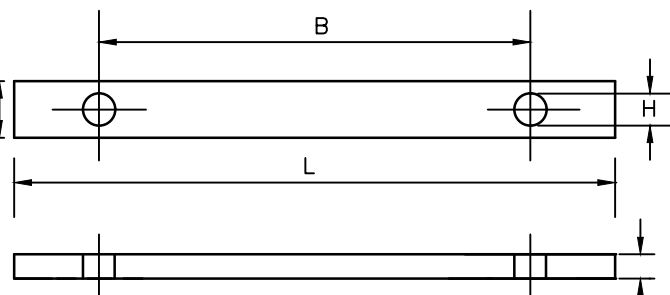
BOLT HOLES SHALL BE 1/16" DIA. LARGER THAN BOLTS.



TEE ANCHOR STRAP AT PLUG



JOINT STRAP & ROD ARRANGEMENT



PLUG ANCHOR STRAP

STEEL SOCKET CLAMP DIMENSIONS (INCHES)							
SIZE	A	B	C	D	E	T	ROD, C & WASH. SIZE
6	7 1/8	17 7/8	1/2	2	5/8 X 3 1/2	5/8	3/4
8	9 5/16	19 1/8	5/8	2 1/2	5/8 X 3 3/4	5/8	3/4
10	11 1/2	21 3/8	5/8	2 1/2	3/4 X 3 3/4	3/4	3/4
12	13 1/2	25 1/8	5/8	3	7/8 X 4 1/2	3/4	3/4
14	15 3/4	28 1/4	3/4	3	7/8 X 4 1/2	7/8	3/4
16	17 7/8	31 3/8	3/4	4	1 X 4 1/2	7/8	3/4
20	22 1/8	37 3/4	3/4	4 1/2	1 1/4 X 5	1 1/8	3/4
24	26 3/8	44 1/4	3/4	5	1 1/2 X 5 1/2	1 1/4	3/4

ABOVE ANCHOR STRAP DIMENSIONS (INCHES)						
SIZE	B	G	H	L	R	S
6	12 1/8	5/8 X 2 1/2	13/16	14 1/2	3 9/16	3/4
8	14 3/8	5/8 X 2 1/2	13/16	16 3/4	4 21/32	3/4
10	16 11/16	5/8 X 2 1/2	1 1/16	19 1/16	5 3/4	3/4
12	19 3/16	5/8 X 3	1 1/16	22 5/16	6 3/4	7/8

NOTES:

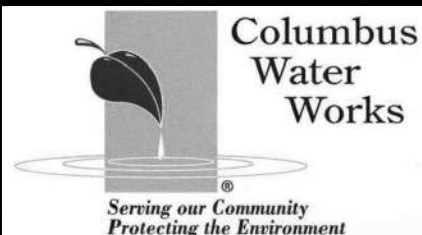
1. INSTALLATION OF AND MATERIALS FOR RODS, CLAMPS, STRAPS, BOLTS AND WASHERS SHALL CONFORM TO THE NATIONAL FIRE CODES – NFFA NO. 24 LATEST REVISION.
2. YOKES AND ANCHOR STRAPS FOR FITTINGS LARGER THAN 12" SHALL BE DESIGNED AND APPROVED FOR SPECIFIC INSTALLATION.
3. RODS TO BE HIGH TENSILE, HOT ROLLED STEEL WITH TENSILE STRENGTH OF 110,000 P.S.I. AND A MIN. OF 95,000 YIELD STRENGTH.
4. NUTS TO HAVE HEAVY DUTY SEMI-FINISH WITH NATIONAL COURSE THREADS.
5. AFTER INSTALLATION TIE RODS AND CLAMP ASSEMBLY SHALL BE THOROUGHLY COVERED WITH ROYSTON LABS, INC. ROSKOTE MASTIC NO A939, OR KOPPERS CO., INC. BITUMASTIC SUPERSERVICE BLACK OR APPROVED EQUIVALENT.

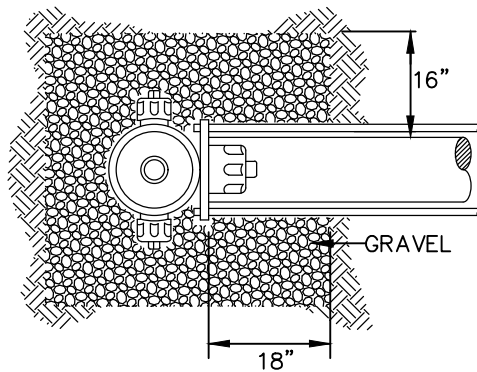
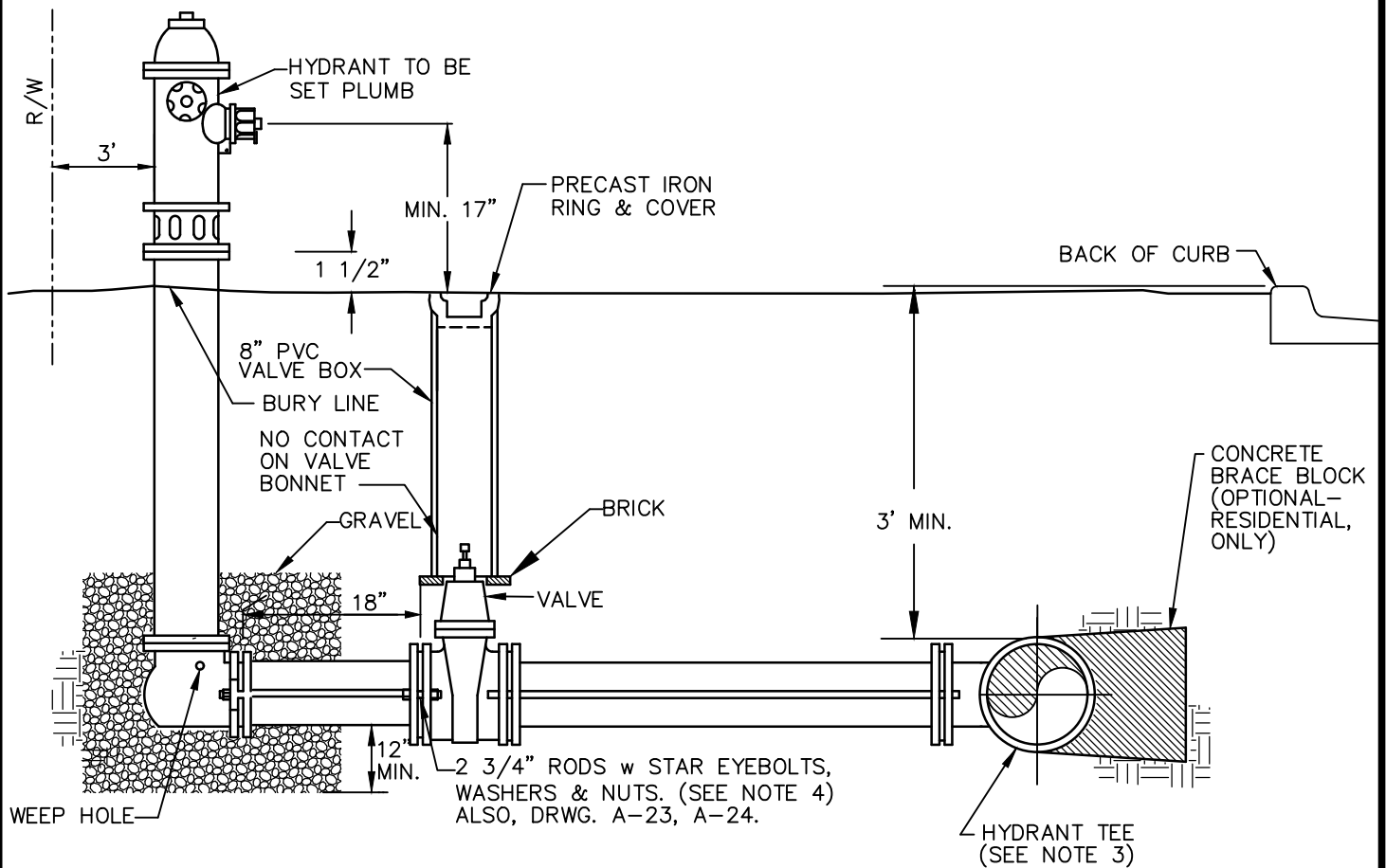
THRUST RESTRAINT: STRAP & ROD DETAILS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-22





PLACE GRAVEL TO 6" ABOVE WEEP HOLES, 18" BELOW WEEP HOLES AND 18" TOWARDS THE MAIN. ALSO 16" Laterally ON EACH SIDE. COMPACT GRAVEL UNDER HYDRANT.

NOTES:

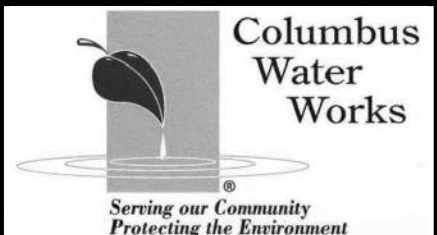
1. RODS TO BE HIGH TENSILE, HOT ROLLED STEEL WITH TENSILE STRENGTH OF 110,000 P.S.I. AND A MINIMUM YIELD STRENGTH OF 95,000 P.S.I.
2. FOR ALL WATER MAINS IN COUNTY, STATE, OR FEDERAL R/W'S - MINIMUM TRENCH DEPTH SHALL BE 4'-0" FROM TOP OF CURB.
3. IF REGULAR TEE USED, MINIMUM NIPPLE LENGTHS SHALL BE 12".
4. IF SUITABLE LENGTH ANCHOR COUPLINGS ARE USED, RODS MAY BE OMITTED.
5. SPACE HYDRANTS AS SHOWN ON APPROVED PLAN

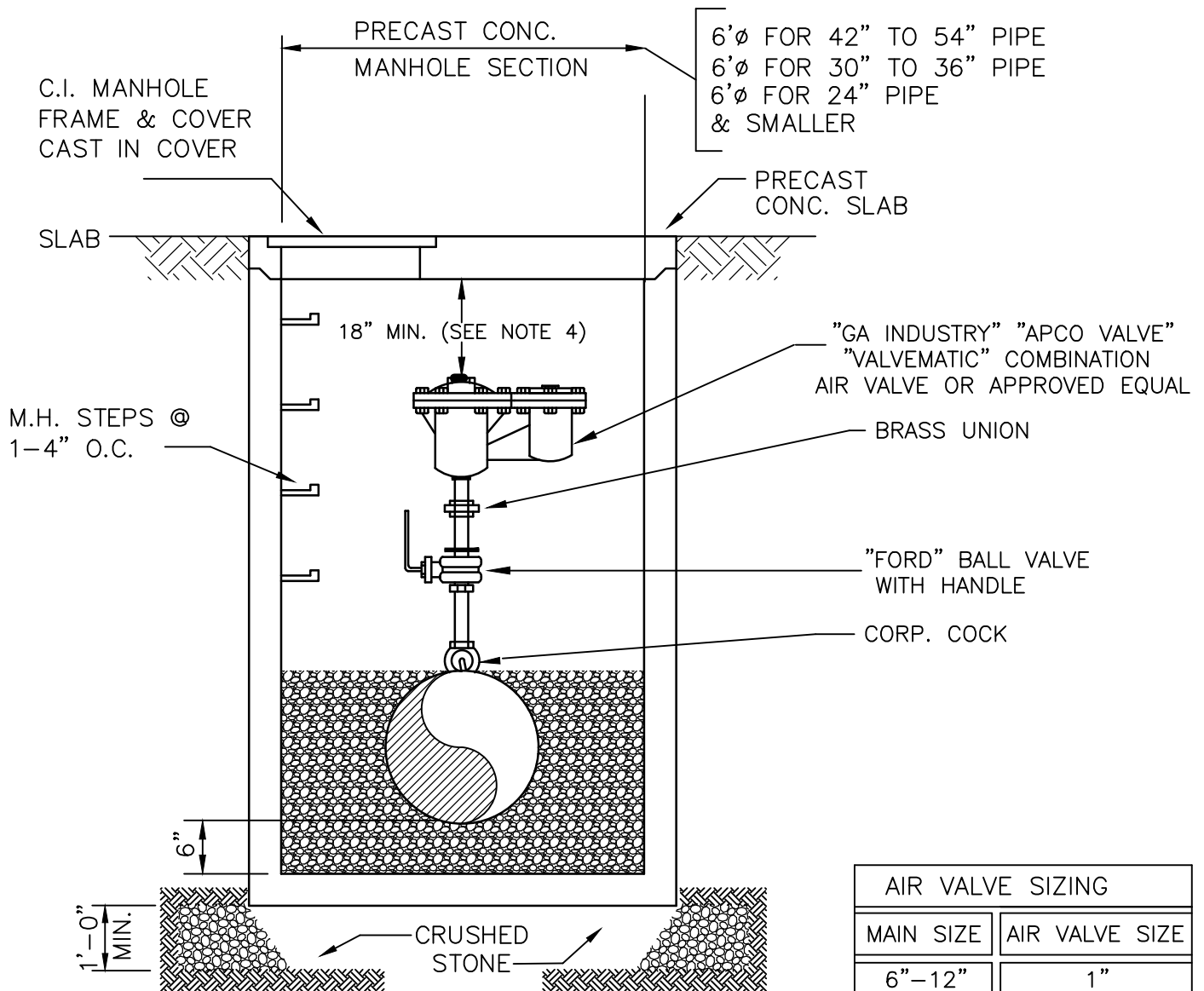
FIRE HYDRANT INSTALLATION

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-23





AIR VALVE SIZING	
MAIN SIZE	AIR VALVE SIZE
6"-12"	1"
14"-16"	1 1/2"
20"-30"	2"
36"-42"	2"

NOTES:

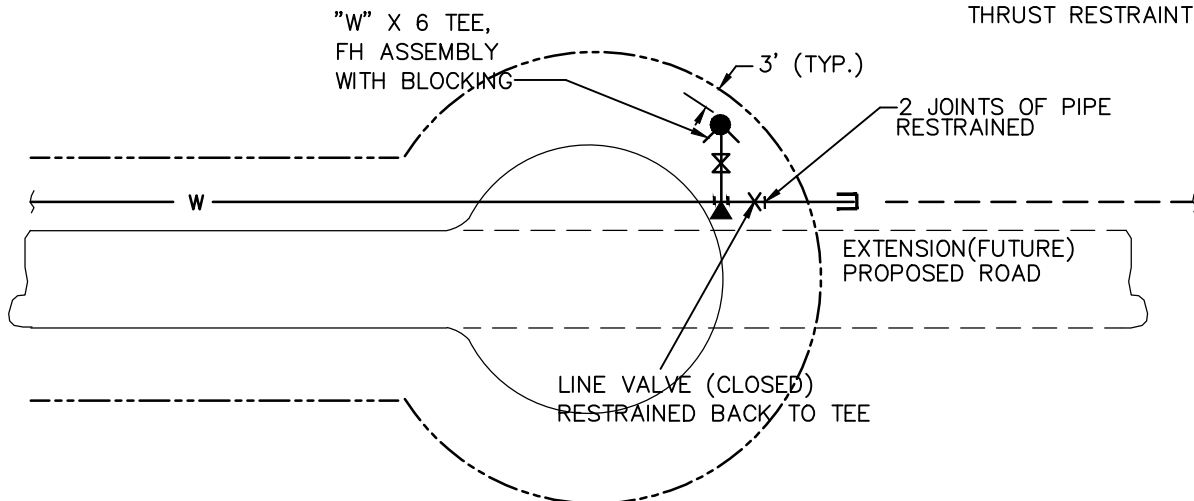
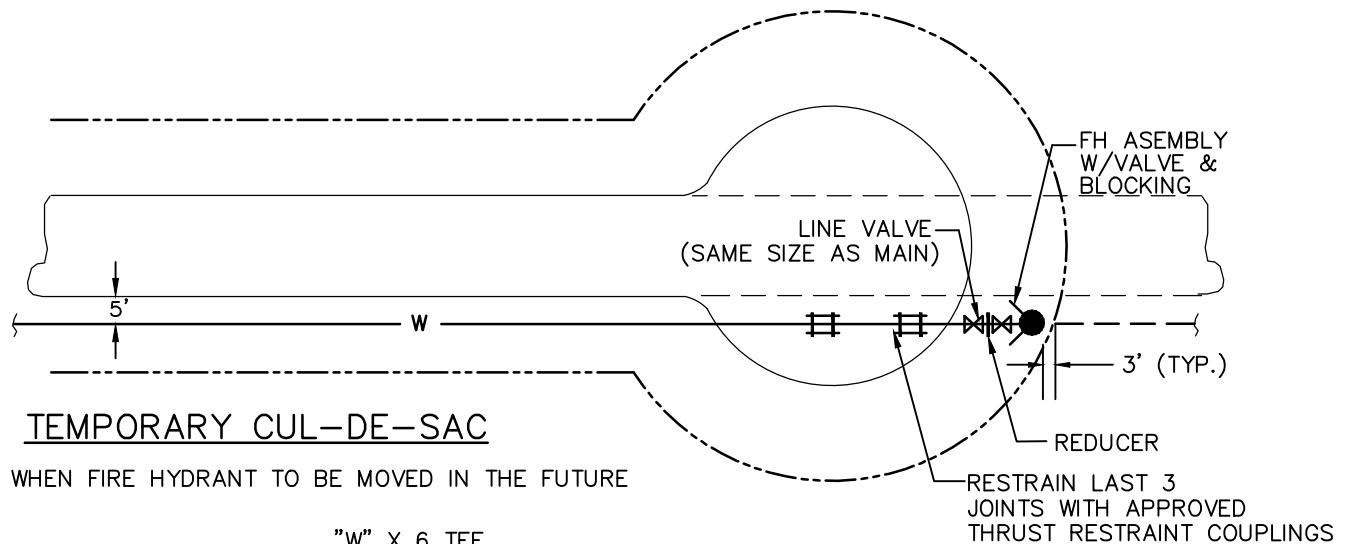
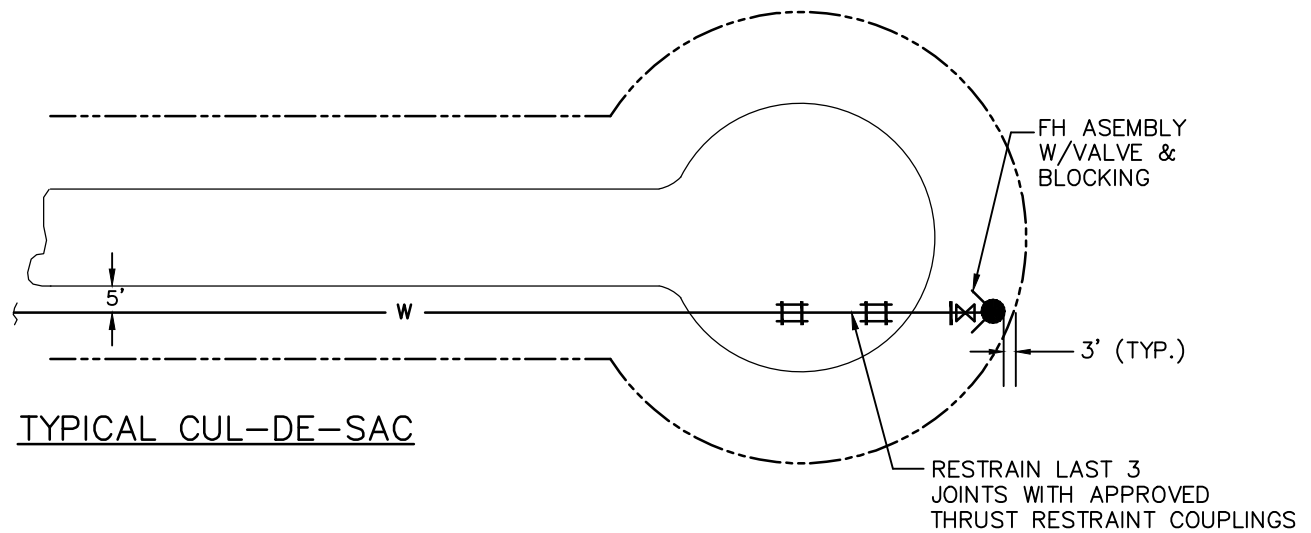
1. ALL NIPPLES TO BE "ALL THREADED" MINIMUM LENGTH.
2. ALL PIPE TO BE RED BRASS.
3. ALL FITTINGS TO BE BRASS.
4. WHERE DIMENSIONS WILL BE LESS THAN 18", CONTACT CWW ENGINEERING DEPT. FOR SPECIAL DESIGN.
5. STANDARD METER BOXES WITH EXTENSIONS MAY BE SUBSTITUTED FOR MANHOLES WHEN APPROVED BY CWW ENGINEERING DEPT.
6. AIR VALVES SHALL BE "GA INDUSTRY" "APCO VALVE" OR "VALVEMATIC COMBINATION AIR VALVES WITH SCREWED CONNECTIONS.

AIR VALVE INSTALLATION

SCALE: N.T.S.

DATE: NOVEMBER 2019

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FIRE HYDRANT IN A CUL-DE-SAC

SCALE: N.T.S.

DATE: NOVEMBER 2019

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APPROVED TAPPING SADDLE SIZES

MAIN SIZE		3/4"	1"	1-1/4"	1-1/2"	2"
	3"	NO	YES	YES	YES	YES
	4"	NO	NO	YES	YES	YES
	6"	NO	NO	NO	YES	YES
	8"	NO	NO	NO	NO	YES
	10"	NO	NO	NO	NO	YES
	12"	NO	NO	NO	NO	NO

DESIGN CRITERIA FOR SPECIFYING USE OF TAPPING SADDLE MINIMUM 2 FULL THREADS

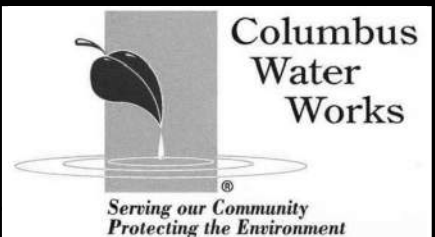
MAIN SIZE		NO. FULL THREADS ENGAGED				
		3/4"	1"	1-1/4"	1-1/2"	2"
	3"	2.4	1.6	0.6	0	0
	4"	2.7	2.0	1.1	0.5	0
	6"	3.3	2.6	2.0	1.5	0.4
	8"	3.7	3.0	2.5	2.2	1.3
	10"	4.1	3.4	2.9	2.6	1.9
	12"	4.4	3.7	3.3	3.0	2.5

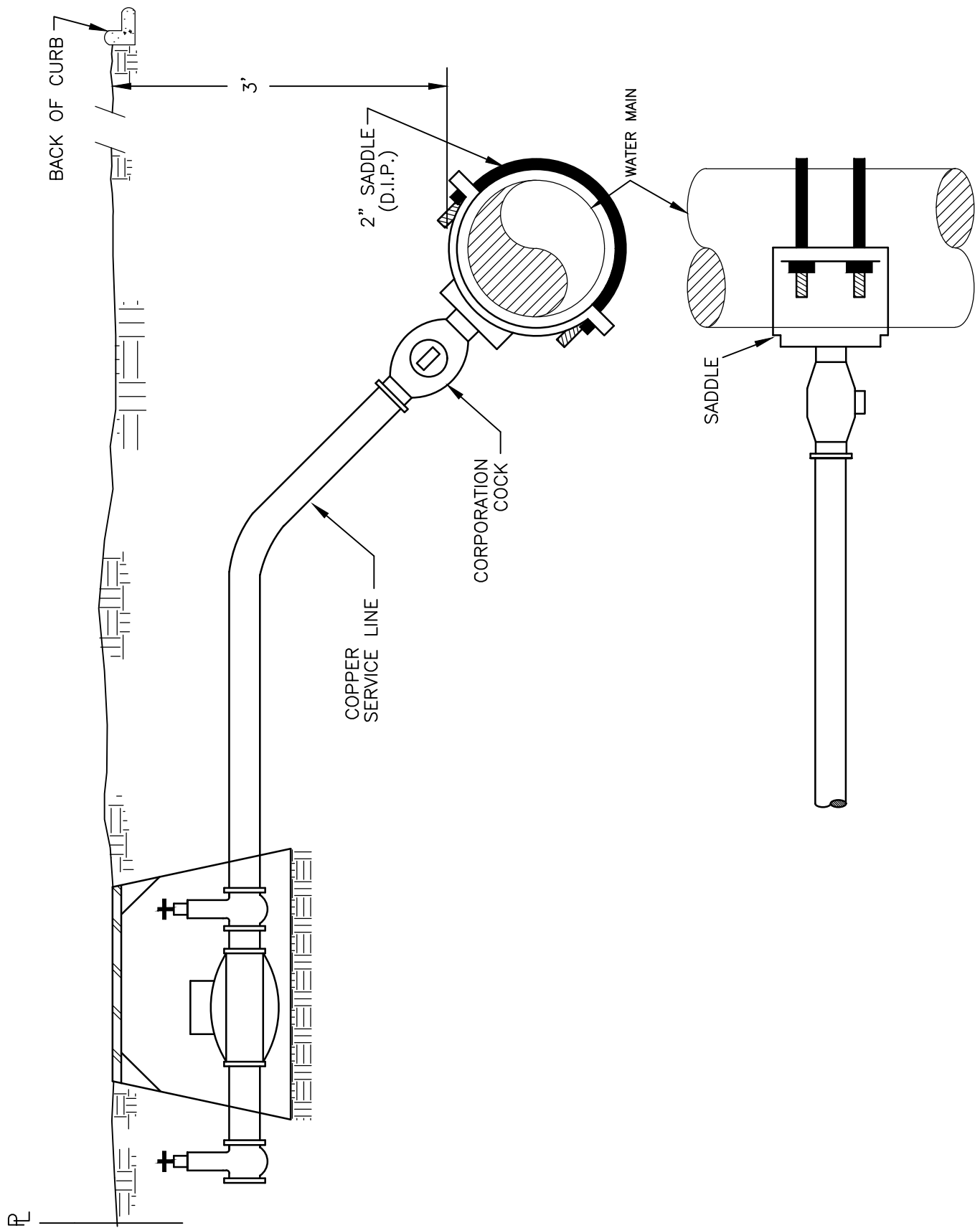
SERVICE CONNECTION REQUIREMENTS

SCALE: N.T.S.

DATE: NOVEMBER 2019

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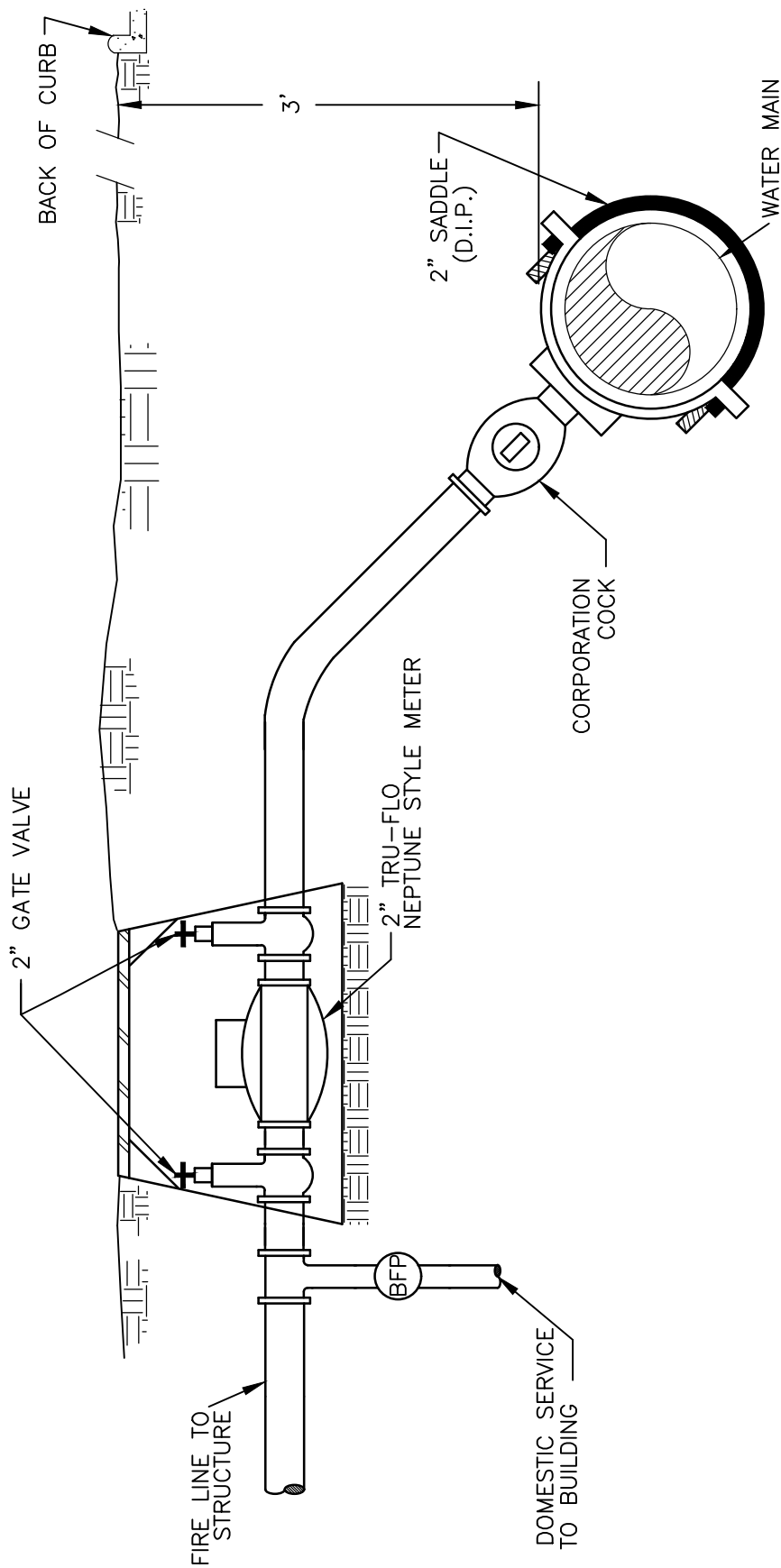


2" METER SETTINGS

SCALE: N.T.S.

DATE: NOVEMBER 2019

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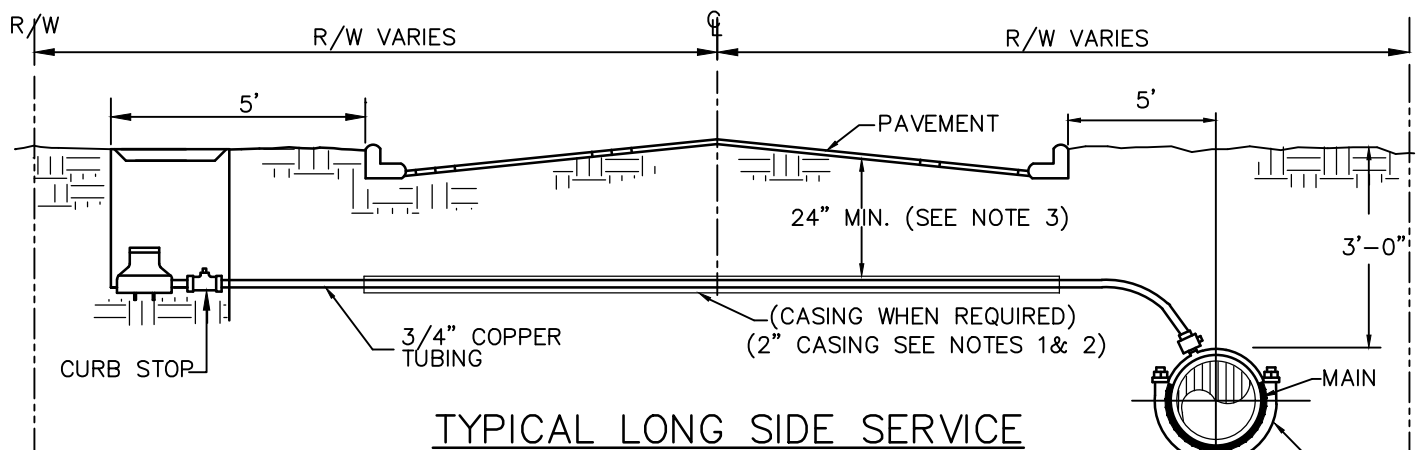
- NOTES:
1. THIS WORK MUST COMPLY WITH NFPA - 13R
 2. SINGLE METER WILL SERVE BOTH DOMESTIC AND FIRE SERVICE
 3. 2" GATE VALVE TO CONTROL WATER SUPPLY TO BOTH DOMESTIC AND FIRE SERVICE

TYPICAL 2" DOMESTIC/FIRE

SCALE: N.T.S.

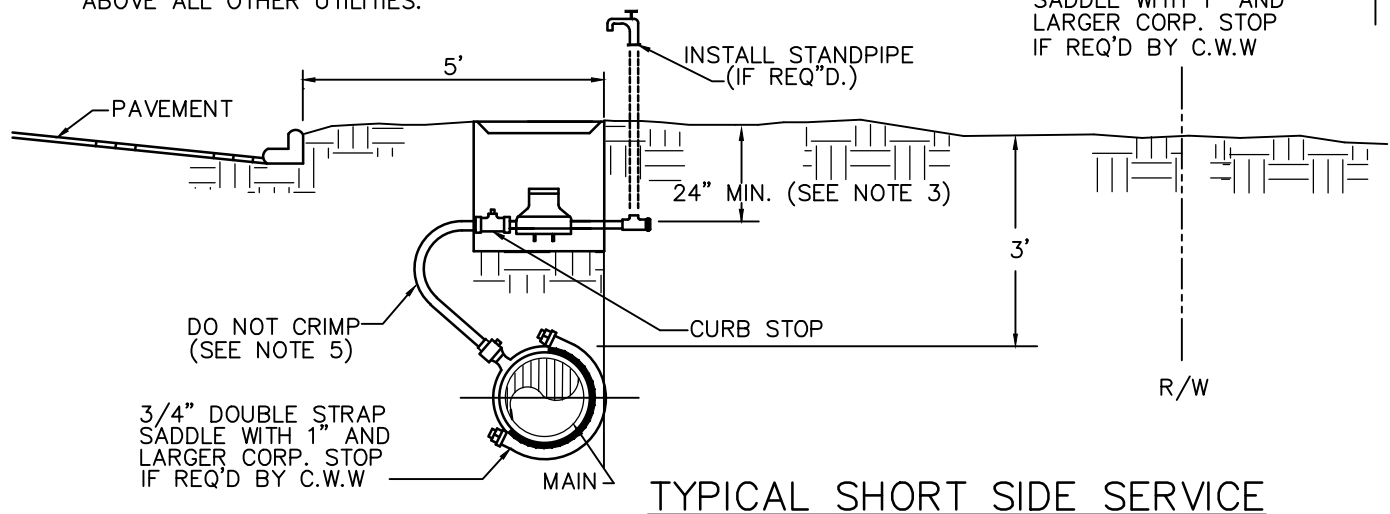
DATE: NOVEMBER 2019

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NOTE: WATER SERVICE LINE IS LOCATED ABOVE ALL OTHER UTILITIES.

USE DOUBLE STRAP SADDLE WITH 1" AND LARGER CORP. STOP IF REQ'D BY C.W.W



NOTES:

1. IN THE EVENT CASING IS NOT PRESENT ON LONG SIDE LOT, BORING SHALL BE PERMITTED. WHEN CASING DOES EXIST-1" OR 3/4" PIPE SHALL BE INSERTED THROUGH CASING TO COMPLETE THE INSTALLATION FROM THE MAIN TO THE METER.
2. NO ROAD CUT WILL BE PERMITTED UNTIL 3 ATTEMPTS HAVE BEEN MADE AT BORING. THE SPECIFIC APPROVAL OF THE WATER SYSTEM'S INSPECTOR SHALL BE OBTAINED PRIOR TO CUTTING THE PAVEMENT.
3. 24" COVER (MIN.) FROM SURFACE TO TOP OF SERVICE PIPE, FOR MAJOR ROADS MINIMUM COVER SHALL BE 48".
4. ALL CUTS IN PAVEMENT SHALL BE REPAIRED IN ACCORDANCE WITH EITHER GA. D.O.T. OR CITY OF COLUMBUS STANDARDS. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER DITCH COMPACTION, CUT BACK OF DITCH SIDES AND PAVING OF THE REQUIRED CONCRETE SUB-BASE AND PLATING THE DITCH TO ALLOW TRAFFIC FLOW WHILE CONCRETE IS SETTING UP. STEEL TRAFFIC PLATES WILL COVER POURED CONCRETE FOR A MINIMUM OF 24 HOURS.
5. WHEN CHANGING OVER A METER FROM A MAIN TO BE ABANDONED TO A NEW MAIN, THE ENTIRE SERVICE LINE FROM THE NEW MAIN TO THE METER SHALL BE REPLACED WITH COPPER TUBING IF THE EXISTING MATERIAL IS PB OR GALVANIZED. IF THE EXISTING MATERIAL IS COPPER, AN APPROVED COUPLING MAY BE USED TO ADD SUFFICIENT COPPER LENGTH TO THE SERVICE LINE TO CONNECT IT TO THE NEW WATER MAIN. SERVICE LINE SHALL BE LOCATED OVER ALL OTHER UTILITIES.
6. FINAL METER BOX SHALL BE PLACED 5' OFF THE BACK OF CURB OR EDGE OF PAVEMENT.

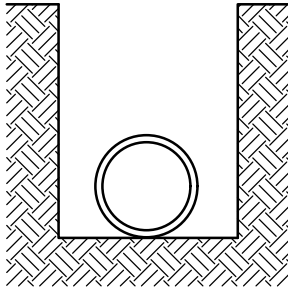
**3/4" - 1" METER
SETTINGS
SHORT & LONG SIDES**

SCALE: N.T.S.

DATE: NOVEMBER 2019

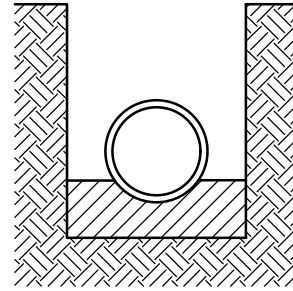
A-29





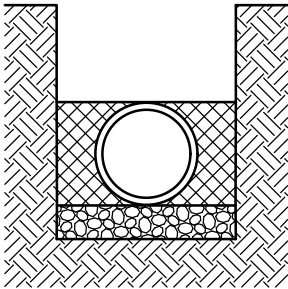
TYPE 1*

FLAT BOTTOM TRENCH . + LOOSE BACKFILL



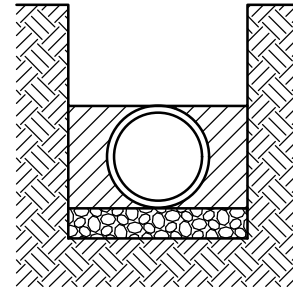
TYPE 2

FLAT-BOTTOM TRENCH. + BACKFILL LIGHTLY CONSOLIDATED TO CENTERLINE OF PIPE.



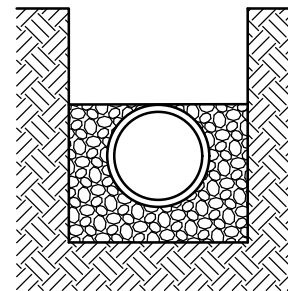
TYPE 3

PIPE BEDDED IN 4" MINIMUM LOOSE SOIL.++ BACKFILL LIGHTLY CONSOLIDATED TO TOP OF PIPE.



TYPE 4

PIPE BEDDED IN SAND, GRAVEL OR CRUSHED STONE TO DEPTH OF 1/8 PIPE DIAMETER 4" MINIMUM. BACKFILL COMPACTED TO TOP OF PIPE. (APPROXIMATELY 80% STANDARD PROCTOR, AASHTO T-99.)



TYPE 5

PIPE BEDDED TO ITS CENTERLINE IN COMPACTED GRANULAR MATERIAL, 4" MINIMUM UNDER PIPE. COMPACTED GRANULAR OR SELECT MATERIAL++ TO TOP OF PIPE. (APPROXIMATELY 90% STANDARD PROCTOR, AASHTO T-99.)

NOTES:

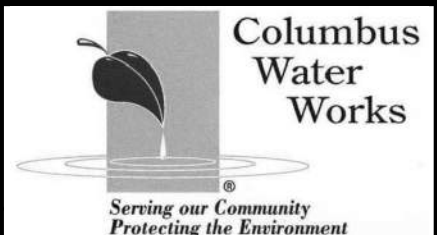
- * FOR 30" AND LARGER PIPE, CONSIDERATION SHOULD BE GIVEN TO THE USE OF LAYING OTHER THAN TYPE 1.
- + "FLAT-BOTTOM" IS DEFINED AS UNDISTURBED EARTH.
- ++ "LOOSE SOIL" OR "SELECT MATERIAL" IS DEFINED AS NATIVE SOIL EXCAVATED FROM THE TRENCH, FREE OF ROCKS, FOREIGN MATERIAL AND FROZEN EARTH.

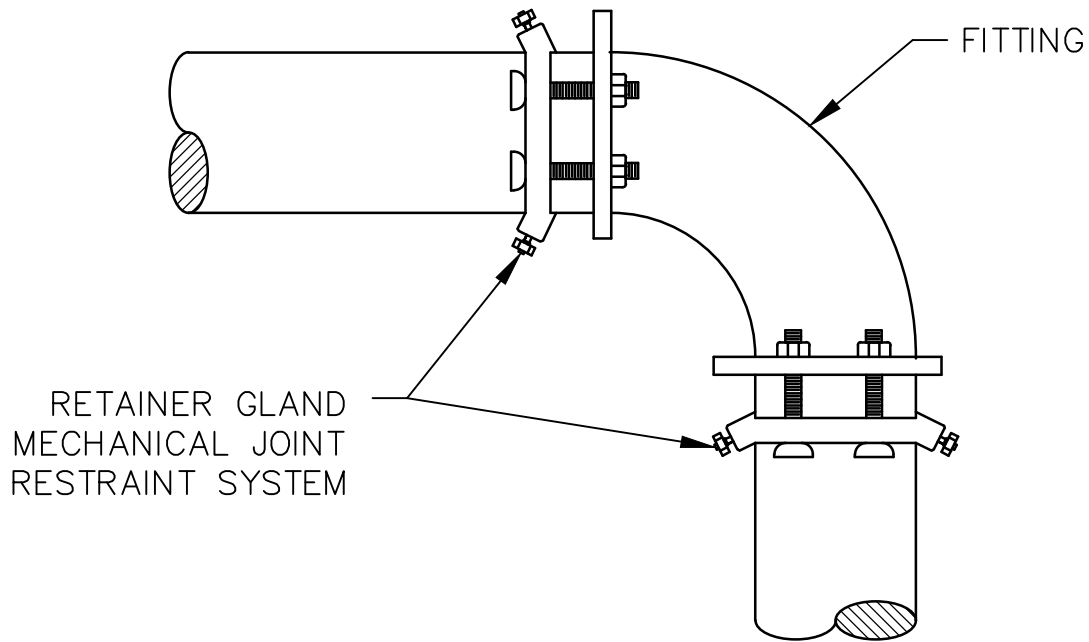
STANDARD PIPE LAYING CONDITIONS

SCALE: N.T.S.

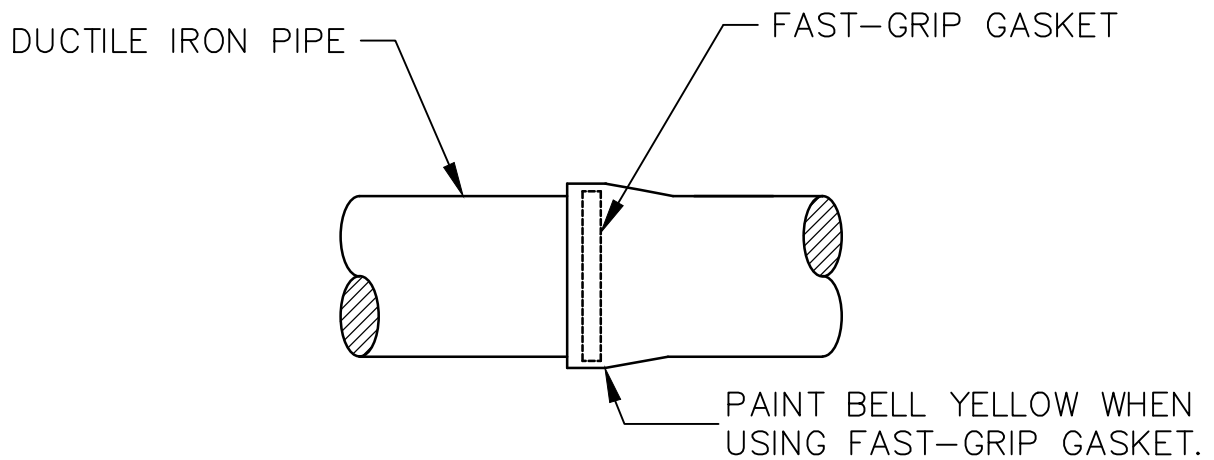
DATE: NOVEMBER 2019

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PIPE TO FITTING JOINT RESTRAINT



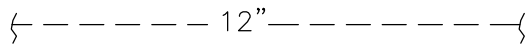
PIPE TO PIPE JOINT RESTRAINT

RESTRAINED JOINTS (SLIP-ON PIPE)

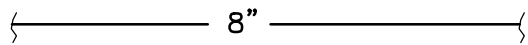
SCALE: N.T.S.

DATE: NOVEMBER 2019

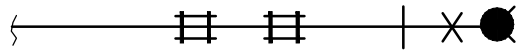
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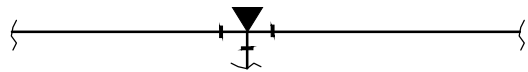
EXISTING 12" DIA. WATER LINE



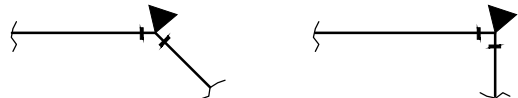
PROPOSED 8" DIA. WATER LINE



FIRE HYDRANT ASSEMBLY
W/ THRUST RESTRAINTS



TEE & BLOCKING



45° BEND & 90° BEND W/ BLOCKING



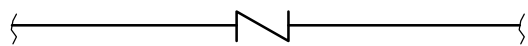
CLOSED VALVE



AIR RELEASE VALVE



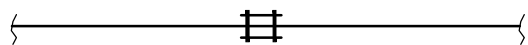
GATE VALVE



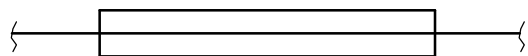
CHECK VALVE



REDUCER



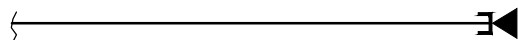
RESTRAINED JOINT



CASING

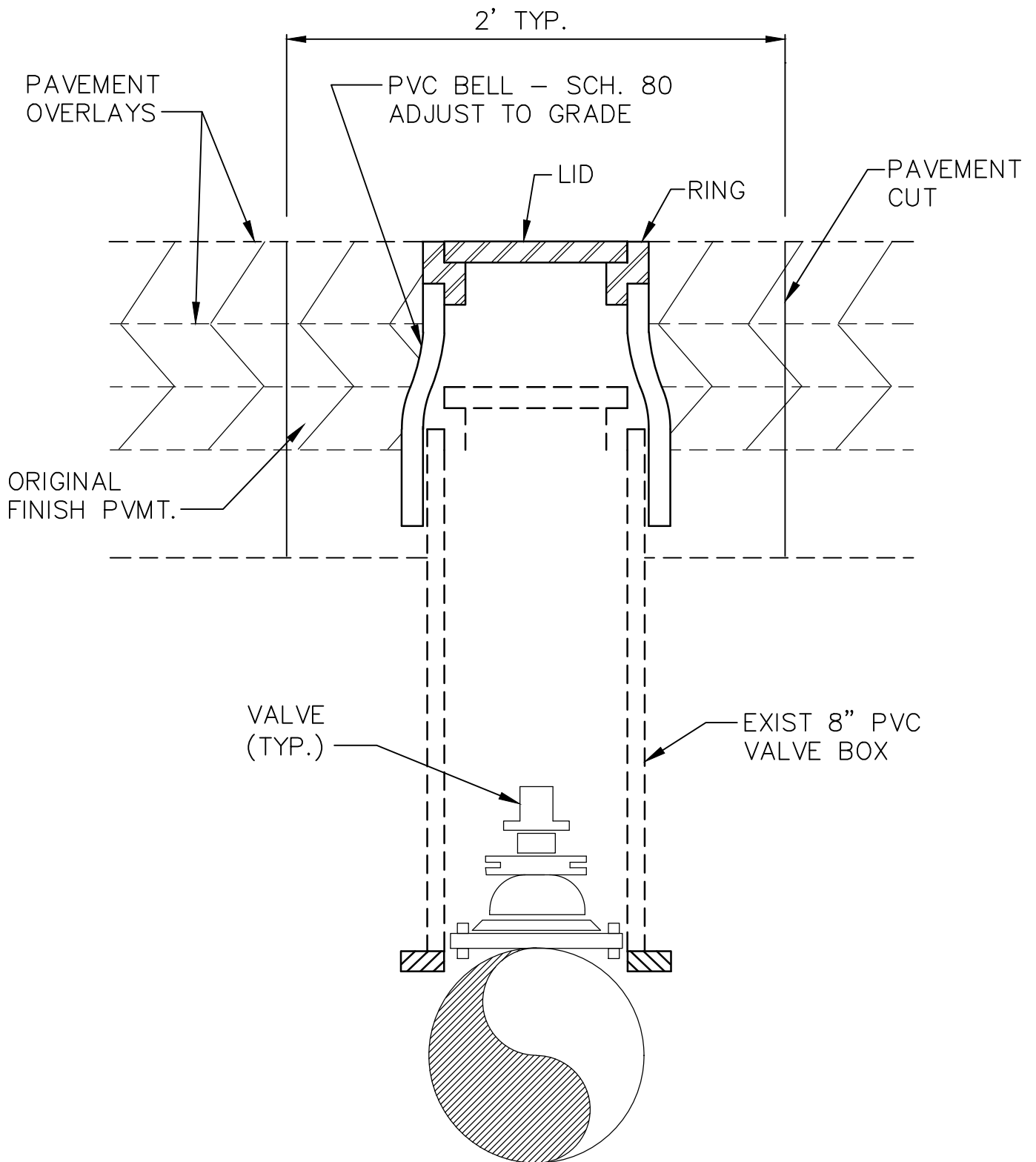


BACKFLOW PREVENTOR



PLUG & BLOCKING

PIPING SYMBOLS

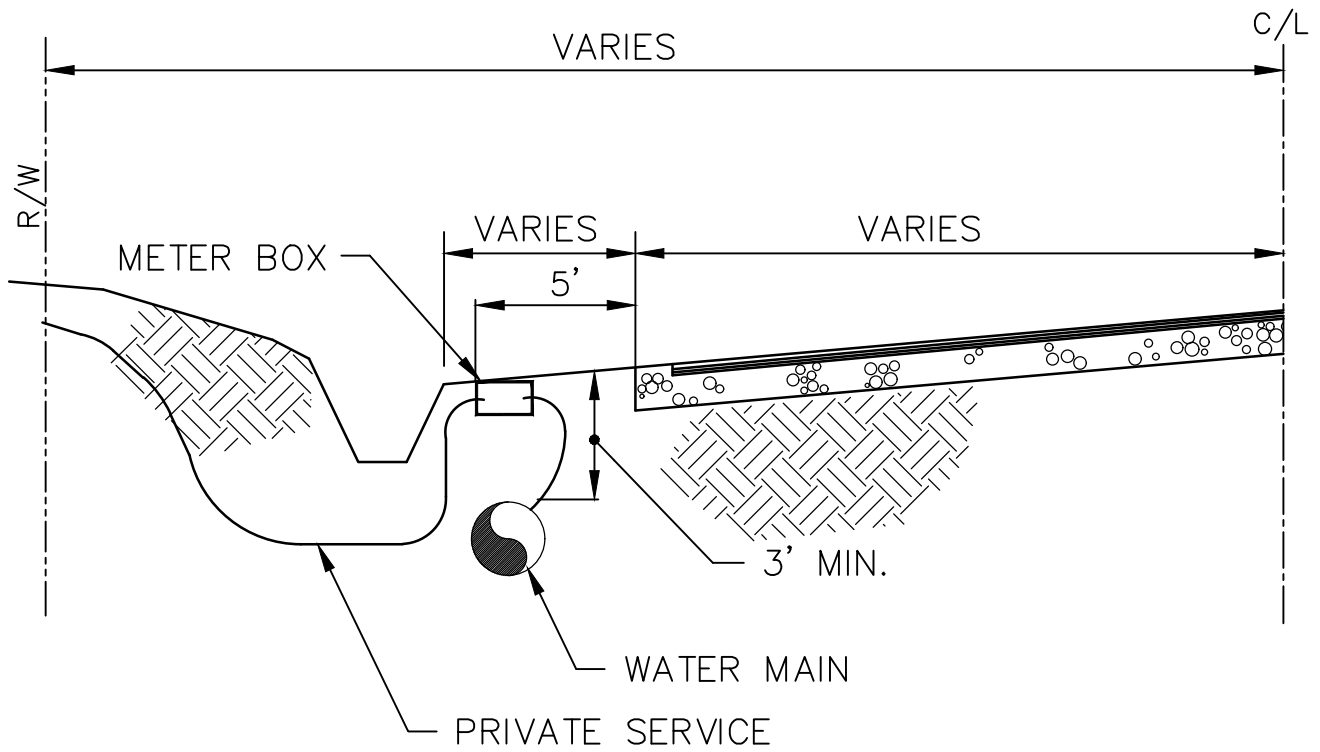


TYPICAL VALVE BOX ADJUSTMENT

SCALE: N.T.S.

DATE: NOVEMBER 2019

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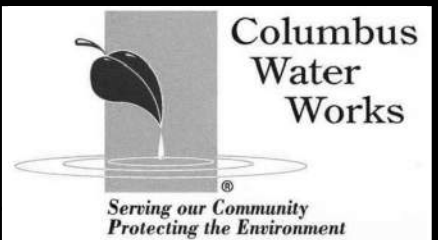


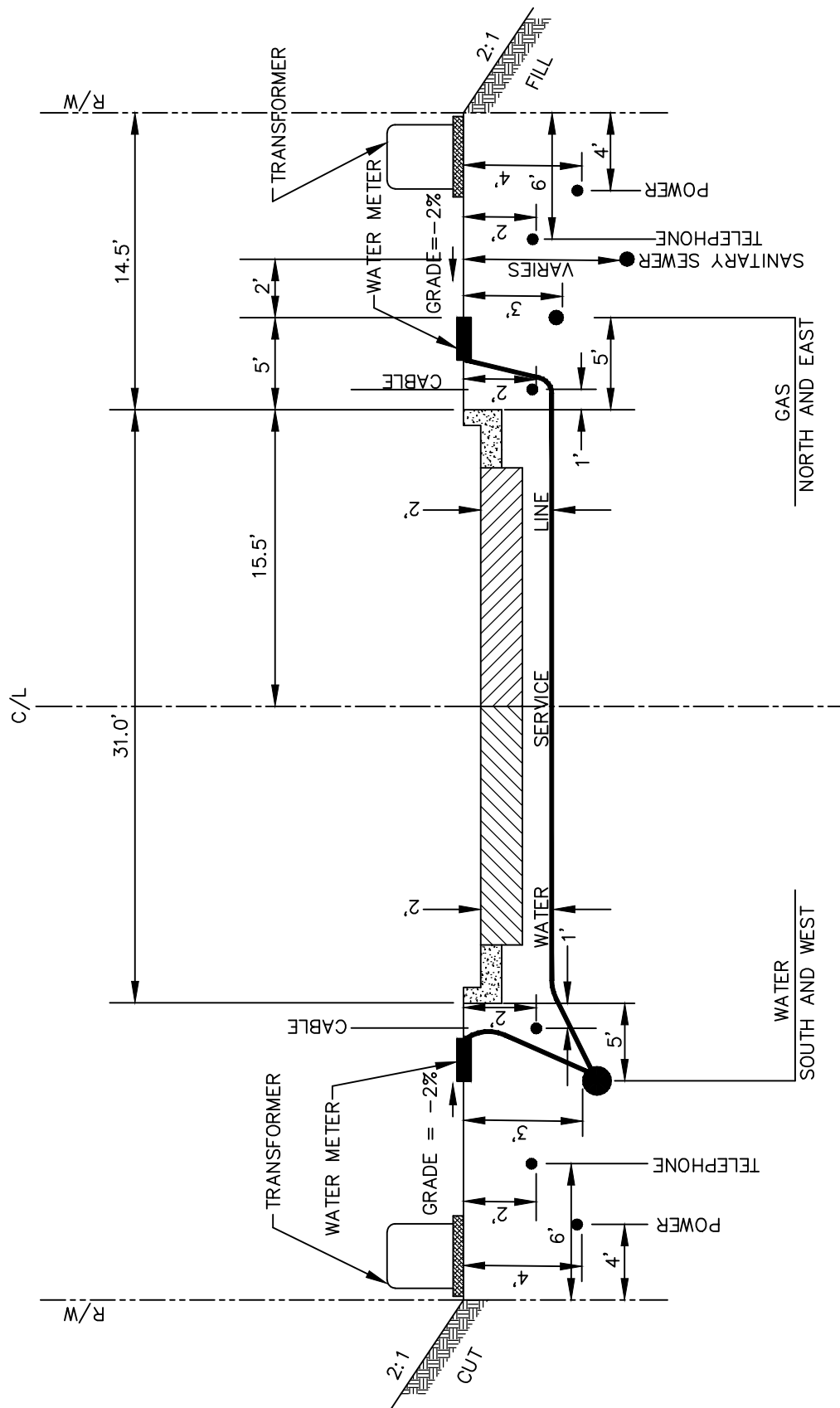
WATER SERVICE DETAIL FOR RURAL STREET SECTION

SCALE: N.T.S.

DATE: NOVEMBER 2019

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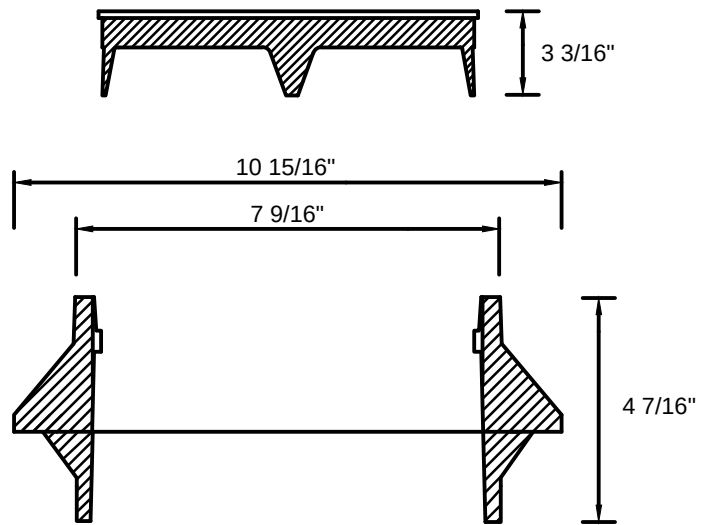
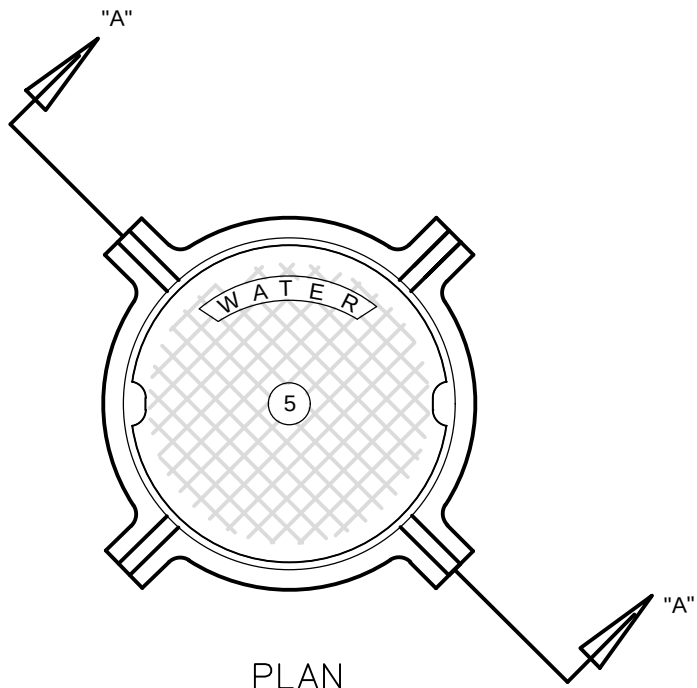


UTILITY LOCATIONS ALONG TYPICAL ROADWAY (60' R/W)

SCALE: N.T.S.

DATE: NOVEMBER 2019

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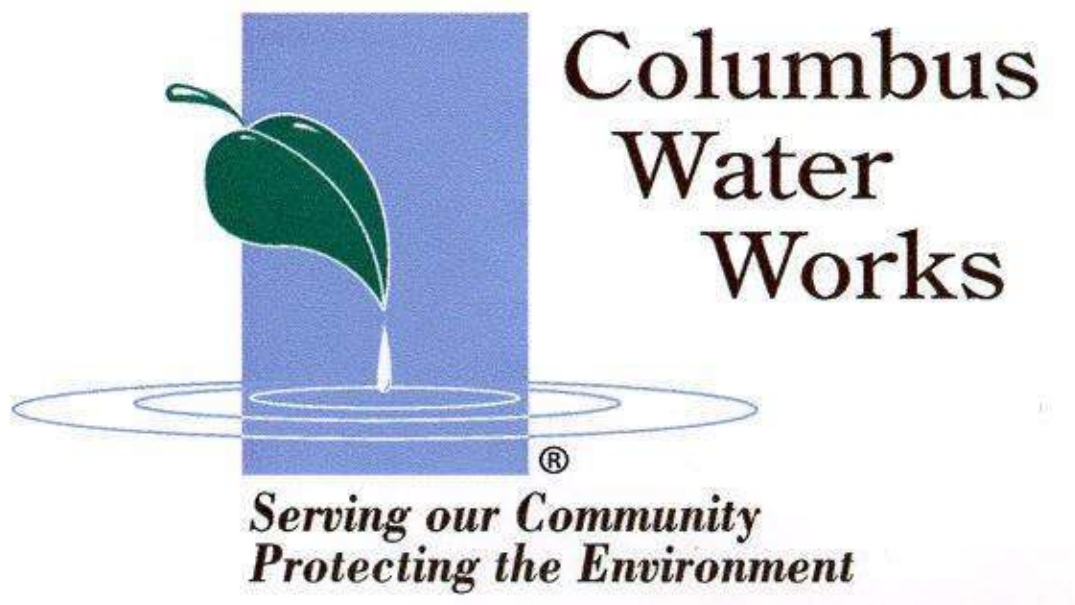
VALVE COVER

SCALE: N.T.S.

DATE: NOVEMBER 2019

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Specifications and Details for the Design and Construction of Sanitary Sewers



Fort Moore

2023

**SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF SANITARY
SEWER SYSTEMS - FORT MOORE, GEORGIA**

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SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF SANITARY SEWER SYSTEMS - FORT MOORE, GEORGIA

Section 1.01 – Purpose:

This section of the Specifications describes materials to be incorporated into sanitary sewer lines and requirements for installation and use of these materials. The Contractor/Developer shall furnish all materials and perform all labor necessary to fulfill the requirements of these Specifications. **When public sanitary sewer service is desired in a development, the main(s) and other system upgrades necessary to support the development with an acceptable level of service, i.e. main line connections, lift stations, road bores, manholes, monitoring equipment, or any other upgrades necessary to meet CWW standards, will be at the Developer's expense.**

Compliance with these specifications by the Contractor/Developer is required to ensure a public sanitary sewer system constructed with materials approved by Columbus Water Works (CWW). Compliance with these specifications by the Contractor/Developer is a condition of acceptance of the sanitary sewer system into the maintenance program and creates no contractual relationship between CWW and the Contractor. CWW reserves the right to reject any installed items not in compliance with these specifications. *Columbus Water Works also reserves the right to accept exceptions to these standards if conditions warrant changes. Any proposed changes must be clearly indicated on drawings and addressed in a cover letter to CWW. Only changes approved by CWW Engineering will be acceptable.* Latent indications of deficient installation or materials of the sanitary sewer system and/or appurtenances will be the responsibility of the Developer to rectify at his expense.

Section 1.02 – Definitions:

Unless the context specifically indicates otherwise, the meanings of terms used in these Specifications for the Design and Construction of Sanitary Sewers shall be as follows:

- A. "Columbus Water Works" (CWW) shall mean the operating organization working under the policies and direction of the Board of Water Commissioners.
- B. "Engineer" shall mean Owner's/Developer's engineer that is a licensed Professional Engineer (PE) **in the state where work is being performed.**
- C. "Division of Engineering" shall mean CWW Engineering office, which is authorized to have jurisdiction over the sanitary sewer system design and construction.
- D. "Owner/Developer" shall mean any individual, firm association, syndicate, partnership, corporation, trust, or any other entity proposing to subdivide land or provide new or renewed sanitary sewer service for him or for another.
- E. "Contractor" shall mean the constructor or his representative, whether doing work on a contract basis with CWW or working directly for the Owner/Developer.
- F. "Shall" is mandatory; "May" is permissive.

- G. “Building Sewer” or “Service Lateral” shall mean that part of the horizontal piping of a drainage system which extends from the ends of the building drain and which receives the discharge of the building drain and conveys it to a public sanitary sewer, private sanitary sewer, individual sewage-disposal system or other point of disposal.
- H. “Building Drain” shall mean that part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer five (5) feet outside the building wall.
- I. “Public Sanitary sewer” shall mean a common sanitary sewer controlled by public authority.
- J. “Sanitary Sewer” shall mean a sanitary sewer, which carries liquid and waterborne waste from residences, commercial buildings and industrial plants which excludes storm, surface and groundwater.
- K. “Sewage” shall mean any liquid waste containing animal or vegetable matter in-suspension or solution and may include liquids containing chemicals in solution.
- L. “Sewer” shall mean a pipe or conduit for carrying sanitary sewer.
- M. “Subdivision Sanitary Sewer” shall mean a main sanitary sewer that conveys “sewage” from “building sewers” in an area of subdivided land to a trunk line.
- N. “Trunk Line” shall mean any main line of CWW sanitary sewer system.

Section 1.03 - General:

A. Applicable Standards:

Supply all materials and perform all work in accordance with CWW standards, Sanitary Sewer and Disposal Ordinance 83-101 #04-74, American Water Works Association (AWWA) standards, WEF Manuals of Practice, ASCE Manuals and Reports on Engineering Practice, Recommended Standards for Sewage Works, Great Lakes Upper Mississippi River Board of State Sanitary Engineers (10-State Standards), Environmental Protection Agency (EPA) Publications, WEF Journals, latest editions of each, and standards referenced therein, and manufacturers specifications for installation.

B. Laws and Regulations:

The Contractor’s/Developer’s attention is directed to the fact that all applicable federal and state law, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the project throughout. The Contractor shall keep fully informed of all laws, ordinances, and regulations of the federal or state governments or authorities in any manner affecting those engaged or employed in the work or the materials used in the work and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency

should be discovered in these specifications herein referred to, in relation to any such law, ordinance, regulation, order or decree, the Contractor shall herewith report the same, in writing, to CWW.

For all sanitary sewer systems installed within Ft. Moore Georgia, contractors shall possess a valid Georgia Utility Contractor's License and GSCWW Level IA certification. For work installed within Ft. Moore Alabama, contractors must possess any/all licensure as required by the state of Alabama. The Contractor shall at all times observe and comply with all such existing and future laws, ordinances, and regulations, and shall protect and indemnify CWW, and their agents against the violation of any such law, ordinance, regulation, order or decree, whether by the Contractor or by the Contractor's employees.

The Contractor/Developer is responsible for enforcing safety in accordance with all OSHA and other applicable regulations. CWW assumes no responsibility for the Contractor's/Developer's job site safety program.

C. Lands and Rights of Way:

In order for the sanitary sewer distribution system to be accepted by CWW, the Contractor/Engineer shall provide all necessary record drawings to insure inclusion in the CWW mapping system for the purpose of maintaining said system. Easements will be a minimum of fifteen (15) feet wide and are granted to CWW annually by Ft. Moore based on updated maps prepared by CWW. The Contractor is required to comply with the easement terms, as provided in Appendix B of this document.

D. Testing, Inspection & Acceptance of Work:

1. Testing of Materials:

Unless otherwise specifically provided for in the Specifications, the inspection and testing of products to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by CWW; the cost of such inspection and testing shall be paid by the Contractor. The Contractor shall furnish evidence, satisfactory to CWW, that the products have passed the required tests prior to their incorporation into the work. The Contractor shall promptly segregate and remove rejected products from the site of the work.

2. Inspection:

The Contractor shall furnish CWW with every reasonable facility for ascertaining whether or not the work performed and products used are in accordance with the requirements and intent of the Specifications. No work shall be done or products used without suitable inspection by CWW. Failure to reject any defective work or product shall not in any way prevent later rejection when such defects are discovered, or obligate CWW to final acceptance.

3. Authority and Duties of CWW Inspector:

The Inspector will be authorized to inspect all work done and all products furnished, including preparation, fabrication and manufacture of the products to be used. The Inspector may reject material and workmanship or suspend the work until any question at issue can be referred to and resolved by CWW and the Contractor/Engineer. The responsibility of the Contractor is not lessened by the presence of the Inspector.

4. Acceptance of Work and Materials:

All products furnished and all work done that is not in accordance with the approved drawings or specifications or that is defective will be rejected. All rejected products or work shall be removed. All unacceptable products or work shall be replaced with other products or work that conforms to the approved drawings and specifications. Service will not be allowed until installation is acceptable to CWW.

5. Contractor's/Developer's Responsibility:

Inspection of the work will not relieve the Contractor/Developer of any obligations to meet the requirements of the Specifications and defective work shall be made good regardless of whether such work has been previously inspected and accepted. The failure of CWW to reject improper work shall not be considered a waiver of any defect that may be discovered later.

Section 1.04 - Sequence of Activities:

The following is the sequence of steps which will be required for preliminary activities as well as construction and final acceptance activities for successful acceptance of the sanitary sewer system by CWW:

- Submit to CWW Division of Engineering electronic (PDF) of construction drawings for water and sanitary sewer review.
- CWW review of drawings.
- CWW sends required changes/notes to submitting Engineer and/or Corps of Engineers (COE) and keeps a file copy.
- Engineer's review (transpose CWW mark-ups onto construction drawings).
- Engineer returns five (5) transposed drawings (3 full sets, plus 2 additional site plan sheets) for approval.
- CWW reviews, stamps and sends back one (1) approved set of drawings with the Approved for Construction letter. The "Approved for Construction" status is valid for one (1) year from date of approval.
- Engineer of record submits the 144R to Fort Moore Environmental.
- Fort Moore Fire Department must approve fire hydrant placement and spacing, post indicator valve location, and Fire Department connections.
- At the pre-construction conference, the CWW Inspector will give the Contractor an approved set of plans and go over the approved plans, discuss the dates of construction, and review anticipated procedures.

- One (1) copy of the CWW stamped approved plans shall be maintained on site by the Contractor at all times.
- Notify CWW Inspector forty-eight (48) hours before construction begins.
- CWW Inspector checks and approves all stockpiled materials prior to construction.
- To coordinate flushing of a new line, call the CWW Inspector and give at least a forty-eight (48) hour notice.
- Give twenty-four (24) hours' notice to CWW Inspector for final inspection of the system.
- Contractor/Engineer shall submit as-built drawings to CWW for approval. See Section 1.24.
- CWW will accept the system for maintenance upon receipt of approved water sample and all as-built drawings.

The following is a more in-depth explanation of the above steps and should be thoroughly studied:

A. Construction Drawings:

1. The Engineer will be required to furnish two (2) full sets of preliminary construction plans to CWW Division of Engineering for review and comment. The plan must include the Engineer's sewer system design and flow calculations. Upon completion of the preliminary review, the Developer of the project will be notified by CWW of the availability status of sanitary sewers. Additional copies needed by the Contractor/Developer will be submitted as required. *The Engineer will need to allow for easements on the design. Typical easements are fifteen (15) feet wide and should allow for the infrastructure to remain accessible for maintenance. The first submittal should also include any phase lines for subdivisions.*
2. CWW Division of Engineering will review the submitted construction plans and make changes as necessary to indicate to the Contractor/Engineer any changes which need to be made prior to construction activity. CWW Engineering will review the plans, but the responsibility for the design will be with the Engineer. Any plans marked "Amend and Resubmit" or "Rejected" will require a resubmittal prior to construction. Plans marked "No Exceptions Taken" or "Make Corrections Noted" may also be stamped approved for construction by Columbus Water Works Engineering. In this case, a Contractor is permitted to begin construction activities.
3. All drawings submitted to CWW Engineering shall be stamped by a Professional Engineer registered in the State where the project is located. The drawings shall include the following basic information:
 - Engineer's name, address, and phone number.
 - Developer's name, address, and phone number.
 - Subdivision identification or project identification, revision number of the plans, scale, date of latest drawing, north arrow, and sheet number.

- Location map and drainage basin or creek.

B. Submittals Required:

The Contractor/Engineer shall furnish drawings and descriptive literature for all manufactured and fabricated products to CWW for review. Additional information such as special drawings, schedules, calculations, system curves, etc., shall be provided as requested by CWW.

C. Site Plan Drawings:

1. The Contractor/Developer shall review and check drawings and submittals and shall indicate approval by initials and date. Contractor/Developer shall furnish CWW three (3) full sets and two (2) site plans of construction drawings and all submittals. A transmittal form shall accompany each submittal or group of submittals.
2. Plan and profile sheets shall be provided for ALL proposed sanitary sewers except service laterals. Profiles shall have a horizontal scale of not more than one hundred (100) feet to the inch and a vertical scale of not more than ten (10) feet to the inch.

D. Columbus Water Works Review:

All submittals will be reviewed, stamped, and dated by CWW before being returned to the Engineer with the following acceptance comments:

1. No Exceptions Taken: Plans are approved without modification.
2. Make Corrections Noted: Comply with comments marked on drawings by CWW. Plans are approved.
3. Amend and Resubmit: Comments are excessive. Make necessary changes and resubmit.
4. Rejected: Drawings are insubstantial and/or non-compliant with Specifications; return to Engineer.

E. Drawings for Construction:

Drawings or other submittals not bearing the CWW approval stamp shall not be utilized for construction purposes. The Contractor/Developer shall maintain a complete set of construction drawings at the job site bearing CWW approval color stamp.

F. Construction Notification:

It shall be the responsibility of the Contractor/Developer to notify CWW Division of Engineering of the date of construction and name of the Contractor performing said construction, as well as his address and telephone number.

G. Construction and Inspection Procedure:

Curb and Gutter should be in prior to the sanitary sewer, unless approved by CWW Inspector. Avoid cleanouts in the curb and gutter.

The Contractor will install the sanitary sewer main including all manholes along with all service lines, cleanouts, etc. Installation of sanitary sewer mains shall be in accordance with the following procedures:

1. Notify the CWW Inspector forty-eight (48) hours before any pipe is to be laid. Where the sanitary sewer line is to be within a new road right-of-way, all curbing must be in place. The pipe, manholes, fittings, gaskets, etc., must be on the site and ready to be inspected. A pre-construction conference is required with the CWW Inspector on site. *The approved CWW stamped plans will be given to the Contractor at this meeting.*
2. After materials on the site have been approved, installation can begin. Do not backfill over any locations where fittings have been used or thrust blocking is to be placed. The Inspector must approve all tees, bends, reducers, retainer glands, taps of any kind, etc., before backfilling.
3. The Contractor shall coordinate with the Inspector which ends of the pipe to leave open for the initial flushing. The Contractor shall supply all materials deemed necessary by the Inspector to facilitate the flushing. Forty-eight (48) hour notice shall be given to the CWW Inspector prior to flushing. The Inspector must approve the initial flushing, including service lines.
4. CWW does not locate sanitary sewer lines in subdivisions that have not yet been accepted.
5. Testing shall be done in accordance with Section 1.22 of these specifications.
6. After passing test results and as-built drawings have been accepted, the Owner/Engineer will be notified that the line is accepted for maintenance by CWW.
7. Field changes may be worked out with an onsite review with the CWW Inspector, Contractor, and Engineer. Agreement to changes shall be noted on the Inspector's drawings, initialed by the parties in attendance, and verified on the as-built drawings.
8. Numbers to Call:

Inspection:	(706) 575-3342
Engineering:	(706) 577-1571
Field Services:	(706) 689-2645
Coordinator:	(706) 505-8954

H. As-Built Drawings:

See Section 1.24 – Requirements for As-Built Drawings.

I. Final Acceptance:

Final acceptance into the sanitary sewer system will take place upon receipt by CWW of as-built drawings prepared on a recorded plat. CWW must have a copy of the as-built drawing before water service will be provided. Once the as-built is provided then water service will be turned on. CWW will only accept the main line for maintenance when all other utilities are in, the cleanout locations are properly set, and the as-built drawings have been accepted by CWW.

Section 1.05 - Requirements to Connect to Sanitary Sewer System:

This section sets forth general requirements to be met where sanitary sewers are to be constructed by Contractor/Developer and accepted into the CWW sanitary sewer system for maintenance.

A. Required Sanitary Sewer Connections:

1. All sinks, dish washing machines, lavatories, basins, shower baths, bathtubs, laundry tubs, washing machines, and similar plumbing fixtures or appliances shall be connected to the sanitary sewer system when there is "sanitary sewer availability" and when the structure is capable of being "served".
2. No person shall make connections of roof down spouts, foundation drains, areaway drains, swimming pools, or other sources of surface runoff or groundwater into a building sanitary sewer or building drain which in turn is connected directly or indirectly to the sanitary sewer system unless such connection is approved for purposes of disposal of polluted surface drainage and for which a discharge permit has been issued.

B. Sanitary Sewer Availability:

1. Sanitary sewer shall be considered available, to a site not within a subdivision, when the ground level floor of the structure can be connected by gravity flow to a public sanitary sewer line in any public right-of-way or easement, which is within a distance as determined by CWW.
2. In order for sanitary sewer service to be considered "available," there must be adequate capacity in the sanitary sewer line, sanitary sewer collection system, and the receiving wastewater treatment plant, as determined by CWW. Capacity upgrades necessary, due to new development, are the responsibility of the Developer.

C. Capability of Being Served:

1. The sanitary sewer system is designed to provide gravity service to the ground level floor of structures. Basements and below-ground living areas may or may not be capable of sanitary sewer service due to vertical accessibility.

2. Sand and Oil/Grease Interceptors:

- a. All users involved in the preparation of food for commercial purposes shall provide oil/grease traps. The design criteria for oil/grease interceptors is shown in Columbus, Ga. Ordinance 83.101 and CWW “Program for the Control of Grease and Oil in the Sanitary Sewer System”.
- b. All users whose wastewater is generally accompanied by unusually large quantities of grit, sand or gravel shall be required to install a sand/grit interceptor. All car/truck wash systems shall be required to install sand traps. The design criteria for sand/grit interceptors is shown in Columbus, Ga. Ordinance 83.101 and CWW “Program for the Control of Grease and Oil in the Sanitary Sewer System”.

D. Prohibited Sanitary Sewer Locations:

1. Generally, no sanitary sewers shall be located in or under detention basins, ponds, lakes, dams or slopes which will prohibit access by maintenance vehicles.
2. No sanitary sewer mains will be accepted that are installed through or in close proximity to an abandoned landfill site or any other site used for waste disposal.

Section 1.06 – Materials:

The Contractor/Developer shall furnish all pipe, manholes, fittings, and other material required to complete the work. All materials shall be manufactured in the United States, unless approved by CWW. Materials will be in accordance with the following:

A. Description:

This section includes requirements for furnishing pipe, fittings, and structures. The term “Manufacturer” shall mean an organization, which has at least ten (10) years’ experience in producing and furnishing materials of size and type specified. All manufacture and testing of materials will be conducted in facilities located in the U.S.A. and operating under laws and regulations of the U.S.A.

B. Quality Assurance:

1. All material suppliers shall be ISO registered or provide the services of an independent inspection agency. Prior to the start of manufacturing, any Manufacturer not meeting the ISO registration requirements, shall submit to CWW the name of an independent inspection agency for approval. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical tests, sample visual inspection of quality assurance tests performed on in-process pipe and fittings, and a sample visual and dimensional inspection of finished product for this project. Chemical samples shall be taken from each ladle of iron and the Manufacturer’s chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus, silicon, magnesium, chromium, manganese, tin, aluminum, cerium, copper, and lead. When chemical values fall outside the Manufacturer’s

control limits, additional mechanical property tests shall be performed to assure minimum mechanical properties are met.

2. Reinforced Concrete Pipe (R.C.P.) shall be accepted on the basis of plant load-bearing tests, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in ASTM C 76. Provide results of tests on pipe, joint material, and made-up joints performed by an independent testing laboratory approved by CWW if requested. Include materials, absorption, crushing (where applicable), and hydrostatic leakage tests on pipe of each size in accordance with applicable specifications. Each length of pipe shall be stamped by the approved testing laboratory. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Pipe that has been repaired or patched at the gasket grooves, shoulders, or barrel shall not be accepted.
3. Polyvinyl Chloride Pipe (PVC) shall be accepted on the basis of CWW inspection and the Manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, if requested. Provide results of tests on pipe, joint material, and made-up joints performed by an independent testing laboratory approved by CWW if requested. Include materials, absorption, crushing (where applicable), and hydrostatic leakage tests on pipe of each size in accordance with applicable specifications. Each length of pipe shall be stamped by the approved testing laboratory. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Pipe that has been repaired or patched at the gasket grooves, shoulders, or barrel shall not be accepted.
4. Submit affidavits of compliance from the Manufacturer for the following:
 - a. Reinforced Concrete Pipe in accordance with the requirements of ASTM C 76 and gasket type joints conforming to ASTM C 443.
 - b. Ductile iron pipe in accordance with the requirements of AWWA C151/ANSI A21.51 and these specifications. Cement mortar lining of ductile iron pipe in accordance with the requirements of AWWA C104/ANSI A21.4 and these specifications. Rubber gasket joints for push-on or mechanical joints shall be in accordance with the requirements of AWWA C111/ANSI A21.11 and these specifications.
 - c. Polyvinyl Chloride Pipe in accordance with the requirements of ASTM D 3034 and elastomeric gasket in accordance with the requirements of ASTM D 3212.
 - d. All pipe shall be certified that it is in compliance with this specification and shall be certified by a Professional Engineer.
5. Within forty-eight (48) hours' notice CWW and its agents shall be allowed a full inspection of the manufacturing operations, testing procedures, and quality compliance documentation.

C. Reinforced Concrete Pipe (R.C.P.):

1. Pipe shall be reinforced concrete bell and spigot conforming to ASTM C 76 for Wall B pipe and shall be supplied in lengths of at least six (6) feet.
2. Pipe shall have rubber gasket type joints conforming to ASTM C 443. A rectangular groove shall be supplied in the spigot end to receive the rubber gasket, and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four (4) sides.
3. Bell and spigot surfaces shall be accurately formed and smooth to provide a close siding fit with a nominal clearance of one-sixteenth (1/16) inch.

D. Ductile Iron Pipe (D.I.P.):

1. All D.I.P. shall be furnished in lengths of at least eighteen (18) to twenty (20) nominal feet. D.I.P. shall be manufactured by American Cast Iron Pipe Company or U.S. Pipe, and shall be made in the U.S.A. unless approved by CWW.
2. D.I.P. shall conform to ANSI/AWWA C151/A21.51. CWW requires a minimum of pressure class 250 but may request additional design data on sizing.
3. D.I.P. shall be cement lined in accordance with AWWA C104. Pipe shall be furnished with a bituminous outside coating. Manufacturer shall demonstrate ability to produce a high-performance lining. Plans/specifications may call for the exterior of ductile iron pipe to be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be two hundred (200) g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than three (3) mils with a local minimum not less than two (2) mils. All pipe shall be manufactured and coated in the United States at the pipe Manufacturer's facility. Soil conditions may require a V Bio Polywrap approved by DIPRA.
4. Push-on joints for D.I.P. shall be rubber gasketed joints in accordance with the applicable requirements of AWWA C111/ANSI A21.11. Standard push-on joints shall not exceed the Manufacturer's specifications. Standard and special deflection bells shall not exceed the Manufacturer's specifications. Restrained joint pipe shall be American "Flex-Ring", U.S. Pipe "TR-Flex", Amarillo Fast Grip, or Barracuda Gaskets. All "restrained" bells shall be painted yellow.
5. Mechanical joints for D.I.P. shall be rubber gasket joints in accordance with the applicable requirements of AWWA C111/ANSI A21.11. Mechanical joints shall not exceed the Manufacturer's specifications. The pressure rating for mechanical joints shall be a minimum of two hundred and fifty (250) psi.
6. Pipe Manufacturer may be required to provide a Manufacturer's representative for product design and installations seminars and provide on-site review of material as requested by CWW.

7. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of two hundred and fifty (250) psi. Fittings shall be cement lined in accordance with AWWA C104 and shall be furnished with a bituminous coating. In lieu of cement lining and bituminous coating, fittings may be provided with a fusion bonded coating and lining meeting the requirements of AWWA C116.

E. Polyvinyl Chloride Pipe (PVC):

1. PVC gravity sanitary sewer pipe shall be SDR 35 pipe, manufactured in accordance with ASTM D 3034 and shall be supplied in lengths not longer than fourteen (14) feet unless approved by CWW.
2. Pipe and fittings shall be of the bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage in accordance to ASTM D 3212. The joint system shall be subject to the approval of CWW and shall be identical for pipe and fittings. Fittings for pipe shall be one (1) piece with no solvent-welded joints. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings delivered ready for use.
3. All PVC gravity sanitary sewer pipe shall be laid with a minimum of Type 5 bedding. The installation shall conform to the requirements of ASTM D 2321. See Detail S-10 for chart on pipe materials and laying conditions. Do not install pipe that has exceeded the UV date stamp or that has visible cracks. Do not store pipe in direct sunlight.
4. When installed in a casing, the pipe shall be supported by stainless steel casing spacers as manufactured by Advance Products and Systems, Inc., BWM, Cascade Waterworks Manufacturing CCI Pipeline, Pipeline Seal and Insulator, Inc., or approved equal. Install in accordance with Manufacturer's instructions.

F. Detection Tape:

1. Detection tape is required for all sanitary sewer mains and laterals.
2. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewer Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum two (2) inches when buried less than ten (10) inches below the surface. Tape width shall be minimum three (3) inches when buried greater than ten (10) inches and less than twenty (20) inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

G. Tracer Wire:

1. Tracer Wire shall be installed on the centerline of all mains and laterals (to property line). Tracer wire shall be green in color #12 awg, and eight hundred eight ten thousandths (0.0808) inch in diameter. Tracer wire shall be manufactured by Copperhead model #1230HS, Pro-Trace® HF-CCS PE30 or approved equal.
2. A water tight connection to the wire shall be provided on the lateral. Wire shall not enter manhole through boot.

H. Adapter Couplings:

1. Adapter couplings shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials.
2. Adapters shall provide a positive seal against infiltration and exfiltration and remain leak proof and root proof up to four point three (4.3) psi.
3. The adapter Manufacturer shall provide steel clamps, adapter donuts, and other required accessories. Couplings shall be equal to products of Fernco and shall be installed in accordance with the Manufacturer's recommendations.
4. CWW allows use of a transition coupling such as manufactured by "Harco".

I. Manholes:

1. Precast Concrete Sections:

- a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be four thousand (4,000) psi. The minimum shell thickness shall be six (6) inches or one-twelfth (1/12) of the inside diameter of the riser of the largest cone diameter, whichever is greater.
- b. Seal joints between precast sections by means of rubber "O" ring gaskets or flexible, butyl rubber sealant equal to products of Concrete Sealants CS202, Kent Seal No.2, or Ram-Nek.
- c. Sealant shall not be pre-formed type with a minimum nominal diameter of one (1) inch.

2. Iron Castings:

- a. Cast iron manhole frames and covers shall be gray iron, conforming to ASTM A 48 for Class 30 gray iron and all applicable local standards.
- b. All castings shall be tough, close grained, smooth, and free from blow holes, blisters, shrinkage, strains, cracks, cold shots, and other imperfections.

- c. No casting will be accepted which weighs less than ninety-five (95) percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking.
- d. All castings shall be thoroughly cleaned in the shop and given two (2) coats of approved bituminous paint before rusting begins.
- e. All castings shall be AASHTO H-20/HS-20 traffic rated, capable of passing the proof load test as described in AASHTO M 306.
- f. Manhole frames and covers shall be one of the following types:

Type	Design Weight	Manufacturer's Reference
Standard	385#	U.S. Foundry 223 Ring & Cover (Columbus, GA Standard)
Watertight	385#	U.S. Foundry 223 BN Ring & Cover (Columbus, GA Standard)

Type	Design Weight	Manufacturer's Reference
Standard	370#	EJ V-1349 2HL Sewer Ring & Cover Product # 41349041A01 (Columbus, GA Standard)
Watertight	370#	EJ V-1349 Sewer Ring & Cover Product # 41349040A01 (Columbus, GA Standard)

- g. All frames and covers shall have machined horizontal bearing surfaces and have "SEWER" cast into the cover.
- h. All manholes shall have standard frames and covers except where specifically shown otherwise on the drawings.
- i. Watertight covers shall be bolt-down type and shall be equipped with two (2) one-half (1/2) inch stainless steel bolts and a one-eighth (1/8) inch red rubber or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole. Bolt holes shall have the full three hundred and sixty (360) degree circle within the cover's radius when bored through the cover.

3. Rubber Boots:

Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

4. Plastic Steps:

Manhole steps of polypropylene molded around a steel rod, equal to products of M.A. Industries shall be used.

5. Brick and Mortar:

- a. Brick and mortar shall be used to raise manhole to finish grade. Brick and mortar are not to exceed one (1) foot in height. If manhole must be raised higher to match finish grade, concrete riser sections are to be used.
- b. Brick shall be whole and hard burned, conforming to ASTM C 32 Grade MS.
- c. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 144.
- d. Inside/outside of brick riser section shall be of a mortar finish.

Section 1.07 - Design:

A. Design Period:

1. Sanitary sewer systems should be designed for the estimated ultimate tributary population. Tributary population is considered to be all areas upstream of the discharge point of the system being designed. Sanitary sewers must be designed to the uppermost and lowermost areas of the development being served. Consideration should be given to the maximum anticipated capacity of barracks, training areas, maintenance facilities, etc.
2. Sanitary sewer systems must be designed for all developments, including those in basins that currently do not have sanitary sewer available.

B. Design Factors:

1. General:

In determining the required capacities and materials of sanitary sewers, the following factors should be considered:

- a. In some circumstances CWW may require a review of the Engineer's basis of design to include but not be limited to the following:
 - i. Maximum daily sewage flow based on accepted peaking factors.
 - ii. Minimum flows to maintain two (2) fps.
 - iii. Additional maximum sewage or waste flow from industrial plants.
 - iv. Groundwater infiltration.
 - v. Topography of the area.

- vi. Depth of excavation.
- vii. Manholes in flood plain.
- b. New sanitary sewers for residential areas shall be designed on the basis of an average daily flow of sewage of not less than four hundred (400) gallons per household per day. Peaking factors will be addressed on a case by case basis.
- c. Sanitary sewers shall not be designed to transport storm water.

2. Details of Design and Construction:

- a. No sanitary sewer mains shall be less than eight (8) inches in diameter.
- b. All sanitary sewers in the street shall have a minimum of three (3) feet of cover at the inlet end of all service laterals and over any part of the collector sanitary sewer or service lateral within the street when possible. Laterals shall be installed using a riser as shown in Details S-8, S-9 and S-11.

3. Sanitary Sewer Slopes:

- a. All sanitary sewers shall be so designed and constructed to give mean velocities, when flowing half full, of not less than two (2) feet per second nor greater than ten (10) feet per second*. The following table shows the minimum slopes allowed.

Sewer Size	Min. Slope in ft/100ft.
8"	.50
10"	.40
12"	.35
14"	.22
15"	.20
16"	.20
18"	.20

- b. Maximum slopes up to eighteen (18) percent are allowed, however, any designs with slopes greater than fifteen (15) percent Engineer must submit flow calculations with plans.

* Special design considerations may be incorporated to allow slightly higher velocities or greater slopes.

4. Ductile Iron Pipe Requirements:

- a. D.I.P. for sanitary sewers shall be used under the following circumstances:
 - i. Proposed sanitary sewer line is less than three (3) feet of cover.

- ii. Proposed sanitary sewer line crosses below a storm sewer with less than two (2) feet of separation.
 - iii. Proposed sanitary sewer line is over fourteen (14) feet deep.
 - iv. Proposed sanitary sewer line is at or over the maximum slope.
 - v. When installing force mains.
 - vi. When crossing a stream or ditch.
 - vii. When crossing a Railroad right of way.
 - b. D.I.P. for sanitary sewers may be required by the CWW Engineering Department under the following circumstances:
 - i. Under pavement.
 - ii. When trench conditions necessitate, such as a rocky, wet area, poor backfill material or as directed by CWW Engineering Department.
 - iii. Crossing a D.O.T. right of way.
 - iv. When above ground improvements or other special circumstances necessitate.
5. Drop Manholes:
- a. CWW reserves the right to determine the use of either an inside or outside drop on a case by case basis. An outside drop at the manhole shall be provided wherever the drop is greater than two (2) feet, (vertical differences between the inverts in and out). Drop manholes shall not take the place of the maximum deflection angle requirements for sanitary sewer lines.
 - b. Inside drop manholes are permitted as long as they meet the following criteria:
 - i. Only to be installed when connecting to an existing manhole.
 - ii. Installation is done in compliance with Details S-2A.
 - iii. Approved by CWW during plan review process.
6. Maximum deflection angles between influent and effluent sanitary sewer lines shall be ninety (90) degrees or greater.
7. Maximum distance between two manholes shall be four hundred (400) feet.

8. Minimum depth of a manhole shall be no less than five (5) feet unless approved by CWW.
9. Sanitary Sewer Laterals into Manholes:
 - a. Inverts for sanitary sewer laterals shall be a minimum of six (6) inches above the manhole invert at the deepest point of the individual lateral.
 - b. Individual sanitary sewer laterals directly out of manholes may be cored and booted five (5) feet below finished grade as long as three (3) to six (6) inches of pipe extends past manhole wall.
 - c. For manholes over six (6) feet deep, laterals shall be five (5) feet below top of manhole lid. Provide core and rubber boot connection with three (3) to four (4) inches of pipe extended into manhole.
 - d. The minimum slope of sanitary sewer laterals between the outer most wall of the structure and the connection to the sewer main or manhole shall be two (2.00) percent.
10. Air Valves for Sewage Service:
 - a. Valves shall be combination air valves and shall be equal to Val-matic.

Section 1.08– Handling Materials:

Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, manholes, and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

A. Handling:

Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.

B. Distribution:

Distribute and place pipes and materials so as to not interfere with traffic. Do not string pipe more than one thousand (1,000) feet beyond the area where pipe is being laid. Do not obstruct drainage ditches or create a traffic hazard.

C. Storage:

Store all pipes, which cannot be distributed, along the route. Make arrangements for the use of suitable storage areas with CWW Inspector.

Section 1.09 – Construction along Highways, Streets and Roadways:

Install pipe lines and accessories along highways, streets, and roadways in accordance with the applicable regulations of the Georgia Department of Transportation, CWW and/or Department of Public Works (DPW) with reference to construction operations, safety, traffic control, road maintenance and repair. Refer to sections 1.15 and 1.16 for additional roadway requirements. Water mains will generally be located on the south and west sides of roads, unless otherwise approved by CWW and/or DPW. Advertise in the Bayonet for two (2) weeks prior to starting work.

A. Protection of Traffic:

Provide and maintain suitable signs, barricades and lights for protection of traffic. Removal of highway signs for construction shall be under permission of the Georgia Department of Transportation or the Columbus Consolidated Government. Do not close or block any highway, street or roadway without first obtaining permission from the proper authorities. Traffic control shall conform to the Manual on Uniform Traffic Control Devices for Streets and Highways. Manuals may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington DC., 404 Publication Number FHWA-SA-89-006 (or latest revision). Flagmen shall be certified by a GDOT approved flagman training program.

B. Construction Operations:

In accordance with Georgia law, the Contractor shall call 811 to request marking of utilities in all areas in which construction activities are scheduled. Perform all work along highways, streets and roadways to least interfere with traffic.

1. Clearing and Grubbing:

Erosion control measures shall be installed in accordance with approved drawings and all applicable regulations prior to clearing and grubbing and shall be properly maintained during the life of the project.

2. Trenching, Laying and Backfilling:

Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day maintaining positive drainage, which does not impact traffic.

3. Shaping:

Reshape damaged slopes, side ditches and ditch lines immediately after completing backfill operations. Replace topsoil if necessary to re-establish sod and other landscaping removed from shoulders.

C. Excavated Materials:

Do not place excavated material along highways, streets, and roadways in a manner which obstructs traffic. Sweep all scattered and excavated material off the pavement. Wash the street if necessary.

D. Drainage Structures:

Keep all ditches, culverts, cross drains and other drainage structures clear of excavated material and free to drain at all times.

E. Maintaining Highways, Streets, Roadways and Driveways:

Maintain streets, highways, and roadways in suitable condition for movement of traffic until completion and final acceptance of the work. Use street running plate to maintain traffic until pavement replacement is completed.

F. Easements:

See Section 1.03 (c).

Section 1.10 – Existing Underground Utilities, Landfills, and Obstructions:

It is the responsibility of the Contractor to locate all existing utilities along the path of construction. Drawings shall indicate underground utilities or obstructions that are known to exist. Where these or unforeseen underground utilities are encountered, the location and alignment may be changed, upon approval of CWW, to avoid interference. Such changes will be marked up on Contractor's and Inspector's construction drawings and the as-built plans. No water mains will be accepted that are installed through or in close proximity to an abandoned landfill site or any other site used for waste disposal.

Section 1.11 – Water and Sewer Separation:

Water mains shall maintain a minimum ten (10) foot edge to edge separation from sewer lines, whether the sewer operates by gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the ten (10) foot horizontal separation, the water main must be separated a minimum of eighteen (18) inches above the top of the sewer. Where the water main crosses a sewer line, an eighteen (18) inch vertical separation shall be maintained and a full joint of water pipe shall be centered over the sewer line. Adjustments to this shall be made by CWW.

No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

Section 1.12 – Connection to Existing Pipe Lines:

CWW or their approved Contractor will make connections to existing pipe lines with necessary materials.

A. Location:

Before laying pipe, locate the points of connection to existing pipe lines and uncover as necessary for CWW to confirm the nature of the connection to be made.

B. Interruption of Services:

CWW or their Contractor will make connections to existing pipe lines only when system operations permit.

Section 1.13 – Excavation:

Excavate all material encountered and dispose of excess excavated material not required for backfilling in accordance with applicable local, state and federal regulations.

A. Depth of Trenches:

Excavate trenches to provide a minimum cover of three (3) feet, to the top of pipe. Within the proximity of highways, streets, or roadways, excavate to place the top of the pipe at a minimum of four (4) feet below the nearest pavement edge, and at least two (2) feet below the bottom of the drainage ditch.

B. Width of Trenches:

Excavate trenches wide enough to allow proper installation of pipe, fittings, and other materials, and not less than six (6) inches clear of the outside barrel of the pipe on any side at any point.

C. Bell Holes:

At each joint, excavate bell holes to a depth and width which will permit the joint to be made properly and to relieve any stresses on the pipe bell.

D. Earth Excavation:

Excavate and prepare the trench bottom to support the pipe uniformly throughout its length. For ductile iron pipe, the trench shall meet the requirements of Standard Laying Condition Type 2 in accordance with AWWA C-151. If the trench is excavated to excessive width or depth, provide sand or gravel to achieve Standard Laying Condition Type 4 in accordance with AWWA C-151. (See Detail S-10).

E. Bracing and Sheet piling:

When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities, or trees which are specifically required to remain, provide bracing and sheet piling. Remove bracing and sheet piling in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheet piling in place when in the

opinion of CWW it cannot be safely removed. Cut off sheeting left in place at least two (2) feet below the surface.

1. Timber:

Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.

2. Steel Sheet Piling:

Continuous lock joint steel sheet piling may be substituted for timber sheeting when approved by CWW. Steel piling may be removed, without cutting, provided the rate of removal is kept in pace with the tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where ordered to be left in place by CWW for reasons of safety, will be cut off where directed.

F. De-Watering Trenches:

Maintain a water level two (2) feet below the bottom of the trench by pumping out water continuously. Continue to de-water running sand by using well pointing. Where soil conditions do not permit the use of well pointing, construct trench drains of crushed stone or gravel to conduct water to sumps.

G. Trench Stabilization:

Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, CWW will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with crushed stone bedding material. Place and compact this material to bring the trench to the required grade. No pipe shall be laid directly on excavated rock. Trench stabilization shall be in accordance with Detail S-10.

Section 1.14 – Laying and Jointing Pipe and Fittings:

Lay all pipe and fittings to accurately conform to the lines and grades approved by CWW as follows:

A. Handling:

Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe. Examine all pipes carefully for cracks and other defects as it is laid. Do not use pipe or other materials which are known to be defective. Lower all pipe, fittings, and accessories into the trench by suitable means. Do not drop or dump pipe or accessories into the trench. If any pipe or other material is discovered to be defective or damaged after being

laid, remove and replace it. Clean pipe and fittings thoroughly before laying. Keep the pipe line clean until final acceptance.

B. Alignment and Gradient:

Lay pipe straight in alignment and gradient. Maintain suitable equipment along with competent personnel on the job to lay out angles and ensure that deflection allowances are not exceeded.

C. Expediting Work:

Do all of the following promptly: excavate the trench, call for inspection, install the pipe, fittings, and manholes, and backfill as soon as possible. Notify CWW Engineering Department twenty-four (24) hours before backfilling is to commence. All thrust restraint must be in place at time of inspection. The Contractor must receive approval to backfill by the Inspector. Any deficiencies noted by the Inspector must be brought into compliance and a second inspection must be scheduled, as directed by CWW.

Do not leave un-jointed pipe in the trench. Backfill and compact as soon as possible after laying and jointing is completed. Plug the exposed end of the installed pipe each day at the close of work with an approved plug and at all other times when work is not in progress, pipe must be sealed with an approved plug. If necessary to backfill over the end of an uncompleted pipe, close the end with an approved plug.

D. Laying Pipe in Trenches:

Lay the pipe with solid bearing throughout its length. All Pipe bedding shall be done as specified in AWWA C-151 or last revision. Refer to typical Detail S-10.

1. Earth Trenches:

Grade the bottom of the trench to a true line. Lay the pipe in clean bedding material, free of rock, organics and other unsuitable materials.

2. Wet Trenches:

Do not lay pipe in water. Provide de-watering equipment to maintain a ground water level two (2) feet below the bottom of the pipe while the pipe is being laid.

3. Blasted Rock Trenches:

Do not lay pipe directly on to blasted rock. Keep a minimum six (6) inch layer of crushed stone underneath the pipe at the highest peak of the blasted rock as in Detail S-10.

E. Joint Assembly:

1. Joints shall be assembled in accordance with the Manufacturer's recommendations.

F. Cutting:

Cut pipe using an abrasive wheel saw. Remove all burrs and smooth the end before jointing.

Section 1.15 - Bedding of Sanitary Sewer:

Bed pipelines in accordance with the detail drawings included in Detail S-10 or S-14 and the following specifications.

A. Materials:

1. Bedding for PVC pipe shall meet the requirements of Class I materials as defined by ASTM D 2321. All other bedding materials shall be crushed stone unless shown or specified otherwise.
2. Crushed stone bedding material shall meet the requirements of Georgia Department of Transportation Specification 800.01 for Number 57 stone.
3. Where specifically allowed, earth bedding shall be suitable materials selected from materials excavated from the trench. Bedding shall be clean and free of rock, organic, and other unsuitable material.

B. General:

Compact stone bedding material by tamping or slicing with a flat blade shovel. Prepare the trench bottom to support the pipe uniformly throughout its length. Provide bell holes to relieve pipe bells of all load. If the trench is excavated to excessive width or depth, provide the next better class of bedding. In rock trenches, bed pipe in at least six (6) inches of suitable bedding. See Detail S-10 for classes and types of bedding allowed by CWW. Bedding shall then be carefully placed and compacted to provide full support under and up to the centerline of the pipe.

C. Manholes:

1. Excavate to a minimum of twelve (12) inches below the planned elevation of the base of the manhole.
2. Place and compact stone bedding material to the required grade before installing the manhole.

D. Force Main:

1. Unless shown otherwise on the drawings, bed force mains in suitable bedding materials.

2. Bedding shall be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

Section 1.16 – Manholes:

- A. Manholes shall be located no more than four hundred (400) feet apart and shall be located at all changes in grade direction or line size. Typical manhole details are included herein. All laterals out of manholes shall be cored and rubber boots installed per CWW Detail S-6.

- B. Precast Concrete:

Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. If preformed openings must be enlarged or altered, or if new openings must be made in the field, minimize the amount of material removed to provide closely matched surfaces for grouting. Install gaskets in accordance with Manufacturer's recommendations to produce a watertight structure. Grout all joints and lift points inside and outside with a non-shrink grout.

- C. Brick Risers:

Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, three quarter (3/4) inch thick, on the inside and outside. Brick risers shall be no greater than twelve (12) inches high unless approved by CWW Inspector.

- D. Inverts:

Form channels as shown on the drawings, rounded and troweled smooth. Maintain consistent grade through the invert. Core and boot all manhole connections.

- E. Future Laterals:

Where future laterals have been identified, provide the first length of pipe for future lateral sanitary sewers, properly laid to alignment and grade and suitably capped. All future lateral shall be installed per CWW Detail S-8. Inverts for sanitary sewer laterals shall be one half (0.50) foot above the sanitary sewer main invert unless approved by the CWW Inspector.

- F. Top Elevations:

Frame and Covers: unless frame and cover are at grade, the frame shall be cast into the cone section.

Build manholes outside of paved areas and right of way to eighteen (18) inches above ground unless otherwise shown on the plans or directed by CWW. Build manholes in paved areas and right of way to existing grades.

G. Drop Connections:

Manholes requiring drop connections shall be shown on the approved drawings. Construct drop connections of the same materials as the upstream sanitary sewer and in accordance with the details shown herein.

H. PVC Pipe Connections:

Make all manhole connections to PVC pipe with the connector specified. Couplings shall be grouted into the manhole opening after jointing with the PVC pipe.

I. Steps shall be installed in all manholes over four (4) feet deep. See Detail S-1.

J. Manholes in a flood zone shall have bolt down lids.

Section 1.17 - Lift Stations:

Lift stations are a last resort consideration to be covered under a separate specification by CWW Division of Engineering. CWW must approve Lift stations before design drawings are submitted.

Section 1.18 – Backfilling:

All trenches are to be backfilled and compacted to prevent settlement and displacement of the pipe.

A. Material:

Backfill trenches with earth only. Do not use rock or organic material excavated from trenches in the backfill. If necessary, furnish suitable earth material to backfill the trench. Use select material for initial backfill.

B. Compaction:

Consolidate backfill material in the bottom of the trench and up to two (2) feet above the pipe in six (6) inch layers.

C. Initial Backfill:

1. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
2. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least eighteen (18) inches above the pipe barrel. Layer depths shall be a maximum six (6) inches for pipe eighteen (18) inches in diameter and smaller, and a maximum of twelve (12) inches for pipe larger than eighteen (18) inches in diameter.

3. Backfill and compact on both sides of the pipe simultaneously to prevent side pressures.
4. Compact each layer thoroughly with suitable hand tools or tamping equipment.
5. Initial backfill shall be compacted to a minimum ninety (90) percent of the maximum dry density based on standard proctor unless shown or specified otherwise. The Contractor will provide the service of an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

D. Final Backfill:

1. Backfill carefully to restore the ground surface to its original condition. Remove all excavated rock from the ground surface and restore the area to a mowable condition, free from rock and deleterious materials.
2. The top six (6) inches shall be topsoil when directed by CWW.
3. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of. The site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
4. After initial backfill material has been placed and compacted, backfill with final backfill material. Final backfill shall not contain more than one-third (1/3) broken rock, of which no stone or boulder will be six (6) inches in diameter or weigh more than fifty (50) pounds. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
 - In six (6) inch layers, if using light power tamping equipment such as a “jumping jack.”
 - In one (1) foot layers, if using heavy tamping equipment, use a hammer with tamping feet.
5. If the trench settles, refill and grade the surface to conform to the adjacent surfaces. The Contractor will provide the service or an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

Section 1.19 – Removing and Replacing Pavement:

A. Removing Pavement:

Remove existing pavement as necessary for installing the pipeline and appurtenances. When pipeline crosses pavement at an angle other than perpendicular, then the pavement shall be overlaid at ninety (90) degrees to the pavement edge and replaced to the ends of the excavation.

1. Marking:

Before removing any pavement, mark the pavement neatly paralleling pipe. Space the marks to the width of the trench.

2. Breaking:

Break asphalt pavement along the marks using jack hammers or other suitable tools as directed by CWW. Cut Portland cement concrete pavement along the marks by use of pavement saws.

3. Machine Pulling:

Do not pull pavement with machines until completely broken and separated from pavement to remain.

4. Damage to Adjacent Pavement:

Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

5. Sidewalk:

Remove and replace sidewalks for their full width, without installing additional joints.

6. Curbs:

Remove and replace or tunnel under any curb encountered. All pavement and/or curbing repairs or replacement will require Ft. Moore approval as a condition of acceptance.

B. Replacing Pavement:

During backfilling, arrange to have the compaction tested by an approved independent testing laboratory if required by CWW. After the compaction testing has been satisfactorily completed, then replace all pavements, sidewalks and curbs in accordance with Georgia Department of Transportation and/or Government standard details as required. Payment for all costs incurred for testing shall be the Contractor's responsibility.

Section 1.20 – Roadway Crossing:

Furnish and install pipe casing and install the pipeline therein in accordance with the drawings and in accordance with Georgia Department of Transportation specifications.

A. General:

Operate well points or drainage systems in the vicinity of the casing construction to prevent the accumulation of water in the casing and to maintain the ground water table below the casing invert.

B. Pipe Casing:

Furnish all material and equipment and perform all labor required to install steel pipe casing as required by the CWW. Casings need to be placed at all roadway and driveway crossings by Contractor for future service connections. All casings shall terminate at a (3) foot minimum for in-line fitting or connection.

1. Boring:

The steel casing pipe shall be a minimum of Schedule 30 steel pipe manufactured from steel conforming to ASTM A-139, Grade B. Size and minimum wall thickness shall be as follows:

UNDER HIGHWAYS:

<u>Pipe Diameter</u> <u>Inches</u>	<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Minimum Inches</u>
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
14	22	0.250
16	24	0.250
18	30	0.312
20	30	0.312
24	36	0.375
30	42	0.375

UNDER RAILROADS:

<u>Pipe Diameter</u> <u>Inches</u>	<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Minimum Inches</u>
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.312
14	24	0.344
16	30	0.406
18	30	0.406
20	32	0.469
24	36	0.469
30	42	0.500

The outside of the casing pipe shall be primed and coated with a hot coal tar enamel a minimum of three thirty seconds (3/32) inch thick. Only new primed and coated pipe shall be used.

When casing depth exceeds fifteen (15) feet, it is the responsibility of the Engineer to calculate the required casing wall thickness.

Install the steel pipe casing by the dry boring method. Bore the hole and install the casing through the soil simultaneously by using a cutting head on a continuous auger mounted inside the casing pipe. Lengths of casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

C. Installation of Pipe:

After installation of the casing is complete, install the pipelines as shown on the Drawings. Close the ends of the casing with either four (4) inch brick walls sealed with Portland cement mortar OR end seals by CCI Piping Systems Model ESW or ESC (or equal). Leave a four (4) inch by eight (8) inch opening at the bottom of the lowest closure for drainage. See Detail Drawing A-24 for restraining fittings to steel casing pipe.

D. Safety:

Provide all necessary bracing bulkheads and shields to ensure complete safety to all traffic at times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

Section 1.21 - Concrete Piers

Construct piers as shown on Details S-15 through S-19 and in accordance with the following requirements:

A. Material:

1. Concrete shall have a compressive strength of not less than three thousand (3000) psi, with not less than five and a half (5.5) bags of cement per cubic yard and a slump between three (3) and five (5) inches.
2. For job mixed concrete, submit the concrete mix design for approval.
3. Ready-mixed concrete shall be mixed in accordance with ASTM C 94.
4. Reinforcing steel shall conform to the requirements of ASTM A 615, grade 40.

B. Bearing:

1. Where earth excavation reveals undisturbed earth subsurface, construct piers with spread footing foundations as shown herein.
2. Where rock excavation reveals level or benched rock having a minimum safe bearing value of twenty thousand (20,000) psf, construct piers with foundations bearing directly on rock. Drill a minimum of four (4) holes into the rock under each pier and grout dowels into place to anchor the pier to the rock. Grout holes from bottom up using a grout pump. Take extreme care to ensure that the entire hole is filled with grout prior to inserting the dowel.

C. Installation:

1. Employ experienced form work carpenters to construct forms. Build form work sufficiently strong to resist movement and distortion during pouring and to protect the pier from caving in or lateral movement.
2. Before placing concrete, dewater the bottom and clean out all mud, loose earth, and extraneous matter.
3. Pour concrete as soon as possible after the forms have been approved. Do not leave the excavation open for prolonged periods of time. Protect the excavation from surface water. Do not allow water to accumulate in the excavation or in surrounding areas.
4. Take all necessary precautions to protect the work and personnel on the site. Cover open holes when work is not in progress. Examine all the surrounding excavations and embankments for possible hazards.

Section 1.22 - Testing

Clean and test all lines before requesting final acceptance. Where any obstruction is met, clean the sanitary sewers by means of rods, swabs or other instruments. When requested by CWW flush out lines and manholes before final inspection. CWW Inspector must be present for all required testing. Additional test may be required if deemed necessary by CWW Inspector.

A. Gravity Sanitary Sewers:

1. Pipelines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.
2. If required, install suitable weirs in manholes selected by CWW to determine the leakage of ground water into the sanitary sewer. Measure leakage only when all visible leaks have been repaired and the ground water is above the top of the pipe. If leakage in any section of the sanitary sewer line exceeds twenty-five (25) gpd/inch diameter/mile, locate and repair leaks. Repair methods must be approved by CWW. After repairs are completed, retest for leakage. The maximum length of line for each infiltration test shall be five thousand (5,000) feet.
3. Test PVC gravity sanitary sewers for excessive deflection by passing a "Mandrel" through the line with a diameter equal to ninety-five (95) percent of the inside diameter of the pipe. The following guidelines will be utilized when mandrel testing:

<u>PIPE SIZE</u>	<u>MANDREL DIAMETER</u>
8"	7.20
10"	9.50
12"	11.40
15"	14.25

Excavate and properly reinstall any section of pipe not passing this test. Retest until results are satisfactory.

4. No connection shall be made to existing sanitary sewers until sanitary sewers being laid are inspected and approved by CWW. All connections to existing sanitary sewer system will be made by CWW, unless Contractor is authorized to do so by CWW.
5. Ensure service lateral installation and backfill is sufficient to limit obstructions and deflections in the laterals. The minimum allowable slope on laterals within the easement or public right-of-way shall be two (2.00) percent.

B. Force Mains:

1. All sections of pipeline subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section will be considered ready for testing after completion of all thrust restraint and backfilling.

2. Furnish, install and remove all temporary bulkheads, flanges or plugs required to perform the pressure test and furnish all equipment and labor to carry out the test.
3. Pressure test force mains at pressure determined by CWW and measured at the lowest point. Test for a minimum of two (2) hours. Leakage shall not exceed twelve hundredths (0.12) gph/inch diameter/1000ft.
4. If leaks are detected, locate, repair and retest. Repair methods must be approved by CWW. If results are not totally satisfactory, CWW may require testing for a longer time.

C. Hydra-static Testing on Manholes:

When required by CWW, all manholes shall be hydra-statically tested in the following manner after backfilling and tamping has been completed:

1. Each manhole indicated on the drawings shall be tested for water tightness.
2. All connecting piping shall be plugged. Manhole and downstream pipe shall be filled with water, allowed to stand for one (1) hour, and then refilled. If measurable water level drop occurs after a second one (1) hour period, the Contractor shall repair the leakage and retest at no additional cost to the Owner.

D. Low Pressure Air Testing:

When required by CWW, all lines shall be air tested in the following manner after backfilling and tamping has been completed:

1. Test Preparation:
 - a. Prior to testing for acceptance, the pipe should be cleaned.
 - b. All wyes, tees or end-of-side sanitary sewer stubs shall be plugged with flexible-joint caps or acceptable alternate, securely fastened to withstand the internal test pressure.

2. Test Procedure:

The sanitary sewer segment being tested shall be pressurized to three point five (3.5) psi. A short period of time (2-4 minutes) may be required to allow the pressure to stabilize. The pressure shall not decrease more than one (1.0) psi (from 3.5 to 2.5 psi) during the time periods shown below:

<u>Pipe Size</u>	<u>Time/110 FT</u>
6	5.7 min.
8	7.6 min.
10	9.4 min.
12	11.3 min.

3. Test failure:

If the pipe installation fails to meet the infiltration or air test requirements shown above, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of these tests and the results of the air test shall be neatly tabulated by the Contractor and submitted to CWW Inspector.

E. Leak Testing by use of a Weir:

When infiltration flow is present in the sanitary sewer system being inspected for acceptance a weir test shall be conducted to insure the flow is under the allowable leakage rate. All weirs shall be approved by the CWW Inspector prior to their use in conducting the test.

Section 1.23 – Protection and Restoration of Work Area:

A. General:

1. All work shall comply with Fort Moore's Record of Environmental Consideration (FB Form 144-R).
- B. The Contractor shall use reasonable care to avoid damaging existing buildings, equipment, and vegetation on the Government installation. If the Contractor's failure to use reasonable care causes damage to any of this property, the Contractor shall replace or repair the damage at no expense to the Government as the Contracting Officer directs. If the Contractor fails or refuses to make such repair or replacement, the Contractor shall be liable for the cost, which may be deducted from the contract price.

C. Man-Made Improvements:

Protect, or remove and replace, with CWW approval, all fences, piers, docks, walkways, mail boxes, pipelines, drain culverts, power, gas, telephone and television lines and cables and other improvements that may be encountered in the work.

D. Cultivated Growth:

Do not disturb cultivated trees or shrubbery unless approved by the CWW. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nursery person. If vegetation is not suitable for replanting; replace in kind.

E. Cutting of Trees:

Do not cut trees for the performance of the work unless specifically approved by CWW and the Contracting Officer's Representative. Removal and/or replacement of plantings on Fort Moore right-of-way must be approved by CWW and the Contracting Officer's Representative. Protect trees that remain in the vicinity of the work from damage by equipment. Do not store spoil from excavation against the trunks. Remove excavated material, stored over the root system of trees, within thirty (30) days to allow proper natural watering of the root system.

Repair any damaged tree more than three (3) inches in diameter, not to be removed, under the direction of an experienced nursery person. All trees and brush that required removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, woodpiles, or trash piles will be permitted on the work site.

F. Grassing:

Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of residential areas, plant the entire area disturbed by the work in Fescue, Bermuda, Clover, St. Augustine or mixtures of these or other suitable groundcover upon completion of work in any area. In all areas, promptly establish successful stands of grass. During non-seasonal months for establishment of permanent grassing, temporary grassing is required such as winter rye.

G. Erosion Control:

Plan all excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. Erosion control activities must comply with all Local, State and Federal requirements. Erosion control permitting is the responsibility of the Contractor or Engineer.

H. Disposal of Rubbish:

Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, City, State and Federal.

Section 1.24 – Requirements for As-Built Drawings:

A. The Contractor/Engineer is responsible for furnishing as-built drawings to CWW as soon as the water construction work has been completed.

B. As-built drawing guidelines are as follows:

1. It is the Engineer's responsibility to insure that the necessary information is received from the Contractor to complete the as-built drawings.
2. As-built data must be in NAD 1983 State Plane Georgia West (U.S. feet) and North American Vertical datum of 1988 (NAVD 88).
3. As-built documents shall include horizontal dimensioning to all valves, hydrants, fittings, etc., referenced from permanent monuments such as property corners, right-of-way markers, or other physical and permanent markers.
4. As-built should be prepared on a copy of a recorded plat or on an otherwise prepared drawing with a reference to a recorded plat book and folio number. In this instance, a copy of the recorded plat should be supplied with the as-built submittal.
5. Water line as-builts should be on a separate plan sheet from other utilities.
6. The as-builts shall contain the name of the development.
7. The location of all water mains, Fire Hydrants, valves, meters, caps/plugs, stream crossings and road crossings shall be shown.
8. Road names shall be on plans.
9. The term "As-Built" in large clear print on the plans.
10. The "As-Built" drawings are to be submitted on 22" x 34" paper. Submit one (1) water as-built drawing for the initial review. After all corrections have been made, submit five (5) water as-built drawings, a pdf file containing all as-built documents, and one (1) digital copy. Acceptable formats include: DXF or DWG files, ESRI GIS shapefiles, ESRI GIS Geodatabase.
11. Minimum scale is one (1) inch equals one hundred (100) feet. The as-builts may be drawn on more than one sheet if necessary to obtain the minimum scale of one (1) inch equals one hundred (100) feet. If multiple sheets are used, then an overall key map shall be included.

12. When a phase of a project is completed, a location sketch of entire project with said phase outlines shown on plans.
13. Contour lines are acceptable as long as they are faint and do not interfere with or overpower details of the drawing.
14. Out-lots should be so noted.
15. As-built plans shall show by appropriate dimensions to the location of all plugged future connecting fittings to the nearest foot. The dimensions are to be parallel with and perpendicular to the property lines to the nearest foot.
16. No hand drawn or marked up construction plans will be accepted as an as-built drawing.
17. The as-built shall have a north arrow and legend.
18. The as-built shall show all necessary horizontal information in order to locate the system. Label lines with length, material, diameter, and depth.
19. The as-built drawings must be sharp, clear, clean and legible and must be suitable for filming as permanent records.
20. The following notes shall be placed on the water as-built drawings and quantities filled in:

CONTRACTOR FOR THIS JOB WAS _____

ADDRESS _____

PHONE NO. _____

____ LF Main (By Diameter)
____ LF of Service Laterals (By Diameter)
____ Valves
____ Fire Hydrants
____ Meters

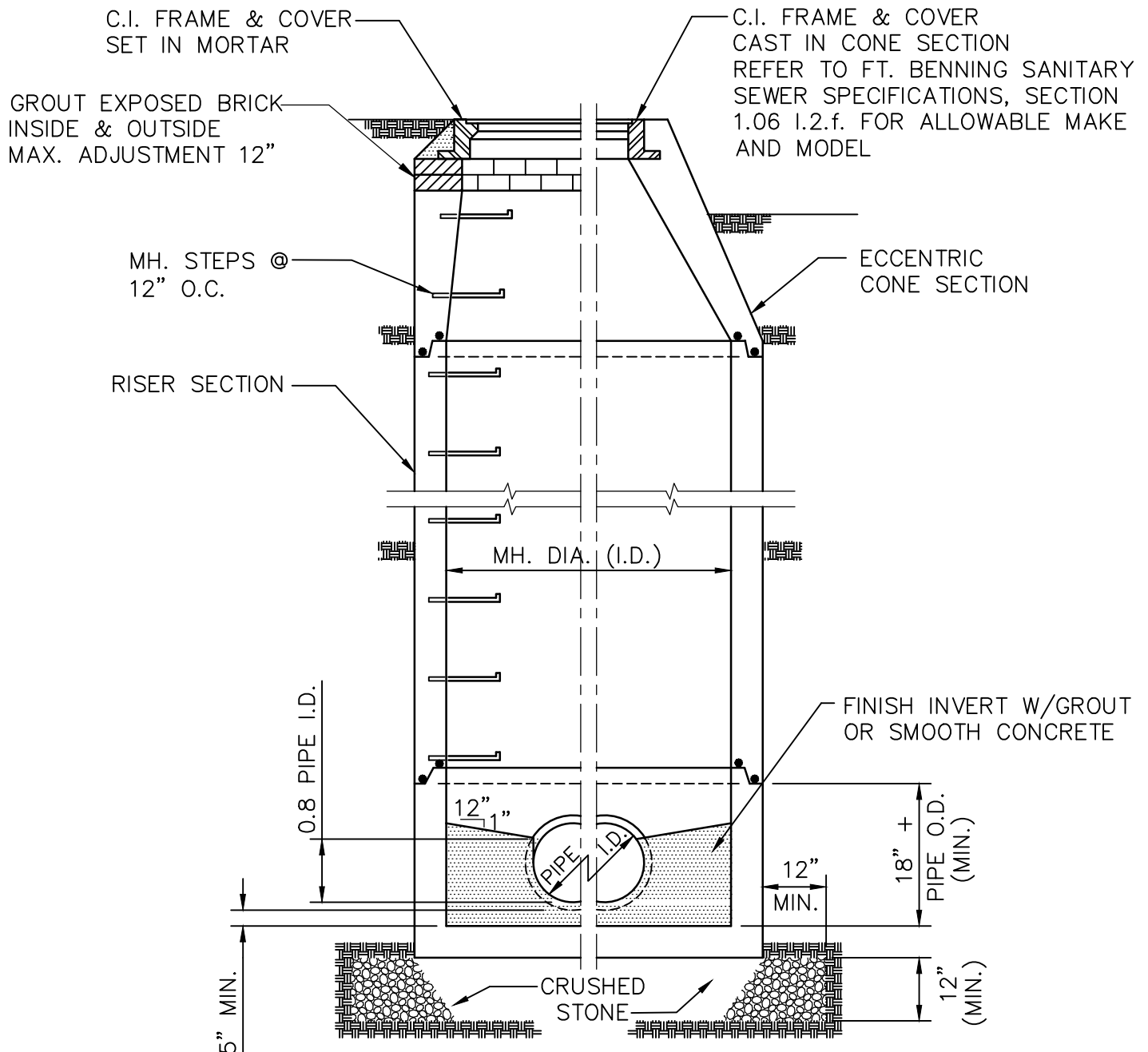
**SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF SANITARY
SEWER SYSTEMS-FORT MOORE, GEORGIA**

TABLE OF STANDARD DETAIL DRAWINGS

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PRECAST CONCRETE MANHOLE INSIDE DROP DETAIL WITH ECCENTRIC CONE SECTION	S-2A
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TOP ABOVE GRADE



GROUT EXPOSED BRICK
INSIDE & OUTSIDE
MAX. ADJUSTMENT 12"

MH. STEPS @
12" O.C.

RISER SECTION

MH.	DIA.	(I.D.)
1	1.0	1.0
2	1.0	1.0
3	1.0	1.0
4	1.0	1.0
5	1.0	1.0
6	1.0	1.0
7	1.0	1.0
8	1.0	1.0
9	1.0	1.0
10	1.0	1.0
11	1.0	1.0
12	1.0	1.0
13	1.0	1.0
14	1.0	1.0
15	1.0	1.0
16	1.0	1.0
17	1.0	1.0
18	1.0	1.0
19	1.0	1.0
20	1.0	1.0
21	1.0	1.0
22	1.0	1.0
23	1.0	1.0
24	1.0	1.0
25	1.0	1.0
26	1.0	1.0
27	1.0	1.0
28	1.0	1.0
29	1.0	1.0
30	1.0	1.0
31	1.0	1.0
32	1.0	1.0
33	1.0	1.0
34	1.0	1.0
35	1.0	1.0
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37	1.0	1.0
38	1.0	1.0
39	1.0	1.0
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42	1.0	1.0
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93	1.0	1.0
94	1.0	1.0
95	1.0	1.0
96	1.0	1.0
97	1.0	1.0
98	1.0	1.0
99	1.0	1.0
100	1.0	1.0

0.8 PIPE I.D.

12"

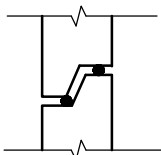
- FINISH INVERT W/GROUT
OR SMOOTH CONCRETE

12"
MIN.

$$\frac{18'' + \text{IPE O.D.}}{(\text{MIN.})}$$
12"
(MIN.)

-CRUSHED
STONE—

NOTE: ALL MANHOLES TO BE CORED AND RUBBER BOOT INSTALLED.



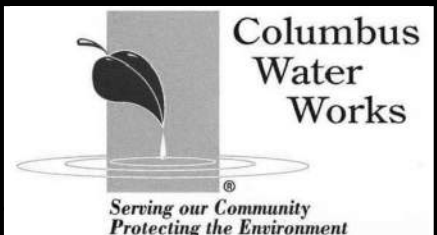
JOINT SEALER

PRECAST CONCRETE MANHOLE DETAIL WITH ECCENTRIC CONE SECTION

SCALE: N.T.S.

DATE: NOVEMBER 2019

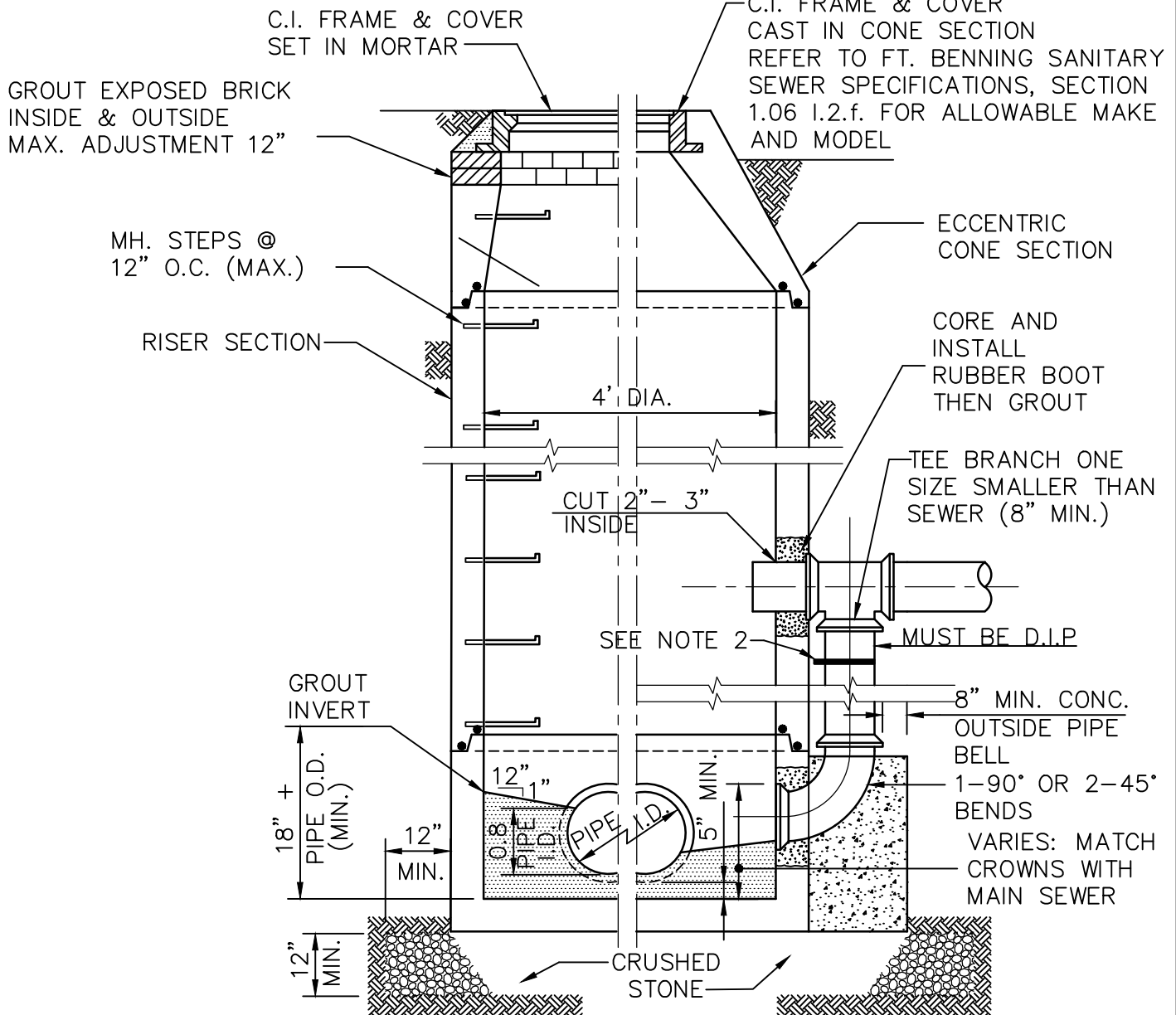
S-1



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TOP AT GRADE

TOP ABOVE GRADE



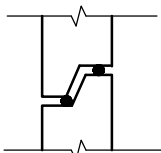
HALF SECTION

STANDARD MANHOLE

HALF SECTION

DROP MANHOLE

SEALANT LOCATIONS
SHOULD CAUSE A
SQUEEZE OUT EFFECT



JOINT SEALER

NOTE:

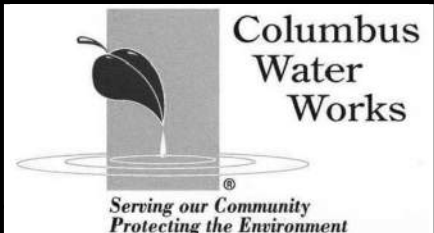
1. ALL MANHOLES TO BE CORED AND RUBBER BOOT INSTALLED. DROP MANHOLE REQUIRED WITH 2' OR GREATER DROP.
2. FOR OUTSIDE DROP CONNECTION VERTICAL PIPING, STAINLESS STEEL STRAPS SHALL BE ATTACHED TO THE EXTERIOR OF THE MANHOLE WITH ANCHOR WEDGES. ANCHOR WEDGES SHALL BE SPACED NO GREATER THAN 5 FT FOR VERTICAL DROPS 5 FT AND GREATER.

PRECAST CONCRETE
MANHOLE OUTSIDE DROP
DETAIL WITH ECCENTRIC
CONE SECTION

SCALE: N.T.S.

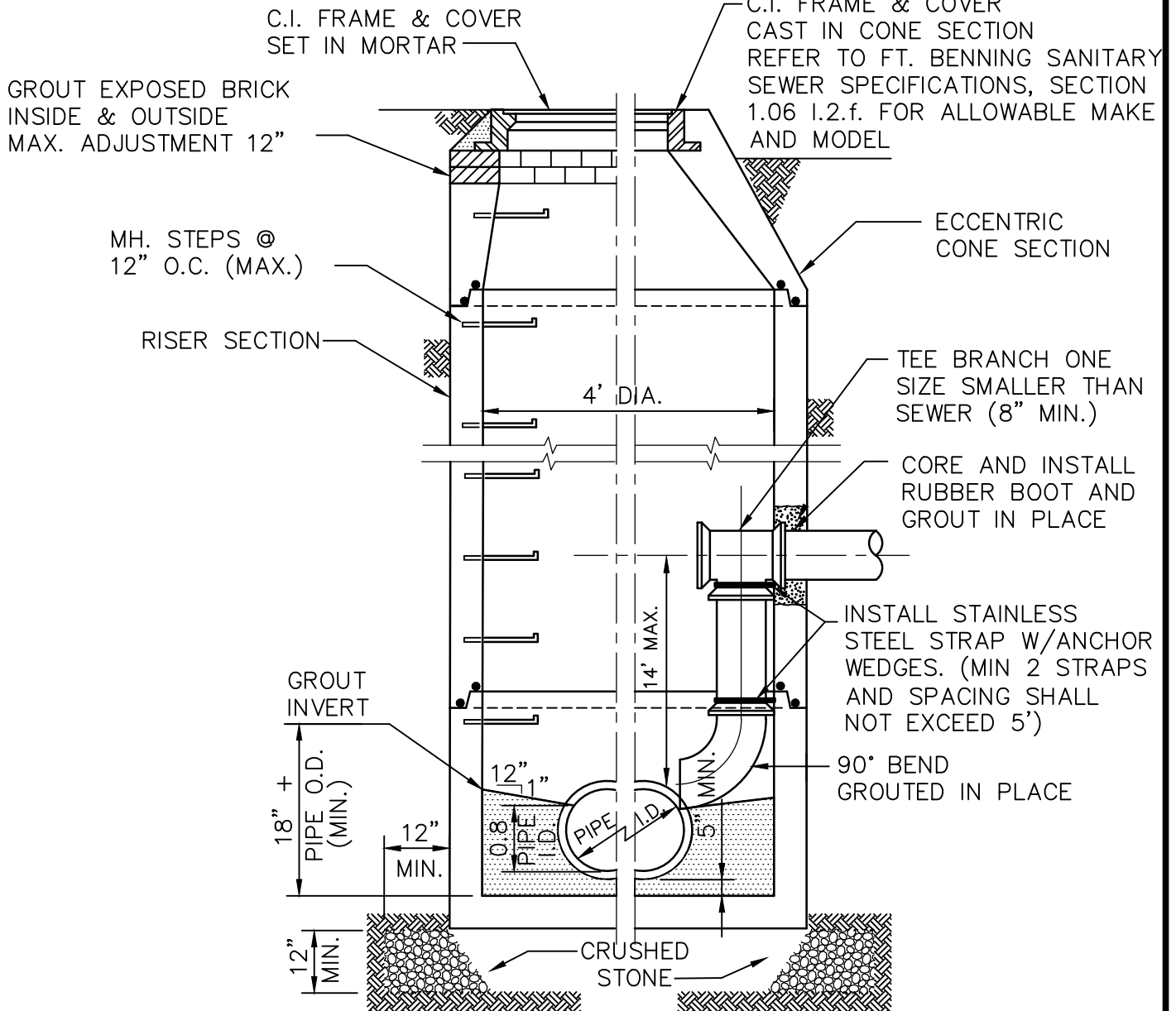
DATE: NOVEMBER 2019

S-2



TOP AT GRADE

TOP ABOVE GRADE



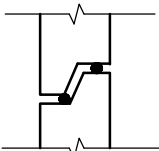
HALF SECTION

STANDARD MANHOLE

HALF SECTION

DROP MANHOLE

SEALANT LOCATIONS SHOULD CAUSE A SQUEEZE OUT EFFECT



JOINT SEALER

NOTE:

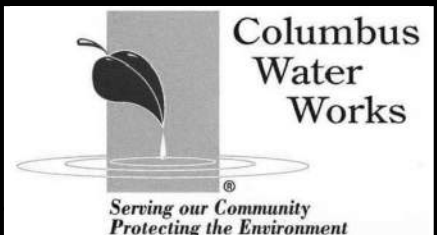
1. ALL MANHOLES TO BE CORED AND RUBBER BOOT INSTALLED. DROP MANHOLE REQUIRED WITH 2' OR GREATER DROP.
2. INSIDE DROP ALLOWED TO A MAXIMUM OF 14' FROM CENTER LINE OF TEE TO CENTER LINE OF 90° BEND.

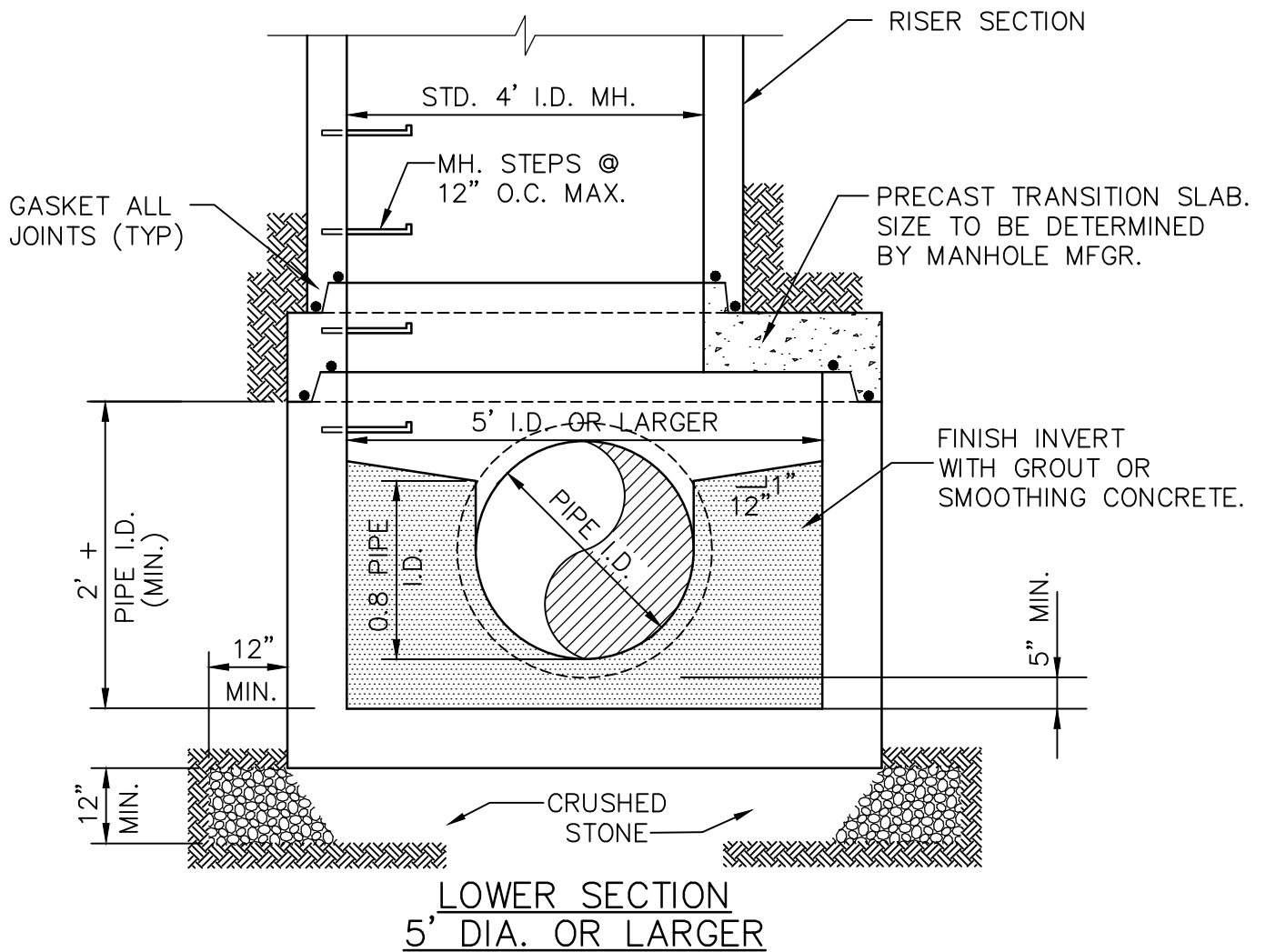
PRECAST CONCRETE
MANHOLE INSIDE DROP
DETAIL WITH ECCENTRIC
CONE SECTION

SCALE: N.T.S.

DATE: NOVEMBER 2019

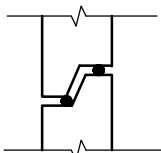
S-2A





NOTE: ALL MANHOLES TO BE CORED AND RUBBER BOOT INSTALLED.

SEALANT LOCATIONS
SHOULD CAUSE A
SQUEEZE OUT EFFECT



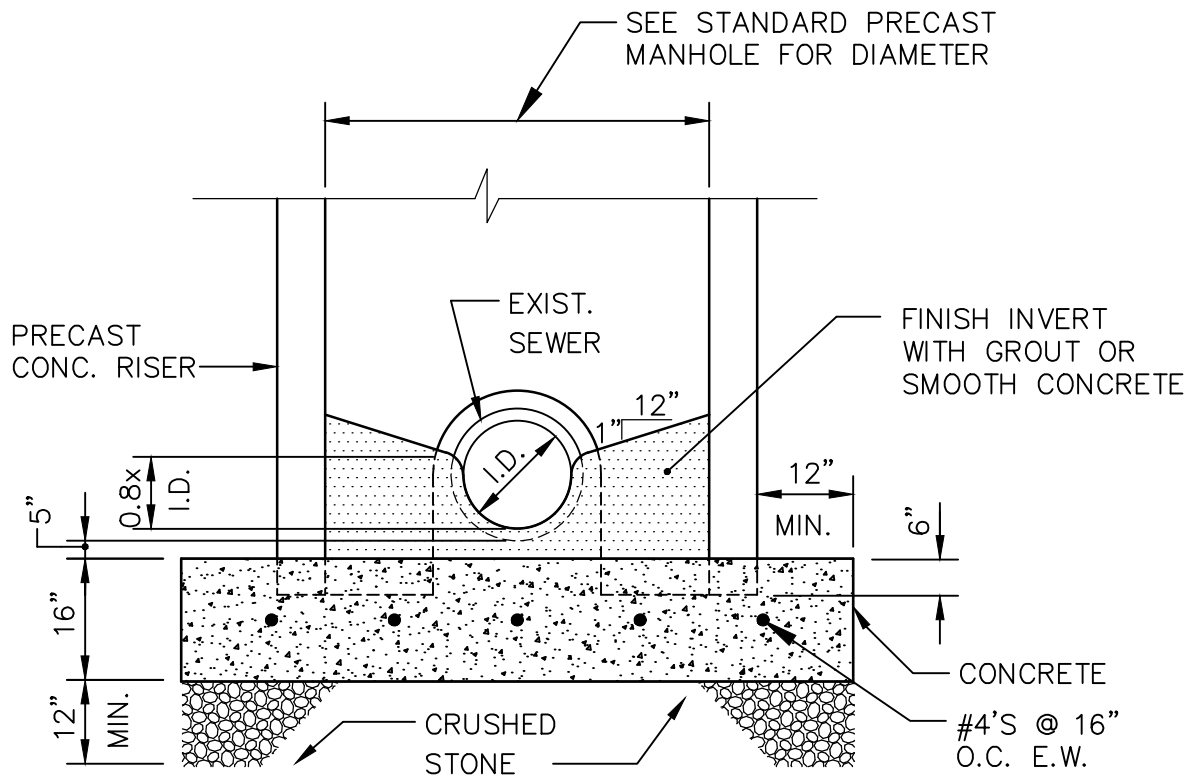
JOINT SEALER

PRECAST CONCRETE
OVERSIZED MANHOLE
DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-3



DOG HOUSE MANHOLE

PRECAST MANHOLE OVER EXISTING SEWER DETAIL

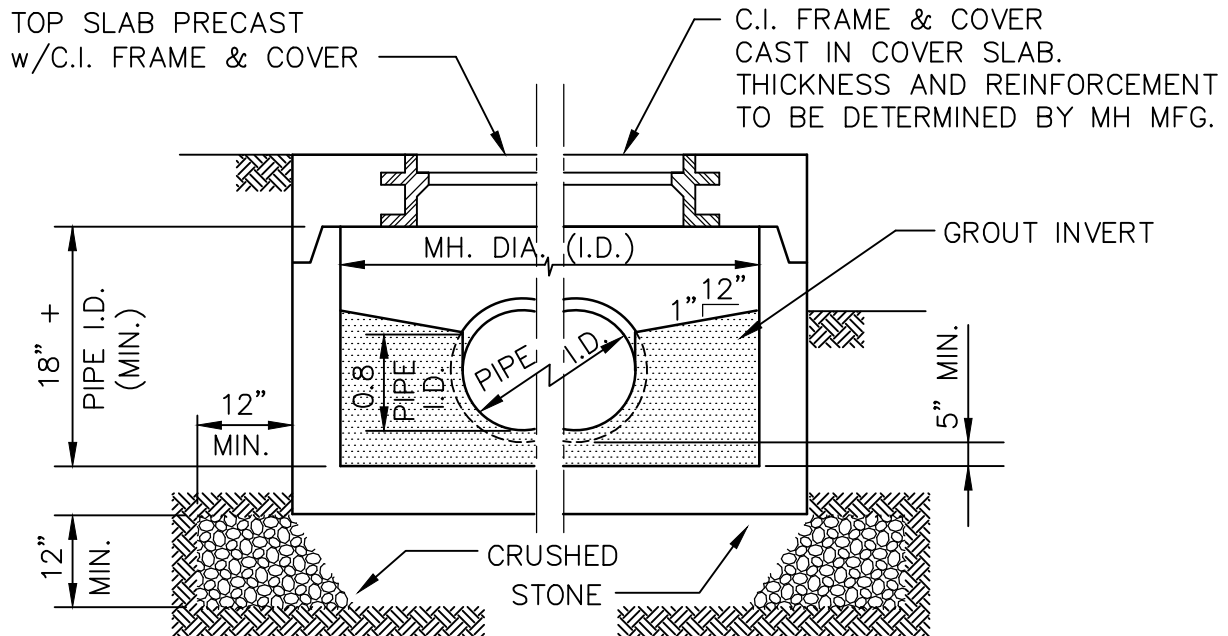
SCALE: N.T.S.

DATE: NOVEMBER 2019

S-4

TOP AT GRADE

TOP ABOVE GRADE



NOTE: ALL MANHOLES TO BE CORED AND RUBBER BOOT INSTALLED.

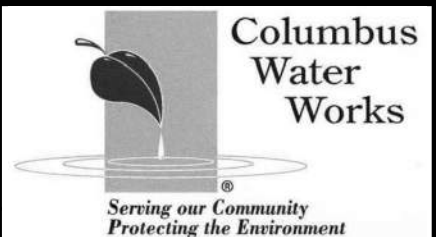
MANHOLE MINIMUM DEPTHS ARE 5' UNLESS APPROVED BY COLUMBUS WATER WORKS FOR SHALLOW MANHOLE. STANDARD MANHOLE DETAIL TO BE USED FOR 4' DIAMETER OR GREATER.

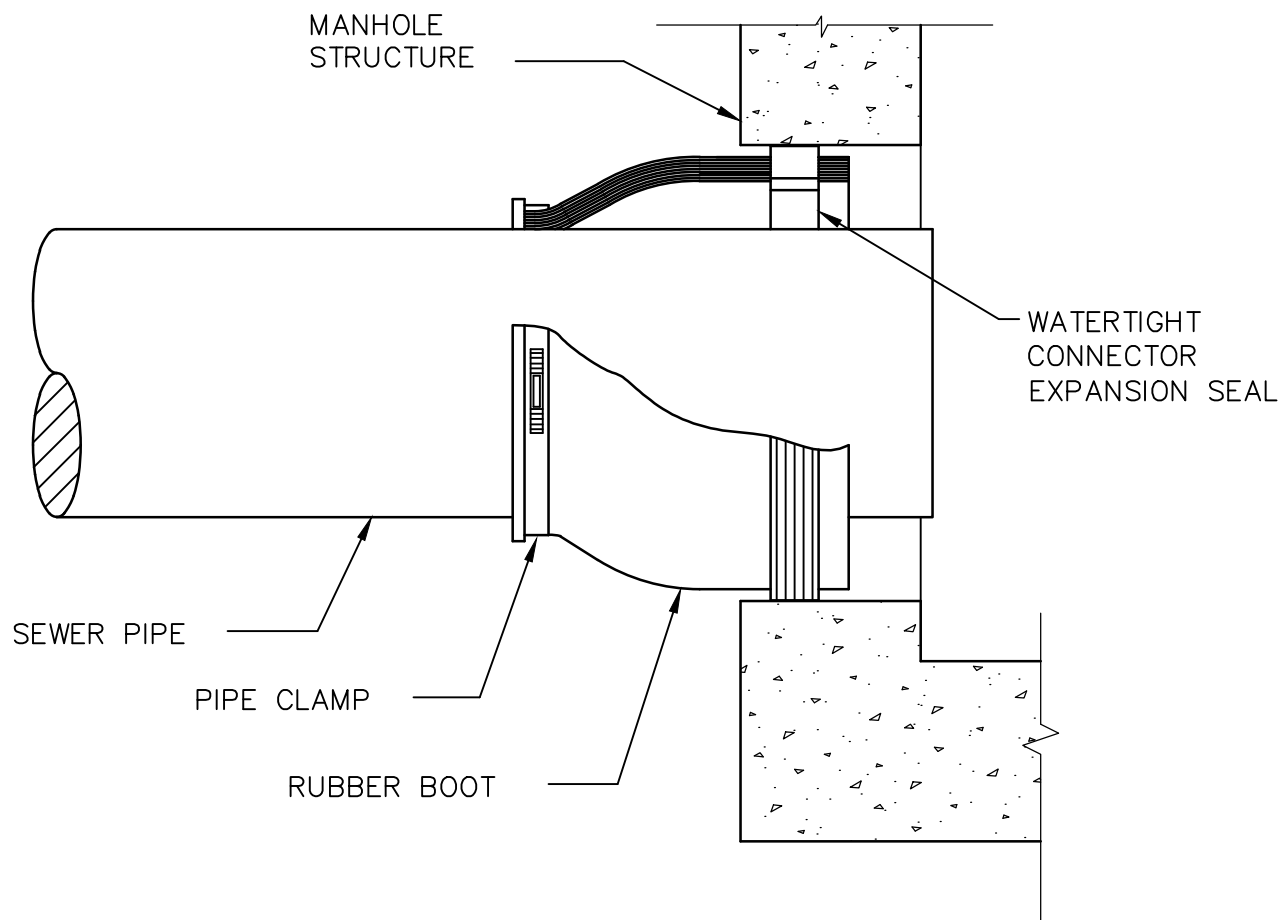
PRECAST CONCRETE SHALLOW MANHOLE DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-5



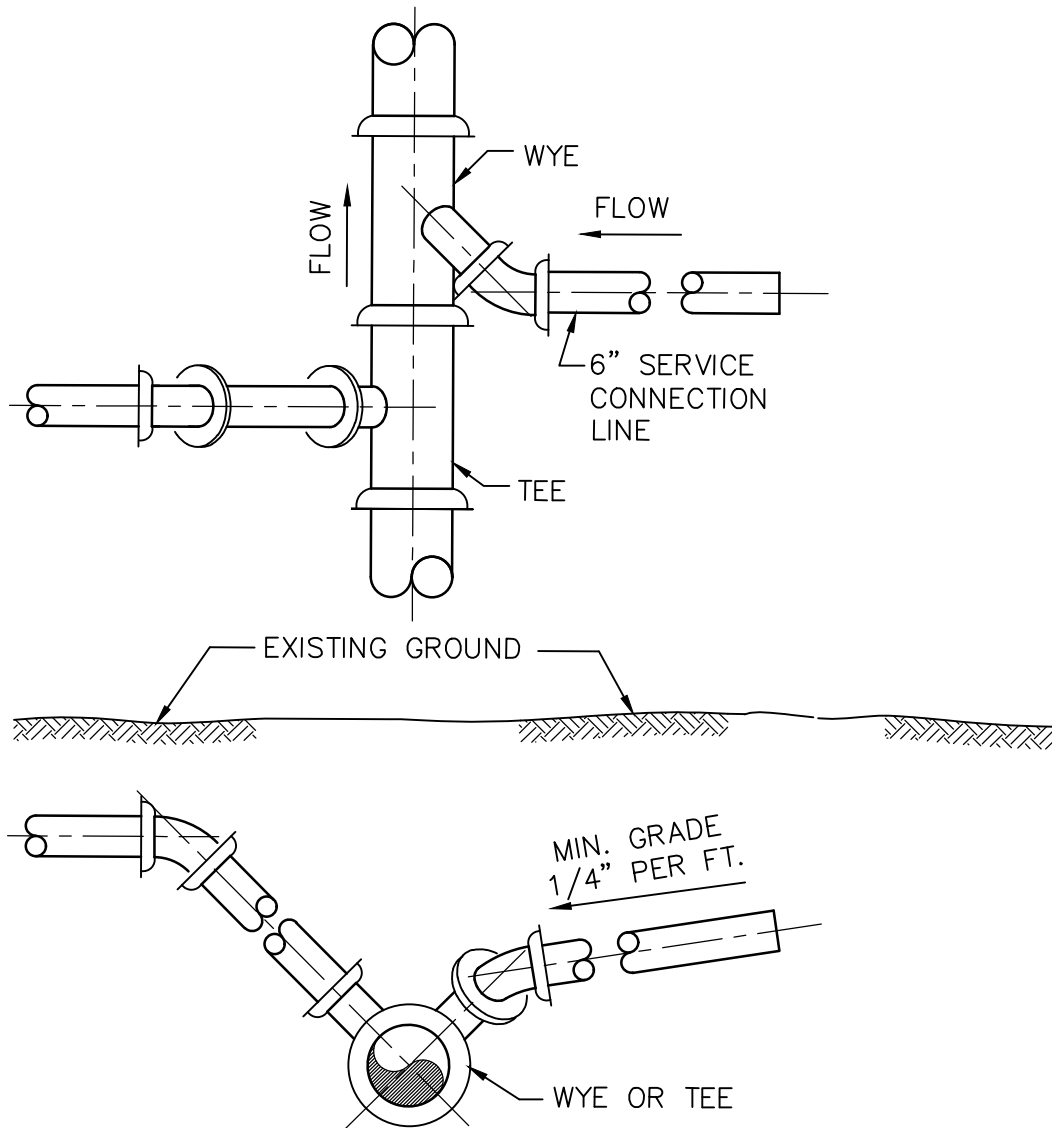


RUBBER BOOT DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-6

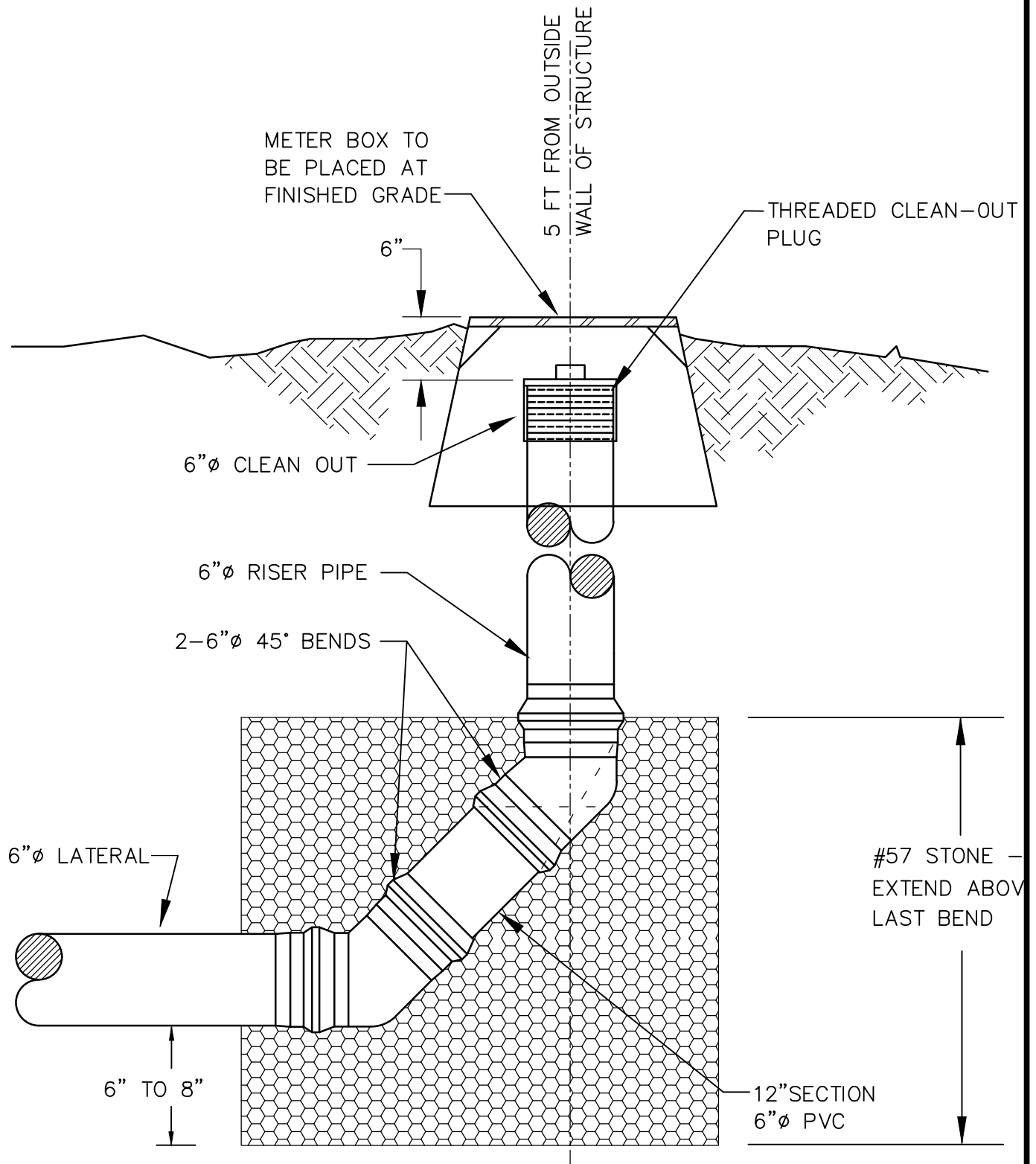


SERVICE CONNECTION DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-7



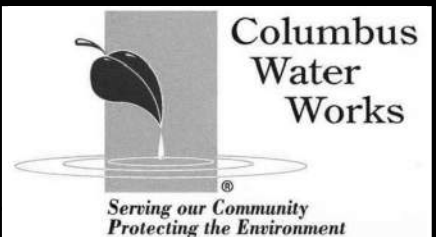
- NOTE:** 1. DEVELOPER/CONTRACTOR SHALL EXTEND 6"Ø PIPE TO 6" BELOW FINISHED GRADE AND PLUG WITH A C/O.
2. USE THIS DETAIL ONLY WHEN THE SEWER LATERAL IS DEEPER THAN 5'.

SEWER LATERAL RISER

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-8



METER BOX TOP TO BE PLACED AT
FINISHED GRADE BY PLUMBER

5 FT FROM OUTSIDE
WALL OF STRUCTURE

6"x4" TEE/WYE CONNECTION
INSTALLED BY PLUMBER

4" HOUSE SERVICE
BY PLUMBER

NOTES:

1. PLUMBER SHALL REMOVE NECESSARY PIPE AND
INSTALL A TEE-WYE CONNECTION AS DIRECTED
BY COLUMBUS WATER WORKS.
2. USE THIS DETAIL ONLY WHEN THE SEWER LATERAL
IS DEEPER THAN 5'.

#57 STONE

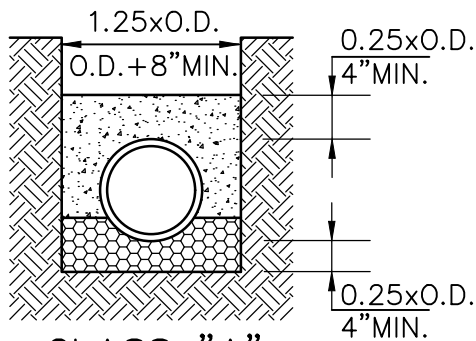
CONNECTING SERVICE TO SEWER LATERAL RISER

SCALE: N.T.S.

DATE: NOVEMBER 2019

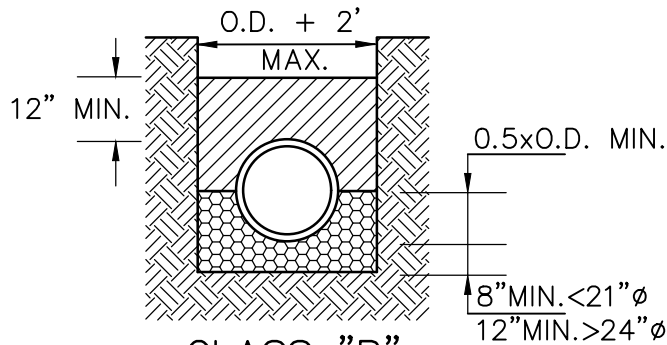
S-9





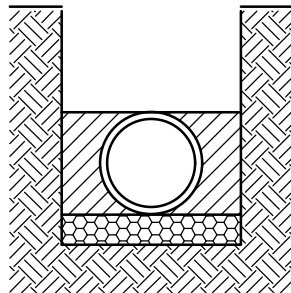
CLASS "A"

PIPE BEDDED IN SAND, GRAVEL OR CRUSHED STONE TO A DEPTH OF 1/4 PIPE DIAMETER OR 4" MINIMUM. PLACE 1500 psi (MIN.) CONCRETE FROM 1/4 OF PIPE DIAMETER ABOVE PIPE INVERT TO 6" ABOVE TOP OF PIPE.



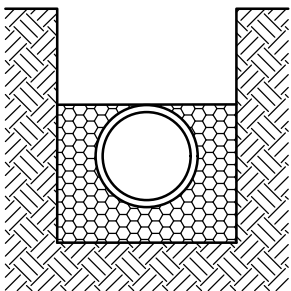
CLASS "B"

PIPE BEDDED TO ITS CENTERLINE IN COMPACTED GRANULAR MATERIAL. COMPACTED GRANULAR OR SELECT MATERIAL++ TO 12" ABOVE TOP OF PIPE. (APPROXIMATELY 90% STANDARD PROCTOR, AASHTO T-99.)



TYPE 4

PIPE BEDDED IN SAND, GRAVEL OR CRUSHED STONE TO DEPTH OF 1/8 PIPE DIAMETER 4" MINIMUM. BACKFILL COMPACTED TO TOP OF PIPE. (APPROXIMATELY 80% STANDARD PROCTOR, AASHTO T-99).



TYPE 5

PIPE BEDDED TO TOP OF PIPE IN COMPACTED GRANULAR MATERIAL, 4" MINIMUM UNDER PIPE. (APPROXIMATELY 90% STANDARD PROCTOR, AASHTO T-99).

NOTE:

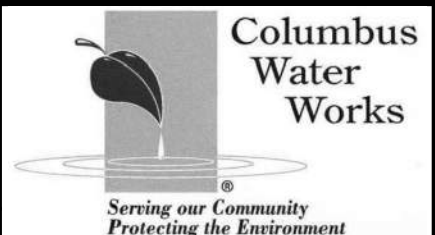
++ "LOOSE SOIL" OR "SELECT MATERIAL" IS DEFINED AS NATIVE SOIL EXCAVATED FROM THE TRENCH, FREE OF ROCKS, FOREIGN MATERIAL AND FROZEN EARTH.

STANDARD PIPE LAYING CONDITIONS

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-10



METER BOX TOP TO BE PLACED AT
FINISHED GRADE BY PLUMBER

6"

5 FT FROM OUTSIDE
WALL OF STRUCTURE

THREADED CLEAN-OUT
PLUG

6"Ø CLEAN OUT

NOTES:

1. PLUMBER WILL REMOVE TEMPORARY END CAP AND
INSTALL FERNCO COUPLING OR EQUAL .
2. USE THIS DETAIL ONLY WHEN THE SEWER LATERAL
IS LESS THAN 5'.

6"Ø 45° BENDS

12"SECTION
6"Ø PVC

6"Ø RISER PIPE

6" WYE CONNECTION

6"Ø LATERAL

#57 STONE

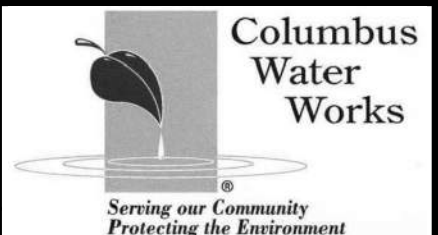
6"X4" FERNCO
BY PLUMBER

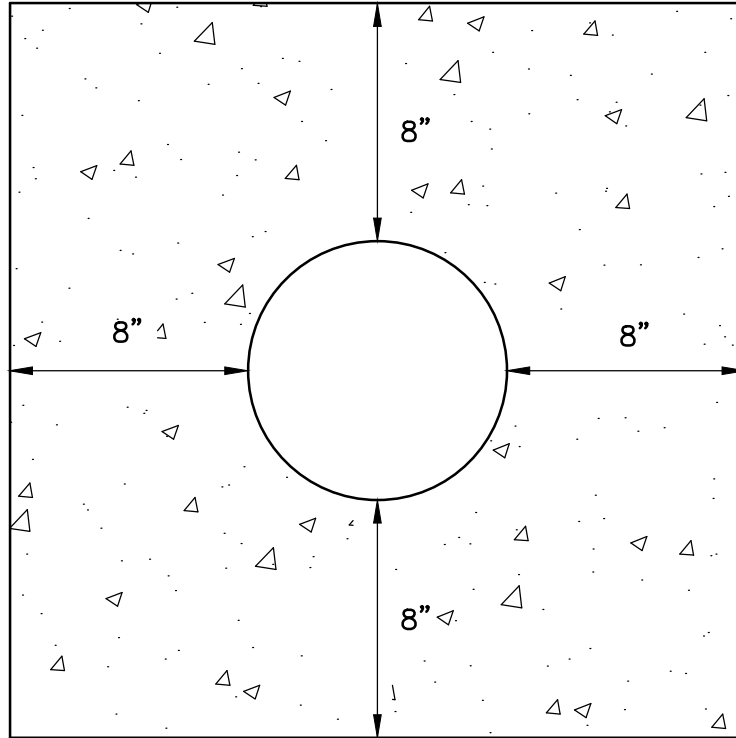
SEWER LATERAL RISER
WHEN CONNECTION IS
LESS THAN 5 FT DEEP

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-11





CONCRETE ENCASEMENT DETAIL

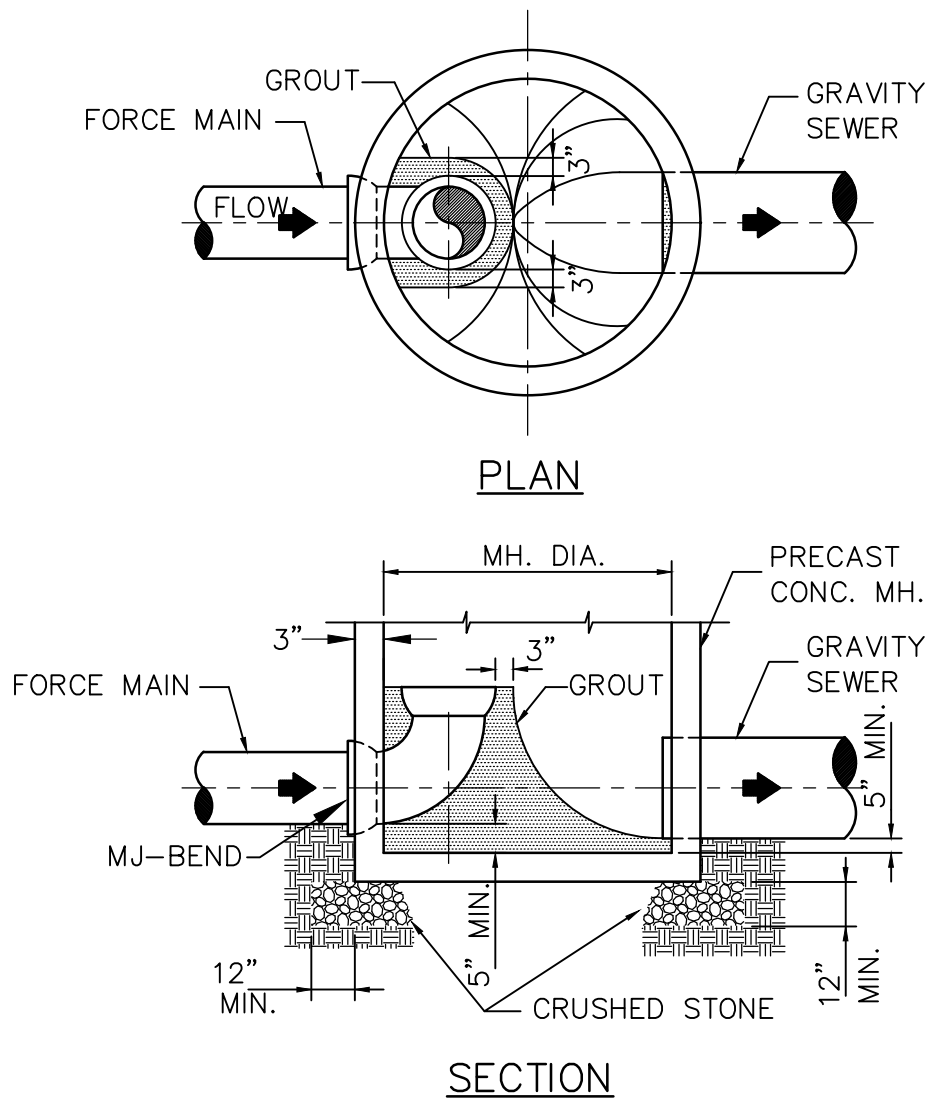
SCALE: N.T.S.

DATE: NOVEMBER 2019

S-12



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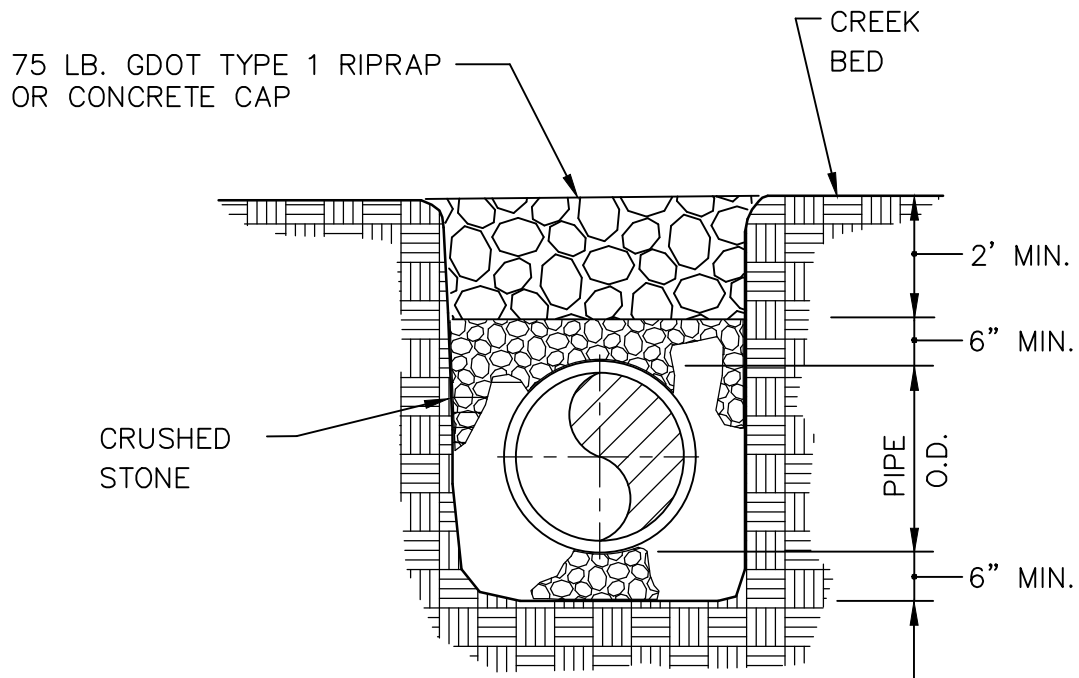
FORCE MAIN END OF LINE CONNECTION

FORCE MAIN
DISCHARGE
MANHOLE

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-13



PIPE BEDDING AT CREEK CROSSING

SCALE: N.T.S.

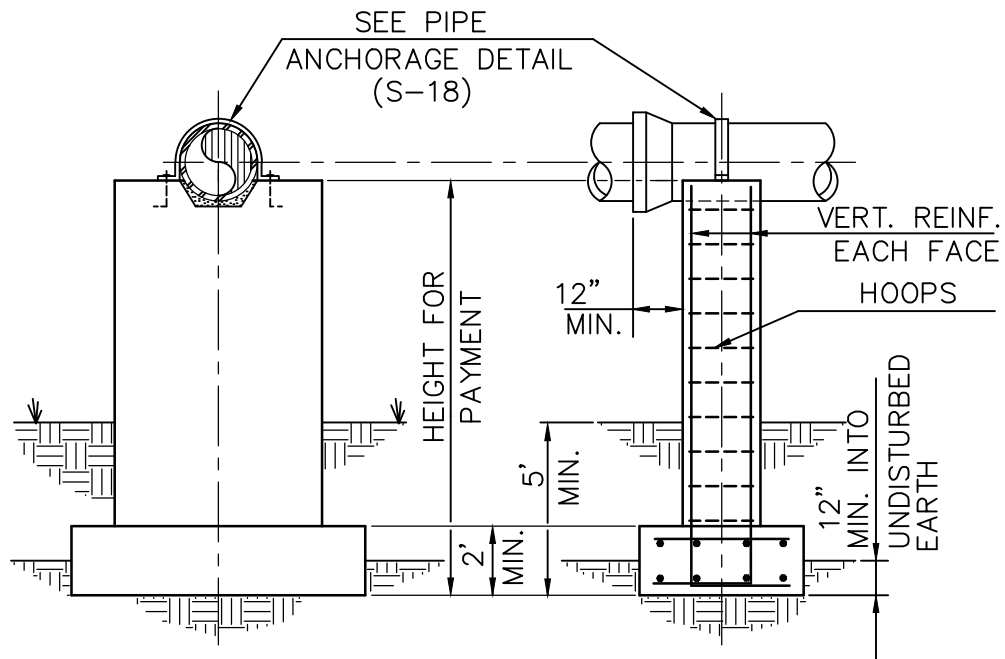
DATE: NOVEMBER 2019

S-14

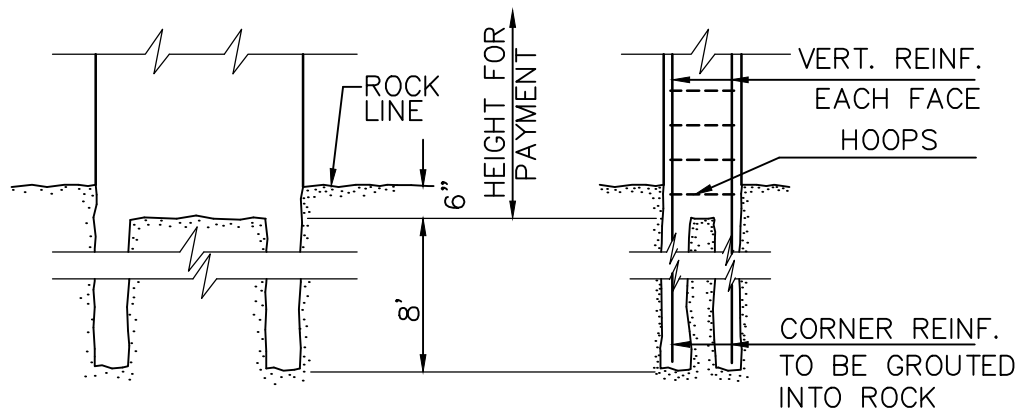


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FOOTING IN EARTH



FOUNDATION IN ROCK

NOTE:

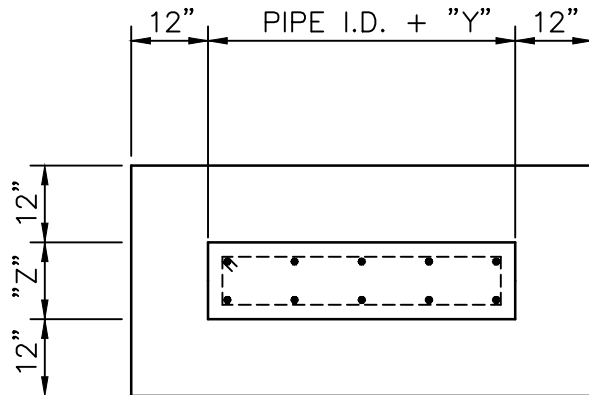
SEE ASSOCIATED DETAILS S-16, S-17,
S-18, AND S-19.

CONCRETE
PIER
DETAILS

SCALE: N.T.S.

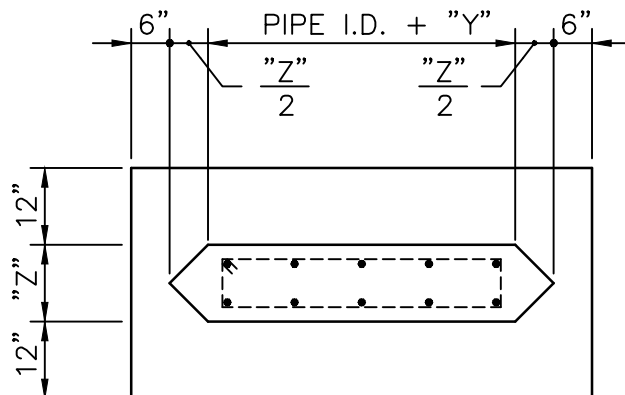
DATE: NOVEMBER 2019

S-15



PLAN — OVERLAND

PIPE I.D.	"Y"	"Z"	VERT. REINF. @12" O.C.	HOOPS @12" O.C.
8"—24"	24"	12"	#5	#3



PLAN — IN STREAM

NOTES:

1. FOOTING REINF. SAME AS VERT. REINF. EA. WAY TOP & BOTTOM. WITH 3" MINIMUM CLEARANCE.
2. WHEN BASE IS IN ROCK OMIT FOOTING & GROUT VERTICAL CORNER BARS 8" INTO ROCK.

CONCRETE PIER DETAILS

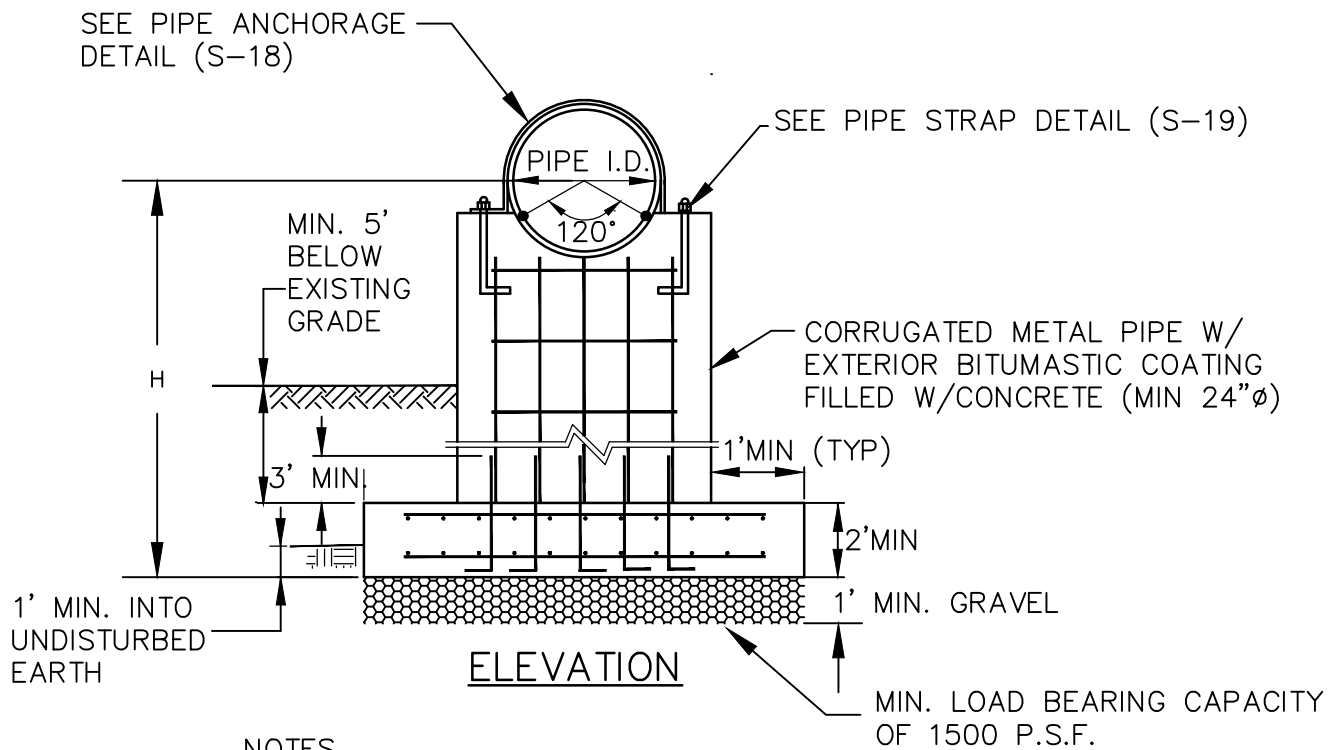
SCALE: N.T.S.

DATE: NOVEMBER 2019

S-16

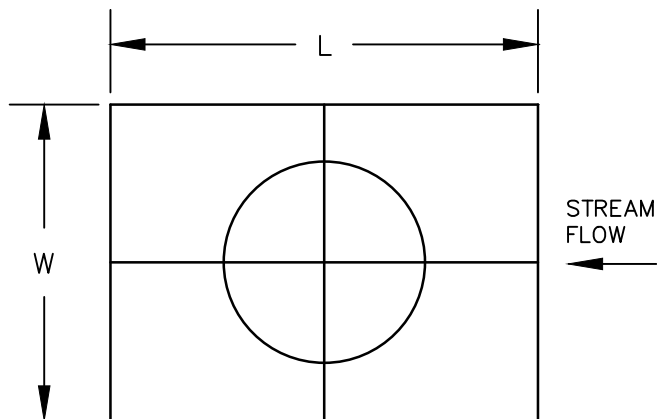


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NOTES

1. VERTICAL REINFORCEMENT @ 6" O.C. - #6 REBAR 2" MIN. CL.
2. HOOPS @ 12" O.C. - #4 REBAR.
3. FOOTING REINFORCEMENT #6 REBAR 12" O.C.E.W.
4. 3" MIN. CLEARANCE ON FOOTING REBAR.



FOOTING

	H < 8'		8' ≤ H ≤ 12'		H > 12'	
PIPE I.D.	W	L	W	L	W	L
12" <	4'	6'	5'	7'	SUBMIT DESIGN FOR REVIEW	
12" ≤ I.D. ≤ 18"	5'	6'	6'	8'		
18" < I.D. ≤ 24"	6'	8'	7'	10'		

FOOTING DIMENSION CHART

CIRCULAR CONCRETE PIER DETAILS

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-17



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8" w x 3/8" thk GALV. STEEL
STRAP W/BITUMASTIC COATING
AFTER INSTALLATION

6" x 3/8" NEOPRENE
STRAP AROUND
PIPE (360°)

SEE PIPE STRAP
DETAIL (S-19)

3" MIN.

PIPE I.D.

120°

NEOPRENE PAD

GROUT AFTER PIPE
IS BROUGHT TO
LINE & GRADE

2" TYP.

1/8" BEFORE
NUT IS TIGHTENED

NOTE:

ANCHOR BOLT DIAMETER AND STEEL STRAP
THICKNESS MUST BE DESIGNED TO SUIT
CONDITIONS FOR SPECIFIC INSTALLATION.

PIPE ANCHORAGE DETAIL

SCALE: N.T.S.

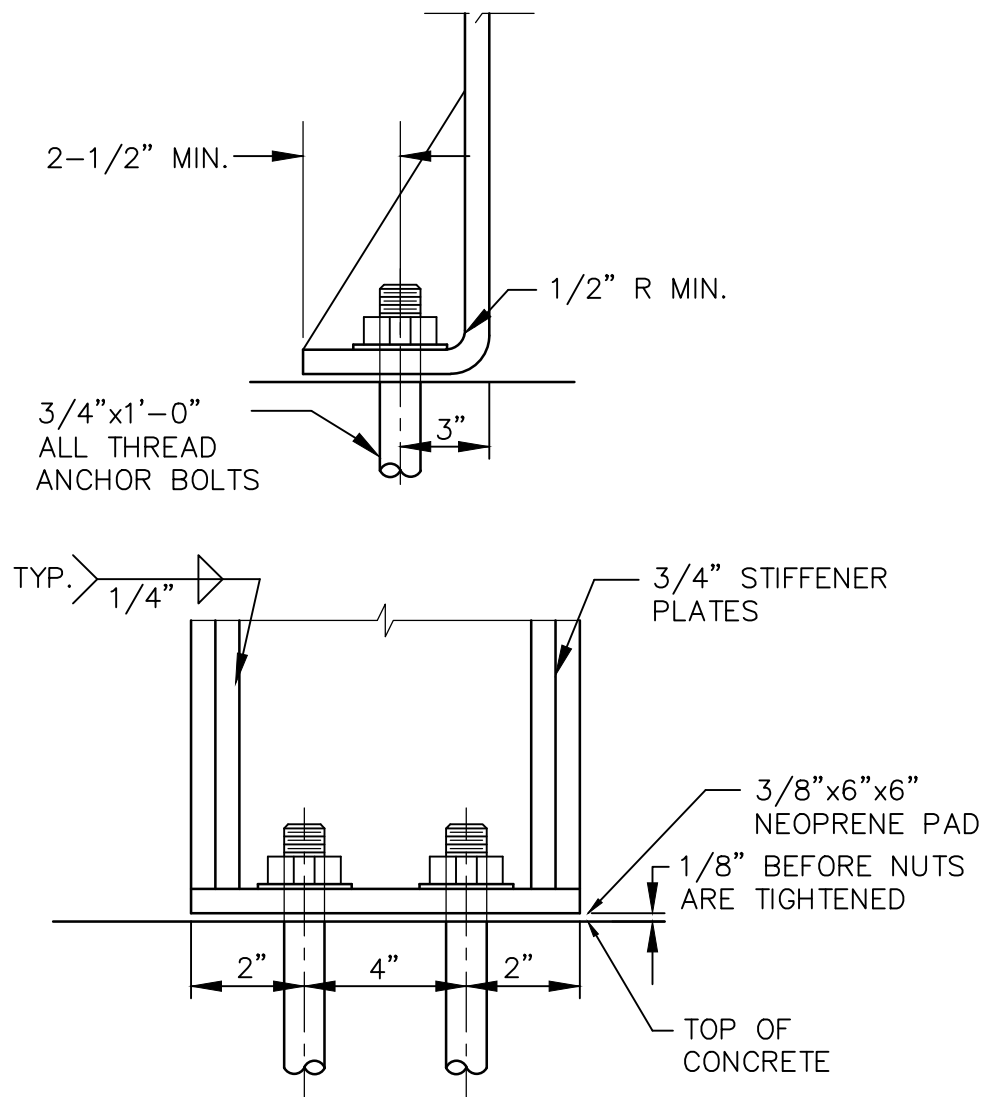
DATE: NOVEMBER 2019

S-18



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NOTE:

ANCHOR BOLT DIAMETER AND STEEL STRAP THICKNESS MUST BE DESIGNED TO SUIT CONDITIONS FOR SPECIFIC INSTALLATION.

PIPE STRAP DETAIL

SCALE: N.T.S.

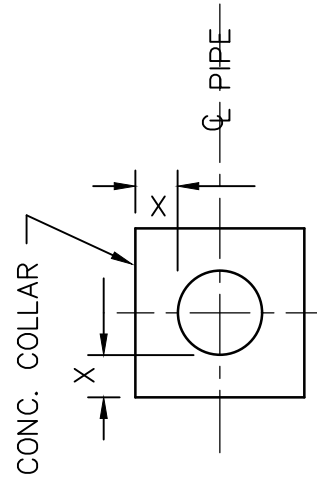
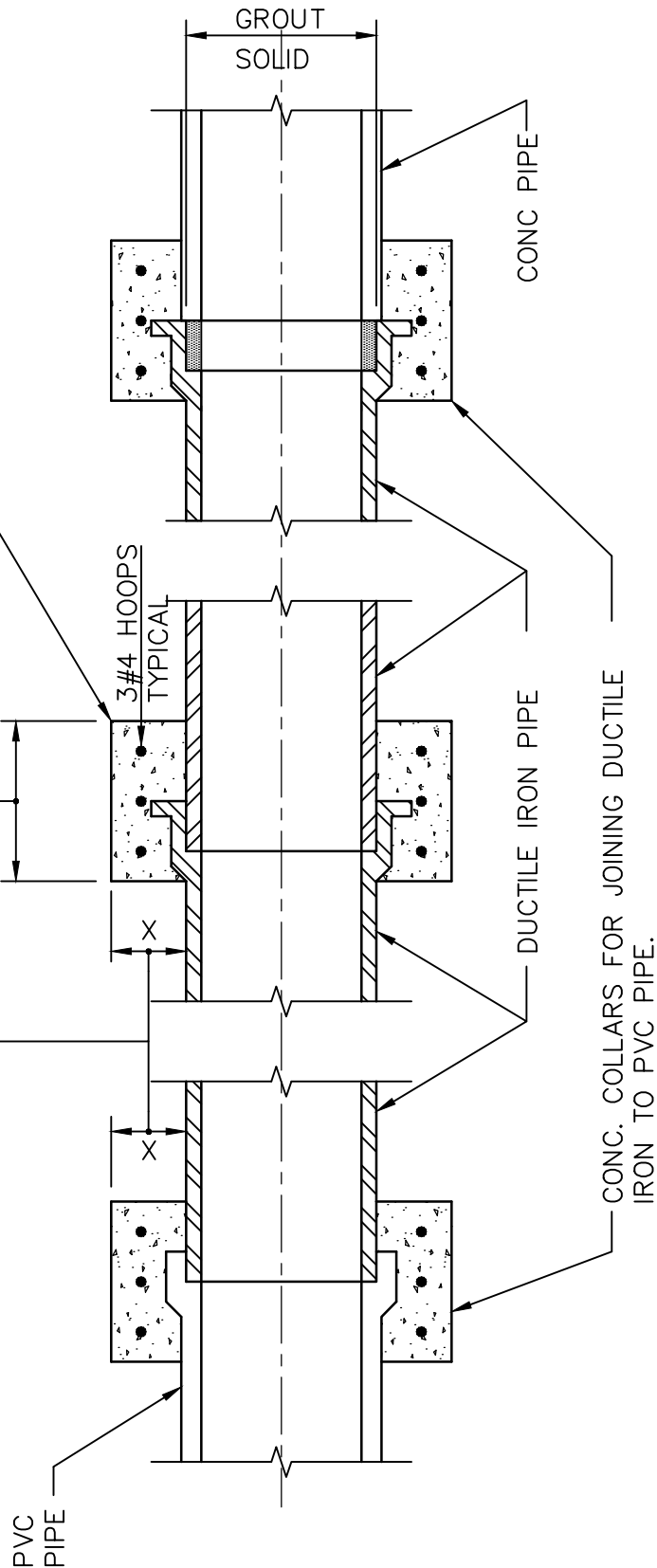
DATE: NOVEMBER 2019

S-19

8" FOR 8" THRU 16" PIPE
12" FOR 18" PIPE
12" FOR 24" & 30" PIPE

12" FOR 10" & 12" PIPE
2' FOR 16" THRU 24" PIPE

ANTI-FLOTATION CONC.
COLLARS TYPICAL AT ALL
JOINTS AND AT ALL CREEK
CROSSINGS. SEE A-21



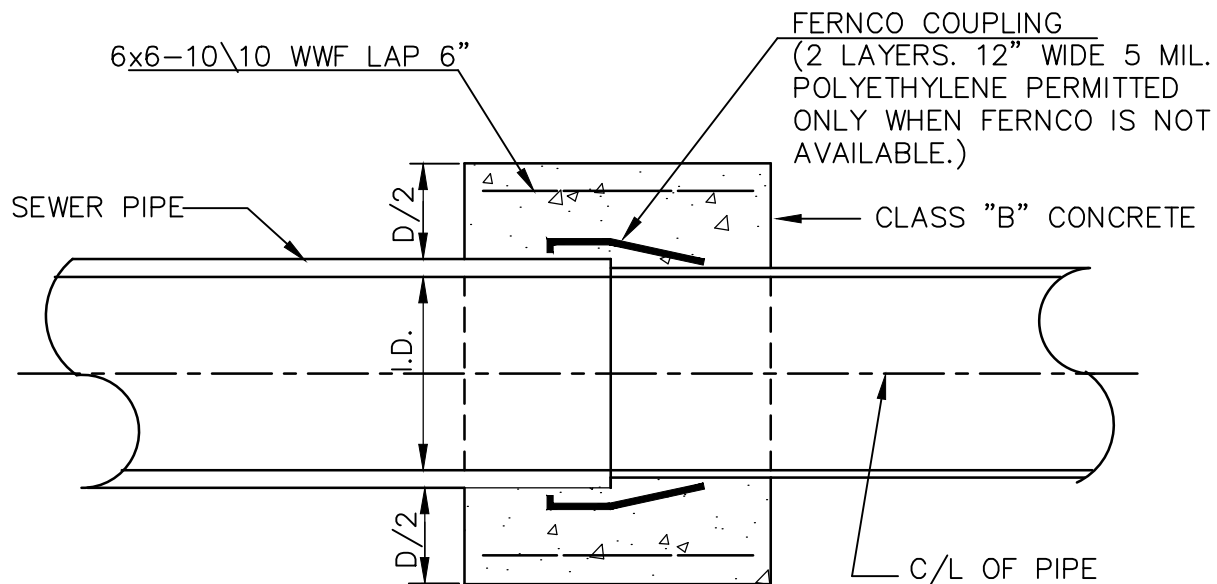
CROSS-SECTIONAL VIEW

CONCRETE COLLAR DETAILS

SCALE: N.T.S.

DATE: NOVEMBER 2019

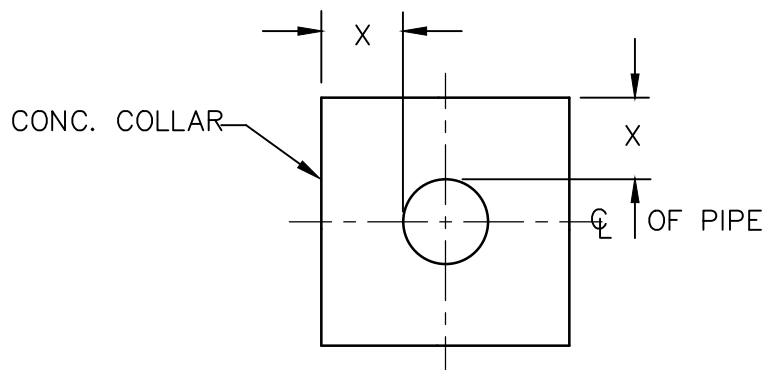
S-20



TRANSITION COLLAR

NOTES

1. TRANSITION JOINTS FROM DUCTILE IRON PIPE TO P.V.C. PIPE FOR PIPE SIZES 12" DIAMETER OR LESS SHALL UTILIZE WATER MAIN TYPE COMPRESSION COUPLINGS (WITH ADAPTER GASKETS IF NEEDED).
2. USE A "FERNCO" TYPE COUPLING ENCASED IN CONCRETE (IF IT IS AVAILABLE IN THE APPROPRIATE SIZE). THE USE OF POLYETHYLENE WRAP WILL GENERALLY BE PERMITTED ONLY FOR CONNECTIONS INVOLVING LARGE DIAMETER PIPES.



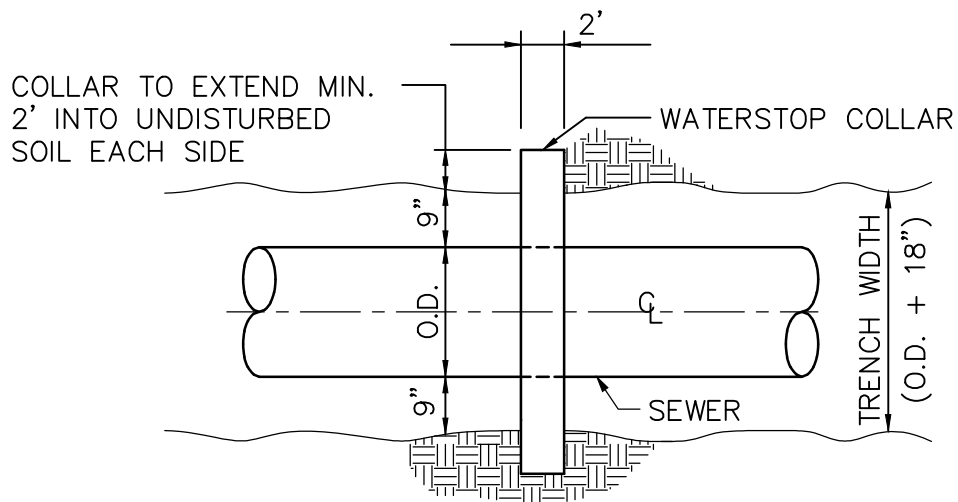
CROSS-SECTION VIEW

CONCRETE
TRANSITION COLLAR
DETAIL

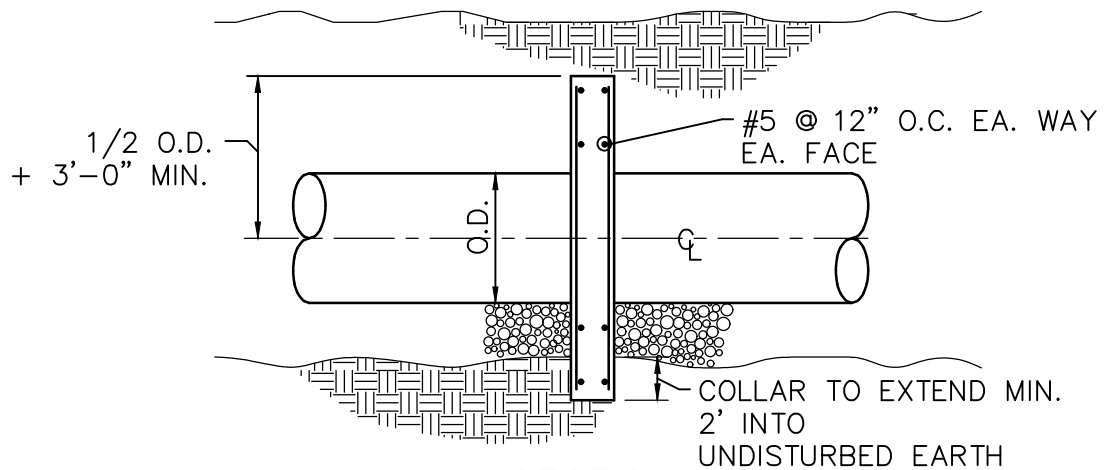
SCALE: N.T.S.

DATE: NOVEMBER 2019

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PLAN



SECTION

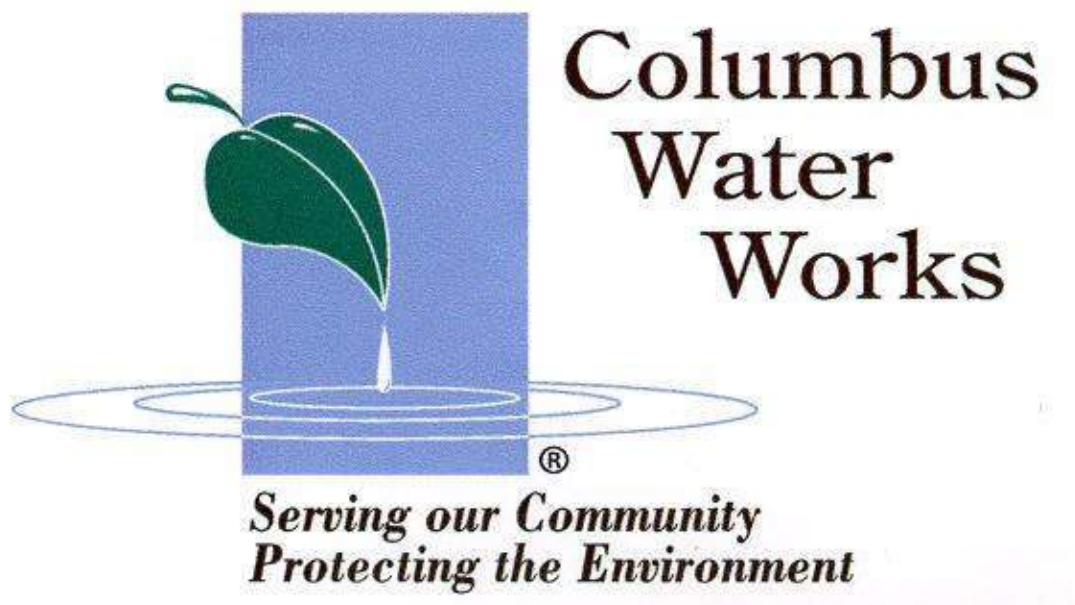
WATERSTOP COLLAR DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

S-22

Specifications and Details for the Design and Construction of Water Systems



Fort Moore

2023

SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF WATER SYSTEMS-FORT MOORE, GEORGIA

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SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF WATER SYSTEMS-FORT MOORE, GEORGIA

Section 1.01 – Purpose:

This section of the Specifications describes materials to be incorporated into water lines and requirements for installation and use of these materials. The Contractor shall furnish all materials and perform all labor necessary to fulfill the requirements of these Specifications.

Compliance with these specifications by the Contractor is required to ensure a safe potable public drinking water system free from potential sources of contamination and constructed with materials approved by Columbus Water Works (CWW). Compliance with these specifications by the Contractor is a condition of acceptance of the water system into the maintenance program and creates no contractual relationship between CWW and the Contractor. CWW reserves the right to reject any installed items not in compliance with these specifications. *Columbus Water Works also reserves the right to accept exceptions to these standards if conditions warrant changes. Any proposed changes must be clearly indicated on drawings and addressed in a cover letter to CWW. Only changes approved by CWW Engineering will be acceptable.* Latent indications of deficient installation or materials of the water main and/or appurtenances will be the responsibility of the Contractor to rectify at his expense.

Section 1.02 – Definitions:

Unless the context specifically indicates otherwise, the meanings of terms used in these Specifications for the Design and Construction of Water Mains shall be as follows:

- A. “Columbus Water Works” (CWW) shall mean the operating organization working under the policies and direction of the Board of Water Commissioners.
- B. “Engineer” shall mean Owner’s/Developer’s engineer that is a licensed Professional Engineer (PE) **in the state where work is being performed.**
- C. “Division of Engineering” shall mean CWW Engineering office, which is authorized to have jurisdiction over the water system design and construction.
- D. “Owner/Developer” shall mean any individual, firm association, syndicate, partnership, corporation, trust, or any other entity proposing to subdivide land or provide water for him or for another.
- E. “Contractor” shall mean the constructor or his representative, whether doing work on a contract basis with CWW or working directly for the Owner/Developer.
- F. “Shall” is mandatory; “May” is permissive.

Section 1.03 – General:

A. Applicable Standards:

Supply all materials and perform all work in accordance with CWW standards, and American Water Works Association (AWWA) standards, latest edition, and standards referenced therein.

B. Laws and Regulations:

The Contractor's attention is directed to the fact that all applicable federal and state law, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the project throughout. The Contractor shall keep fully informed of all laws, ordinances, and regulations of the federal or state governments or authorities in any manner affecting those engaged or employed in the work or the materials used in the work and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency should be discovered in these specifications herein referred to, in relation to any such law, ordinance, regulation, order or decree, the Contractor shall herewith report the same, in writing, to CWW.

For all water systems installed within Ft. Moore Georgia, contractors shall possess a valid Georgia Utility Contractor's License and GSCWW Level IA certification. For work installed within Ft. Moore Alabama, contractors must possess any/all licensure as required by the state of Alabama. The Contractor shall at all times observe and comply with all such existing and future laws, ordinances, and regulations, and shall protect and indemnify CWW, and their agents against the violation of any such law, ordinance, regulation, order or decree, whether by the Contractor or by the contractor's employees.

The Contractor is responsible for enforcing safety in accordance with all OSHA and other applicable regulations. CWW assumes no responsibility for the Contractor's/Developer's job site safety program.

C. Lands and Rights of Way:

In order for the water distribution system to be accepted by CWW, the Contractor/Engineer shall provide all necessary record drawings to insure inclusion in the CWW mapping system for the purpose of maintaining said system. Easements will be a minimum of fifteen (15) feet wide and are granted to CWW annually by Ft. Moore based on updated maps prepared by CWW. The Contractor is required to comply with the easement terms, as provided in Appendix B of this document.

D. Testing, Inspection and Acceptance of Work:

1. Testing of Materials:

Unless otherwise specifically provided for in the Specifications, the inspection and testing of products to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by the CWW; the cost of such inspection and

testing shall be paid by the Contractor. The Contractor shall furnish evidence, satisfactory to CWW, that the products have passed the required tests prior to their incorporation into the work. The Contractor shall promptly segregate and remove rejected products from the site of the work.

2. Inspection:

The Contractor shall furnish CWW with every reasonable facility for ascertaining whether or not the work performed and products used are in accordance with the requirements and intent of the Specifications. No work shall be done or products used without suitable inspection by CWW. Failure to reject any defective work or product shall not in any way prevent later rejection when such defects are discovered or obligate CWW to final acceptance.

3. Authority and Duties of CWW Inspector:

The Inspector will be authorized to inspect all work done and all products furnished, including preparation, fabrication and manufacture of the products to be used. The Inspector may reject material and workmanship or suspend the work until any question at issue can be referred to and decided by CWW and/or the Contractor/Engineer. The responsibility of the Contractor is not lessened by the presence of the Inspector.

4. Acceptance of Work and Materials:

All products furnished and all work done that is not in accordance with the approved drawings or specifications or that is defective will be rejected. All rejected products or work shall be removed. All unacceptable products or work shall be replaced with other products or work that conforms to the approved drawings and specifications. Service will not be allowed until installation is acceptable to CWW.

5. Contractor's Responsibilities:

Inspection of the work will not relieve the Contractor of any obligations to meet the requirements of the Specifications and defective work shall be made good regardless of whether such work has been previously inspected and accepted. The failure of CWW to reject improper work shall not be considered a waiver of any defect, which may be discovered later.

Section 1.04 - Sequence of Activities:

The following is the sequence of steps which will be required for preliminary activities as well as construction and final acceptance activities for successful acceptance of the water system by CWW:

- Submit to CWW Division of Engineering electronic (PDF) of construction drawings for water and sanitary sewer review.
- CWW review of drawings.

- CWW sends required changes/notes to submitting Engineer and/or Corps of Engineers (COE) and keeps a file copy.
- Engineer's review (transpose CWW mark-ups onto construction drawings).
- Engineer returns five (5) transposed drawings (3 full sets, plus 2 additional site plan sheets) for approval.
- CWW reviews, stamps and sends back one (1) approved set of drawings with the Approved for Construction letter. The "Approved for Construction" status is valid for one (1) year from date of approval.
- Engineer of record submits the 144R to Fort Moore Environmental.
- Fort Moore Fire Department must approve fire hydrant placement and spacing, post indicator valve location, and Fire Department connections.
- At the pre-construction conference, the CWW Inspector will give the Contractor an approved set of plans and go over the approved plans, discuss the dates of construction, and review anticipated procedures.
- One (1) copy of the CWW stamped approved plans shall be maintained on site by the contractor at all times.
- Notify CWW Inspector forty-eight (48) hours before construction begins.
- CWW Inspector checks and approves all stockpiled materials prior to construction.
- To coordinate flushing of a new line, call the CWW Inspector and give at least a forty-eight (48) hour notice.
- Give twenty-four (24) hours' notice to the CWW Inspector to pressure test the system.
- Contractor will disinfect the line and CWW will take water samples. Lab results will be provided in seventy-two (72) hours. This information will be given to the Contractor.
- Contractor/Engineer shall submit as-built drawings to CWW for approval. See Section 1.20.
- CWW will accept the system for maintenance upon receipt of approved water sample and all as-built drawings.

The following is a more in-depth explanation of the above steps and should be thoroughly studied:

A. Construction Drawings:

1. The Engineer will be required to furnish two (2) full sets of preliminary construction plans to Columbus Water Works Engineering Department for review and comment. The plans must include the Engineer's water system design. Additional copies needed by the Contractor will be submitted as required. *The Engineer will need to allow for easements on the design. Typical easements are fifteen (15) feet wide and should allow for the infrastructure to remain accessible for maintenance. The first submittal should also include any phase lines for subdivisions.*
2. CWW Division of Engineering will review the submitted construction plans and make changes as necessary to indicate to the Contractor/Engineer any changes which need to be made prior to construction activity. *CWW will indicate the disinfection tap location on the submittal plans.* CWW Engineering will review the plans, but the responsibility for the design will be with the Engineer. Any plans marked "Amend and Resubmit"

or “Rejected” will require a resubmittal prior to construction. Plans marked “No Exceptions Taken” or “Make Corrections Noted” may also be stamped approved for construction by Columbus Water Works Engineering. In this case, a Contractor is permitted to begin construction activities.

3. All drawings submitted to CWW Engineering shall be stamped by a Professional Engineer registered in the State where the project is located. The Engineer is responsible for checking water pressure and available flow and basing his design accordingly. The drawings shall include the following basic information:
 - Engineer’s name, address, and phone number.
 - Contractor’s name, address, and phone number.
 - Subdivision identification or project identification, revision number of the plans, scale, date of latest revision, north arrow, and sheet number.

B. Submittals Required:

The Contractor/Engineer shall furnish drawings and descriptive literature for all manufactured and fabricated products to CWW for review. Additional information such as special drawings, schedules, calculations, system curves, etc., shall be provided as requested by CWW.

C. Site Plan Drawings:

The Contractor/Developer shall review and check drawings and submittals and shall indicate approval by initials and date. Contractor/Developer shall furnish CWW three (3) full sets and two (2) site plans of construction drawings of all submittals. A transmittal form shall accompany each submittal or group of submittals.

D. Columbus Water Works Review:

All submittals will be reviewed, stamped and dated by CWW before being returned to the Engineer with the following acceptance comments:

1. No Exceptions Taken: Plans are approved without modification.
2. Make Corrections Noted: Comply with comments marked on drawings by CWW. Plans are approved.
3. Amend and Resubmit: Comments are excessive. Make necessary changes and resubmit.
4. Rejected: Drawings are insubstantial and/or non-compliant with Specifications; return to the Engineer.

E. Drawings for Construction:

Drawings or other submittals not bearing the CWW approval stamp shall not be utilized for construction purposes. The Contractor/Engineer shall maintain a complete set of construction drawings at the job site bearing the CWW approval color stamp.

F. Construction Notification:

It shall be the responsibility of the Contractor/Engineer to notify the CWW Division of Engineering of the date of the pre-construction meeting and name of the Contractor performing said construction, as well as his address and telephone number.

G. Construction and Inspection Procedure:

Curb and Gutter should be in prior to the water main, unless approved by CWW Inspector. Avoid valve boxes in the curb and gutter. Also, ensure that meter boxes are installed in the correct horizontal location and that water mains are installed at the correct depths according to the approved plans.

The Contractor will install the water main including all fittings, blockings, etc., along with all service lines, meter boxes or vaults, curb stops, corporation stops, fire hydrant assemblies, etc. A CWW pre-approved Contractor shall make the required connections to the existing water system. Installation of water mains shall be in accordance with the following procedures:

1. Notify the CWW Inspector forty-eight (48) hours before any pipe is to be laid. Where the waterline is to be installed along a road, all curbing must be in place. The pipe, fittings, gaskets, etc., must be on the site and ready to be inspected. A pre-construction conference is required with the CWW Inspector on site. *The approved CWW stamped plans will be given to the Contractor at this meeting.*
2. After materials on the site have been approved, installation can begin. Do not backfill over any locations where fittings have been used or thrust blocking is to be placed. The Inspector must approve all tees, bends, reducers, retainer glands, blow-offs, valves, hydrants, taps of any kind, etc., before backfilling. Service locations must be marked on curb or pavement edge with a blue "M".
3. The Contractor shall coordinate with the Inspector which ends of the pipe to leave open for the initial flushing. The Contractor shall supply all materials deemed necessary by the Inspector to facilitate the flushing. Forty-eight (48) hour notice shall be given to the CWW Inspector prior to the flushing. CWW will operate all existing valves. The Inspector must approve the initial flushing, including service lines. The Contractor shall leave corporation stops open until tested.
4. After all meter boxes are installed in their permanent locations, the pressure test shall be performed by the Contractor. Twenty-four (24) hour notice shall be given to the CWW Inspector prior to pressure testing the system. The Contractor shall provide the

pressure gauge and flow meter to be used in the test. If approved by the Inspector, a clean uniformly shaped container may be used to supply water for the test in lieu of a water meter. See Section 1.17 for test procedure and allowable leakage.

5. The approved Contractor shall make all taps to the existing water system. Connection to dead end lines shall be made in presence of the CWW Inspector. *CWW does not locate water lines that have not yet been accepted.*
6. Pressure testing shall be done in accordance with Section 1.17 of these specifications. Upon successful completion of the pressure test, the Contractor/Developer shall disinfect the system, in accordance with Section 1.18, and the CWW Inspector will sample the water for the CWW lab to test. Results from the lab test normally take seventy-two (72) hours. After Laboratory approval, the water line may be put into service.
7. After passing results from the water samples have been obtained and as-built drawings have been accepted, the Contractor will be notified that the lines are accepted for maintenance by CWW. *Note: The new water system must be put into use quickly, or stagnation will occur. In this event, the Contractor may need to re-chlorinate/flush the system. Any measures necessary to disinfect systems after initial disinfection will be the responsibility of the Contractor.*
8. Field changes may be worked out with an onsite review with the CWW Inspector, Contractor, and Engineer. Agreed to changes will be noted on the Inspector's drawings, initialed by the parties in attendance, and verified on the as-built drawings.
9. Numbers to Call:

Inspection:	(706) 575-3342
Engineering:	(706) 577-1571
Field Services:	(706) 689-2645
Coordinator:	(706) 505-8954

H. As-Built Drawings:

See Section 1.20 – Requirements for As-Built Drawings.

I. Final Acceptance:

Final Acceptance into the water system will take place upon receipt by CWW of passing water samples and as-built drawings. CWW must have a copy of the as-built drawing before water service will be provided. Once the as-built is provided, then the water service will be turned on. CWW will only accept the main line for maintenance when all other utilities are in, the meter and valve boxes are properly set and the as-built has been accepted by CWW.

Section 1.05 – Materials:

Contractor shall furnish all pipe, fittings, valves, hydrants, and other material required for completion of the work. All material shall be manufactured in the United States unless

approved by CWW. All material must comply with the “Reduction in Lead in Drinking Water Act” as adopted by the Safe Water Drinking Act. Materials will be in accordance with the following:

A. Description:

This section includes requirements for furnishing ductile iron pipe and fittings. The term “Manufacturer” shall mean an organization, which has at least ten (10) years’ experience in producing and furnishing ductile iron pipe of the type, size and class specified. All manufacture and testing of ductile iron pipe will be conducted in facilities located in the U.S.A. and operating under laws and regulations of the U.S.A.

B. Quality Assurance:

1. All pipe material suppliers shall be ISO registered or provide the services of an independent inspection agency. Prior to the start of manufacturing, any manufacturer not meeting the ISO registration requirements, shall submit to CWW the name of an independent inspection agency for approval. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical tests, sample visual inspection of quality assurance tests performed on in-process pipe and fittings, and a sample visual and dimensional inspection of finished product for this project. Chemical samples shall be taken from each ladle of iron and the Manufacturer’s chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus, silicon, magnesium, chromium, manganese, tin, aluminum, cerium, copper, and lead. When chemical values fall outside the Manufacturer’s control limits, additional mechanical property tests shall be performed to assure minimum mechanical properties are met.
2. All push on joint pipe four (4) inch to sixteen (16) inch diameter (distribution) shall be gage full length per the following table. However, all distribution mains will be eight (8) inch diameter unless approved by CWW. Fire Hydrant leads will be six (6) inch diameter minimum. If requested by the Owner, the Manufacturer shall provide necessary data supporting compliance with this specification:

Size Inches	Outside Diameter Inches	Tolerance Inches
4	4.80	+/- 0.06
6	6.90	+/- 0.06
8	9.05	+/- 0.06
10	11.10	+/- 0.06
12	13.20	+/- 0.06
14	15.30	+0.05/0.08
16	17.40	+0.05/0.08

3. All push on joint pipe eighteen (18) inches and larger (transmission) shall be subjected to a factory hydrostatic test of at least five hundred (500) psi for a period of not less than ten (10) seconds after which time the pressure is to be elevated to a peak pressure

that induces a stress in the pipe wall equivalent to seventy-five (75) percent of the minimum specified yield of ductile iron (42,000 psi) as calculated by the following formula:

$$p = \frac{2f_s t}{D}$$

Where: p = peak hydrostatic pressure
 f_s = stress in pipe wall during hydrostatic test, which shall be 0.75 times the minimum yield strength of the ductile iron in tension, i.e.: 42,000 psi
 t = nominal wall thickness, in.
 D = outside diameter, in.

All transmission pipes shall be furnished gage full length when requested by the Owner/Engineer.

4. Submit affidavits of compliance from the Manufacturer for the following:
 - a. Ductile iron pipe in accordance with the requirements of AWWA C151/ANSI A21.51 and these specifications.
 - b. Cement mortar lining of ductile iron pipe in accordance with the requirements of AWWA C104/ANSI A21.4 and these specifications.
 - c. Rubber gasket joints for ductile iron pressure pipe in accordance with the requirements of AWWA C111/ANSI A21.11 and these specifications.
 - d. Manufacturing facility has been producing ductile iron pipe of specified diameter, dimensions and standards for at least ten (10) years.
 - e. Manufacturer's written certification of compliance with NSF 61, NSF 372, and lead-free requirements of U.S. State and Federal laws.
 - f. All pipe shall be certified that it is in compliance with this specification and shall be certified by a Professional Engineer.
5. Within forty-eight (48) hours' notice from CWW and its agents will be allowed a full inspection of the DIP manufacturing operations, testing procedures, and quality compliance documentation.

C. Ductile Iron Pipe:

1. All D.I.P. shall be furnished in lengths eighteen (18) to twenty (20) nominal feet. D.I.P. shall be manufactured by American Cast Iron Pipe Company or U.S. Pipe and shall be made in the U.S.A. unless approved by CWW.

2. Ductile iron pipe shall conform to AWWA/ANSI A21.51. All pipe shall have a minimum pressure rating as indicated below, or as indicated on contract drawings:

<u>Pipe Sizes (inches)</u>	<u>Pressure Class (psi)</u>
04 - 12	350
14 - 20	250
24	200
30 - 64	150

3. Ductile iron pipe shall with cement lined in accordance with AWWA C104. Pipe shall be furnished with a bituminous outside coating. Manufacturer shall demonstrate ability to produce a high-performance lining. Plans/specifications may call for the exterior of ductile iron pipe to be coated with a layer of arc-sprayed zinc. The mass of the zinc applied shall be two hundred (200) g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than three (3) mils with a local minimum not less than two (2) mils. All pipe shall be manufactured and coated in the United States at the pipe Manufacturer's facility. Soil conditions may require a V Bio Poly wrap approved by DIPRA.
4. Push-on joints for ductile iron pipe shall be rubber gasket joints in accordance with the applicable requirements of AWWA C111/ANSI A21.11. Standard push-on joints shall not exceed the Manufacturer's specifications. Standard and special deflection bells shall not exceed the Manufacturer's specifications.
5. Restrained joints: Where restrained joint pipe (RJP) is shown on the Drawings, restrained joints for pipe diameters 16-inch and less shall be manufactured restrained joint, mechanical joint fitting with retainer gland or restraining gasket joint as specified below.
- Manufactured restrained joints shall be American "Flex-Ring" or "Lok-Ring"; U.S. Pipe "TR FLEX" or "HP LOK"; or Amarillo Fast Grip; or Barracuda Gaskets." No field welding of restrained joint pipe will be permitted.
 - Restraining gasket joints shall be assembled with American Fast-Grip gaskets or U.S. Pipe FIELD LOK gaskets but may only be used in lieu of manufactured restrained joints where approved by the Engineer.
 - Retainer glands on a mechanical joint may be used as a restrained joint only where retainer glands are specifically shown on the Drawings or where specifically specified.
 - Where retainer glands are allowed, in lieu of retainer glands specified elsewhere, the joint may be assembled with US Pipe MJ FIELD LOK gasket.

- e. No field welding for manufactured restrained joint pipe assembly will be permitted. Where field cutting of restrained joint pipe is required, the joint may be assembled with American Field Flex-Rings, US Pipe TR FLEX GRIPPER Rings, or a mechanical joint fitting with retainer gland may be used.
 - f. All “restrained” bells shall be painted yellow.
- 6. Mechanical joints for ductile iron pipe shall be rubber gasket joints in accordance with the applicable requirements of AWWA C111/ANSI A21.11. Mechanical joints shall not exceed the Manufacturer’s specifications. The pressure rating for mechanical joints shall be a minimum of two hundred and fifty (250) psi.
 - 7. Pipe Manufacturer may be required to provide a Manufacturer’s representative for product design and installations seminars and provide on-site review of material as requested by CWW.
 - 8. All fittings thirty (30) inches and larger shall be manufactured in the U.S.A. (unless approved by CWW). Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum working pressure of two hundred and fifty (250) psi. Fittings shall be cement lined in accordance with AWWA C104 and shall be furnished with a bituminous outside coating. In lieu of cement lining and bituminous coating, fittings may be provided with a fusion bonded coating and lining meeting the requirements of AWWA C116.

D. Gate Valves (GV):

Gate valves shall be resilient seat type conforming to the requirements of AWWA C-515 and shall be American Flow Control, M&H, or Mueller. Gate valves to be placed per Detail A-3 and/or Detail A-8. In line valves should be placed at a minimum of two thousand (2,000) L.F. on straight line runs. Valve ends shall be mechanical joint type equivalent to Romac Alpha, except where flanged ends are required. Valves shall open left, have a two (2) inch square operating nut and have “O”-ring type stem seals. Buried valves shall be equipped with valve boxes. If operating nut is not within three (3) feet of finish grade, then Valve Stem Risers are required. Valves, including geared valves, shall be non-rising stem type. Side actuated gate valve may be required by CWW.

E. Butterfly Valves (BV):

Use of Butterfly valves will be based on CWW approval. Butterfly valves shall be resilient seat type conforming to the requirements of AWWA C-504 and shall be American Flow Control, M & H or Mueller. Valves sixteen (16) inches and larger shall be gear operated. Valve ends shall be mechanical joint type except where flanged ends are required. Valves shall open left, have a two (2) inch square operating nut and shall have veering stem seals. Buried valves shall be equipped with valve boxes. Provide extension stems where required to bring operating nut to within three (3) feet of finish grade.

F. Flange Joints:

Provide gaskets for flange joints made of one-eighth (1/8) inch thick rubber. Gaskets may be ring type or full-face type. Provide bolts for flange connections. Bolts shall be steel with American regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagon dimensions, all as specified in ANSI B-17.2. All bolts and all nuts shall be threaded in accordance with ANSI B-1.1, Coarse Thread Series, Class 2A and 2B fit.

G. Valve Boxes (VB):

All buried valves shall be equipped with valve boxes. Valve boxes shall be eight (8) inch PVC. A cast iron ring and cover manufactured to CWW Standards shall be used. A lockable Valve Box purchased from CWW is required on meter bypass valves and may be required on fire line isolation valves. Location will be shown on the approved plans. Manufactured valve boxes may be used. These valve boxes when under pavement shall be adjustable to six (6) inches up or down from the nominal required cover over the pipe. Typical valve box details are included in Drawings A-7 and A-23.

H. Tapping Sleeves, Valves, and Service Saddles:

1. Tapping sleeves shall be the fabricated type, with all parts of stainless-steel construction or epoxy coated. The tapping sleeve shall be manufactured by JCM Industries, Inc., type 412, 414, 415, 452 or Ford Meter Box Company, Inc., models FTSAS, FAST, or FTSC. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve.
2. Tapping valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connections to the tapping sleeve and mechanical joint connection to the branch pipe.
3. CWW reserves the right to select type based on location, age/condition of main or size of branch tap.
4. Install, torque, and hydrostatically test using water to two hundred (200) psi for a minimum of ten (10) minutes. Follow the manufactures instructions and AWWA 223 recommendations for installation. CWW Inspector must be present during install, torque and test.
5. Connections to water main piping shall be by service saddle or by the direct tap method, as shown in the details (See Detail A-26), in full accordance with AWWA requirements. Service saddles shall be ductile iron body type with "O"-ring rubber gasket and double alloy steel straps. Saddles shall be manufactured by JCM Industries, Inc., type 402, Smith-Blair model 313, or Mueller DR2A series.

I. Fire Hydrants (Comply with UFC and NFPA):

1. All fire hydrants shall conform to the requirements of AWWA C-502 for two hundred and fifty (250) psi working pressure. Hydrants shall be the compression type and close with line pressure. The valve opening shall be a minimum five and one quarter (5 ¼) inches. Hydrants shall open left, have two (2) two and one half (2 ½) inch nozzles and one (1) Storz connection. The operating nut shall be a one and one half (1 ½) inch pentagon and the hydrant barrel shall be painted yellow. (See Detail A-23).
2. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.
3. This means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight (8) different directions.
4. Hydrants shall be fully bronze-mounted with all working parts made of bronze. The valve seat ring shall be bronze and shall screw into a bronze retainer.
5. Two (2) hose and one (1) pumper connection shall be breech locked, pinned, or threaded and pinned. Hydrants shall be furnished with a mechanical joint connection to the spigot of the six (6) inch hydrant lead equivalent to Romac Alpha.
6. Minimum depths of bury shall be three (3) feet to top of pipe. Provide extension section where necessary for vertical installation and in accordance with Manufacturers' recommendations.
7. All outside surfaces of the barrel above grade shall be painted with Koppers Glamortex 501 enamel with yellow color. Hydrants shall be American-Darling B-84-B. Spacing along water mains is in accordance with the Fort Moore department.
8. All new fire hydrants shall be flow tested and color coded in accordance with NFPA 291. Refer to section 1.18(E) for color codes. Curb shall be painted red ten (10) feet each side of hydrant. Blue reflector shall be placed at centerline of road.
9. Refer to detail A-23 for notes on restraint.

J. Couplings:

Couplings shall be Dresser Style 38. Couplings requiring thrust restraint shall be equipped with four (4) steel tie-bolts extending from steel lugs welded on the pipe to lugs welded on the middle ring of the coupling. Lugs shall be shop welded and delivered to the job site ready for installation.

K. Valve Markers (VM):

Concrete valve markers shall be supplied when required by CWW.

L. Service Lines:

Type K- Dimensions of Seamless Copper tubes according to ASTM B88							
Nominal Size (inches)	Actual Outside Diameter (inches)		Tolerance on Outside Diameter (inches)		Wall Thickness (inches)		Weight (lb/ft)
					Nominal	Tolerance	
3/4	7/8	0.875	0.003	0.001	0.065	0.006	0.641
1	1 1/8	1.125	0.0035	0.0015	0.065	0.006	0.837
1 1/2	1 5/8	1.625	0.0045	0.002	0.072	0.007	1.36
2	2 1/8	2.125	0.005	0.002	0.083	0.008	2.06

Service lines shall be type “k” soft copper and a minimum three quarters ($\frac{3}{4}$) inch inside diameter, maximum two (2) inch with six hundred twenty-five ten thousandths (0.0625) inch wall thickness. Unions shall be cast bronze and not be used under pavement. Service lines larger than two (2) inches will be Ductile Iron. Fittings shall be brass with compression connection inlet and outlets per ANSI B16.26. All service lines will be metered to include all size fire lines (if required by Fort Moore and/or CWW).

M. Backflow Prevention Devices:

Backflow prevention is required on all new services. The potable water system shall be protected from actual or potential contamination by conforming to the CWW Cross-Connection Control Program and the Georgia Safe Drinking Water Act which includes the “Reduction in Lead Drinking Water Act”. All installations must conform to the guidelines set forth by the SBCCI, AWWA M-14, and EPA guidelines for cross-connection control.

Inquiries related to cross-connection control should be directed to the Program Manager, phone (706)649-3490.

Backflow preventers shall be double check valve for domestic services and shall be Ames/Watts Series 007. For High Hazard service, it shall be an RPZ type. Fire services shall be double detector check valve and shall be manufactured by Ames or Watts.

N. Corporation Stops:

- 3/4” Mueller H-15008, McDonalds 4701-T, or equivalent
- 1” Mueller B-25170R, McDonalds 4701-T, or equivalent
- 1 1/2” Mueller B-25008, McDonalds 4701-BT, or equivalent
- 2” Mueller B-25008, McDonalds 4701-BT, or equivalent

O. Curb Stops:

- 3/4” Mueller B-25170 or McDonalds 6102-TW.

- 1" Mueller B-25170 or McDonalds 6102-TW.
- 1 ½" Gate Valve, gate thread non-rising stem Stockham B-103 or Milwaukee 105.
- 2" Gate Valve, gate thread non-rising stem Stockham B-103 or Milwaukee 105.

P. Meters Vaults and Boxes:

- 5/8" meter goes in a Carson 1015-12 or D-1200.
- 1" meter goes in a Carson 1015-12 or D-1200.
- 1 ½" meter goes in a Carson 1730-18.
- 2" meter goes in a Carson 1730-18.

Contractor shall provide a vault for meter sizes three (3) inch and above, as well as banks of meters. The vault design shall be as shown on drawing A-1 or A-2, or approved submittal. Vaults shall have positive drainage or water tight lids. All meters will be Neptune ® style. All meters must be compatible or read with the Aclara TWACS (Two Way Automatic Communication System) Automated Metering Infrastructure.

Q. Combined Residential Domestic and Fire Service:

Combined domestic and fire must comply with latest version of the NFPA and specifically NFPA-13R. Plans must be submitted to CWW for review but must be approved by the local or state Fire Marshal. The only approved meter for this type of service is the two (2) inch TRU-FLOW Neptune meter. See detail A-28.

R. Thrust Restraint:

See Section 1.13 – Thrust Restraint.

S. Line Stop (Plugging Device):

Usage to be determined by CWW Engineering Department. This method is to ensure minimal customer service outages on existing mains within the CWW Water Distribution System. Hydra-Stop, Inc., Flowserve, TDW services, or Rangeline are the only CWW approved plugging devices for Cast Iron and Ductile Iron materials.

T. Pressure Reducing Valves (PRV):

Pressure Reducing Valve is required on all private services if static pressure will be eighty (80) psi or greater per International Plumbing Code (2009). CWW is not responsible for the installation and maintenance of PRV. Pressure reducing valves shall be Watts Series LF25AUB-23 or Apollo 36LF Series.

U. Blow Off Assembly:

Blow off Assembly shall be per CWW Detail `A-11.

V. Detection Tape:

1. Detection tape is required for all water mains and service lines.
2. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Blue, "Caution: Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum two (2) inches when buried less than ten (10) inches below the surface. Tape width shall be minimum three (3) inches when buried greater than ten (10) inches and less than twenty (20) inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

Section 1.06 – Handling Materials:

Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

A. Handling:

Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift or front loader. Do not use material damaged in handling.

B. Distribution:

Distribute and place pipe and materials so as to not interfere with traffic. Do not string pipe more than one thousand (1,000) feet beyond the area where pipe is being laid. Do not obstruct drainage ditches or create a traffic hazard.

C. Storage:

Store all pipes which cannot be distributed along the route. Make arrangements for the use of suitable storage areas with CWW Inspector.

Section 1.07 – Construction along Highways, Streets and Roadways:

Install pipe lines and accessories along highways, streets, and roadways in accordance with the applicable regulations of the Georgia Department of Transportation, CWW and/or Department of Public Works (DPW) with reference to construction operations, safety, traffic control, road maintenance and repair. Refer to sections 1.15 and 1.16 for additional roadway requirements. Water mains will generally be located on the south and west sides of roads, unless otherwise approved by CWW and/or DPW. Advertise in the Bayonet for two (2) weeks prior to starting work.

A. Protection of Traffic:

Provide and maintain suitable signs, barricades and lights for protection of traffic. Removal of highway signs for construction shall be under permission of the Georgia Department of Transportation or the Columbus Consolidated Government. Do not close or block any highway, street or roadway without first obtaining permission from the proper authorities. Traffic control shall conform to the Manual on Uniform Traffic Control Devices for Streets and Highways. Manuals may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington DC., 404 Publication Number FHWA-SA-89-006 (or latest revision). Flagmen shall be certified by a GDOT approved flagman training program.

B. Construction Operations:

In accordance with Georgia law, the Contractor shall call 811 to request marking of utilities in all areas in which construction activities are scheduled. Perform all work along highways, streets and roadways to least interfere with traffic.

1. Clearing and Grubbing:

Erosion control measures shall be installed in accordance with approved drawings and all applicable regulations prior to clearing and grubbing and shall be properly maintained during the life of the project.

2. Trenching, Laying and Backfilling:

Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day maintaining positive drainage, which does not impact traffic.

3. Shaping:

Reshape damaged slopes, side ditches and ditch lines immediately after completing backfill operations. Replace topsoil if necessary to re-establish sod and other landscaping removed from shoulders.

C. Excavated Materials:

Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered and excavated material off the pavement. Wash the street if necessary.

D. Drainage Structures:

Keep all ditches, culverts, cross drains and other drainage structures clear of excavated material and free to drain at all times.

E. Maintaining Highways, Streets, Roadways and Driveways:

Maintain streets, highways and roadways in suitable condition for movement of traffic until completion and final acceptance of the work. Use street plates to maintain traffic until pavement replacement is completed.

F. Piping Location:

Piping shall be installed at a minimum of five (5) feet behind the roadway curbing or pavement edge. Where possible, pipe will be located on the south or west side of roadways.

G. Easements:

See Section 1.03 (c).

H. Water Meter Locations along Roadways:

Final meter locations will be within the right-of-way as indicated on Drawing A-29. No meter boxes will be located in driveways, sidewalks, pedestrian pathways or ditches. Corporation stops and curb stops shall not be installed under pavement unless allowed by the Inspector. Meters that must be relocated by CWW after acceptance will be moved by CWW at the Contractor's expense.

Section 1.08 – Existing Underground Utilities, Landfills, and Obstructions:

It is the responsibility of the Contractor to locate all existing utilities along the path of construction. Drawings shall indicate underground utilities or obstructions that are known to exist. Where these or unforeseen underground utilities are encountered, the location and alignment may be changed, upon approval of CWW, to avoid interference. Such changes will be marked up on Contractor's and Inspector's construction drawings and the as-built plans. No water mains will be accepted that are installed through or in close proximity to an abandoned landfill site or any other site used for waste disposal.

Section 1.09 – Water and Sewer Separation:

Water mains shall maintain a minimum ten (10) foot edge to edge separation from sewer lines, whether the sewer operates by gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the ten (10) foot horizontal separation, the water main must be separated a minimum of eighteen (18) inches above the top of the sewer. Where the water main crosses a sewer line, an eighteen (18) inch vertical separation shall be maintained and a full joint of water pipe shall be centered over the sewer line. Adjustments to this shall be made by CWW.

No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

Section 1.10 – Connection to Existing Pipe Lines:

CWW or their approved Contractor will make connections to existing pipe lines with tapping sleeves, valves, and other necessary materials. Service lines two (2) inches in diameter or less shall be by service saddle or direct tap based on Detail A-26. CWW will operate all existing valves and new valves that directly connect a new system to the existing distribution system.

A. Location:

Before laying pipe, locate the points of connection to existing pipe lines and uncover as necessary for CWW to confirm the nature of the connection to be made.

B. Interruption of Services:

CWW or their Contractor will make connections to existing pipe lines only when system operations permit. Operation of existing valves will be the sole responsibility of the CWW. Tampering with valves is illegal and fines may be levied.

Section 1.11 – Excavation:

Excavate all material encountered and dispose of excess excavated material not required for backfilling in accordance with applicable local, state and federal regulations.

A. Depth of Trenches:

Excavate trenches to provide a minimum cover of three (3) feet to top of pipe. Within the proximity of highways, streets, or roadways, excavate to place the top of the pipe at a minimum of four (4) feet below the nearest pavement edge, and at least two (2) feet below the bottom of the drainage ditch.

B. Width of Trenches:

Excavate trenches wide enough to allow proper installation of pipe, fittings, and other materials, and not less than six (6) inches clear of the outside barrel of the pipe on any side at any point.

C. Bell Holes:

At each joint, excavate bell holes to a depth and width to permit the joint to be made properly and to relieve any stresses on the pipe bell.

D. Earth Excavation:

Excavate and prepare the trench bottom to support the pipe uniformly throughout its length. For ductile iron pipe, the trench shall meet the requirements of Standard Laying Condition Type 2 in accordance with AWWA C-151. If the trench is excavated to excessive width or depth, provide sand or gravel to achieve Standard Laying Condition Type 4 in accordance with AWWA C-151. (See Detail A-30).

E. Bracing and Sheeting:

When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities or trees which are specifically required to remain, provide bracing and sheeting. 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 CWW it cannot be safely removed. Cut off sheeting left in place at least two (2) feet below the surface.

1. Timber:

Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.

2. Steel Sheet Piling:

Continuous lock joint steel sheet piling may be substituted for timber sheeting when approved by CWW. Steel piling may be removed, without cutting, provided the rate of removal is kept in pace with the tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where ordered to be left in place by CWW for reasons of safety, will be cut off where directed.

F. De-Watering Trenches:

Maintain a water level two (2) feet below the bottom of the trench by pumping out water to continuously. Continue to de-water running sand by using well pointing. Where soil conditions do not permit the use of well pointing, construct trench drains of crushed stone or gravel to conduct water to sumps.

G. Trench Stabilization:

Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, CWW will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with crushed stone bedding material. Place and compact this material to bring the trench to the required grade. No pipe shall be laid directly on excavated rock. Trench stabilization shall be in accordance with Detail A-30.

Section 1.12 – Laying and Jointing Pipe and Fittings:

Lay all pipe and fittings to accurately conform to the lines and grades approved by CWW as follows:

A. Handling:

Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe and the cement lining. Examine all pipes carefully for cracks and other defects as it is laid. Do not use pipe or other materials which are known to be defective. Lower all pipe, fittings, valves, and accessories into the trench by suitable means. Do not drop or dump pipe or accessories into the trench. If any pipe or other material is discovered to be defective or damaged after being laid, remove and replace it. Clean pipe and fittings thoroughly before laying. Keep the pipe line clean until final acceptance.

B. Alignment and Gradient:

Lay pipe straight in alignment and gradient or follow true curves as nearly as practical. Do not deflect any joint more than two-thirds (2/3) the maximum deflection recommended by the Manufacturer. Maintain suitable equipment along with competent personnel on the job to lay out angles and ensure that deflection allowances are not exceeded.

C. Expediting Work:

Do all of the following promptly: excavate the trench, call for inspection, install the pipe, fittings and hydrants, and backfill as soon as possible. Notify the CWW Ft. Moore Engineering Department twenty-four (24) hours before backfilling is to commence. All thrust restraint must be in place at time of inspection. The contractor must receive approval to backfill by the Inspector. Any deficiencies noted by the Inspector must be brought into compliance and a second inspection must be scheduled, as directed by CWW.

Do not leave un-jointed pipe in the trench. Backfill and compact as soon as possible after laying and jointing is completed. Plug the exposed end of the installed pipe each day at the close of work with an approved plug and at all other times when work is not in progress, pipe must be sealed with an approved plug. If necessary to backfill over the end of an uncompleted pipe, close the end with an approved plug.

D. Laying Pipe in Trenches:

Lay the pipe with solid bearing throughout its length. Pipe bedding shall be as specified in AWWA C-151 or last revision. Refer to typical Detail A-30.

1. Earth Trenches:

Grade the bottom of the trench to a true line. Lay the pipe in clean bedding material, free of rock, organics and other unsuitable materials.

2. Wet Trenches:

Do not lay pipe in water. Provide de-watering equipment to maintain a ground water level two (2) feet below the bottom of the pipe while the pipe is being laid.

3. Blasted Rock Trenches:

Do not lay pipe directly on to blasted rock. Keep a minimum six (6) inch layer of crushed stone underneath the pipe at the highest peak of the blasted rock as in Detail A-30.

E. Joints:

1. Push-On Type Joints:

Push-on type joints shall be made in accordance with the Manufacturer's recommendations.

2. Mechanical Joints:

Make mechanical joints in accordance with the Manufacturer's recommendations.

3. Flange Joints:

See Section 1.05 (f).

F. Cutting:

Cut ductile iron pipe using an abrasive wheel saw. Remove all burrs and smooth the end before jointing.

Section 1.13 – Thrust Restraint

Provide restraint at all points where hydraulic thrust may develop. All thrust restraint systems must be approved by CWW. See Details A-13 thru A-22. Gaskets shall meet the requirements of AWWA/ANSI/A21.11 and shall be ANSI/NSF Standard 61 certified. In conjunction with the Details, below are the only current approved methods of thrust restraint:

A. Concrete Blocking:

Provide concrete blocking for all bends, tees and other points where thrust may develop. Concrete blocking shall have a compressive strength of not less than three thousand (3,000) psi, with no less than five and one half (5.5) bags of cement per cubic yard and a slump between three (3) and five (5) inches. Ready mixed concrete shall be mixed and transported in accordance with ASTM C-94. Concrete blocking shall be placed against undisturbed earth.

B. Harnessing:

Install harness rods with eyebolts only where specifically directed by the Columbus Water Works. Harness rods shall be manufactured in accordance with ASTM A-36 or A-307 and shall have an allowable tensile stress not less than twenty-two thousand (22,000) psi. Harness rods shall be stainless steel, hot dip galvanized or field coated with bitumastic before backfilling.

C. Restrained Joints:

1. Manufactured restrained joints (bell and spigot) shall be American FLEX-RING or U.S. Pipe TR-FLEX.
2. Restraining gasket joints shall be assembled with American FAST-GRIP, American Amarillo FAST-GRIP or U.S. Pipe FIELD LOK.
3. All pipes with FAST-GRIP joint shall be painted with a yellow band around the pipe bell.

D. Mechanical Joint Retainer Glands:

Mechanical joint retainer glands for joining pipes to mechanical joint fittings shall be Megalug Series 1100, as manufactured by EBAA Iron, Uni-Flange Series 1400, as manufactured by Ford Meter Box Company, Star Pipe Products – Star Grip Series 3000, or Sigma One-Lok Series SLD for restraining fittings.

E. Thrust Collars:

Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements as specified in Section 31 23 33 – Trench Excavation and Backfill; however concrete shall have a compressive strength of not less than 3,000 psi. Welded on collars shall be attached to the pipe by the pipe manufacturer. Where thrust collars are to be installed on existing pipe, retainer glands shall be used in lieu of a welded-on collar. For use with thrust collars, retainer glands shall be of a split style as specified elsewhere in this Section. The retainer glands, as shown on the Drawings, shall be installed in opposite orientations from each other in order to account for differences in flow direction.

Section 1.14 – Backfilling:

All trenches are to be backfilled and compacted to prevent settlement and displacement of the pipe.

A. Material:

Backfill trenches with earth only. Do not use rock or organic material excavated from trenches in the backfill. If necessary, furnish suitable earth material to backfill the trench. Use select material for initial backfill.

B. Compaction:

Consolidate backfill material in the bottom of the trench and up to two (2) feet above the pipe in six (6) inch layers.

C. Initial Backfill:

1. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
2. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least eighteen (18) inches above the pipe barrel. Layer depths shall be a maximum of six (6) inches for pipe eighteen (18) inches in diameter and smaller, and a maximum of twelve (12) inches for pipe larger than eighteen (18) inches in diameter.
3. Backfill and compact on both sides of the pipe simultaneously to prevent side pressures.
4. Compact each layer thoroughly with suitable hand tools or tamping equipment.
5. Initial backfill shall be compacted to a minimum ninety (90) percent of the maximum dry density based on standard proctor unless shown or specified otherwise. The Contractor will provide the service of an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

D. Final Backfill:

1. Backfill carefully to restore the ground surface to its original condition. Remove all excavated rock from the ground surface and restore the area to a mowable condition, free from rock and deleterious materials.
2. The top six (6) inches shall be topsoil when directed by CWW.
3. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of. The site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
4. After initial backfill material has been placed and compacted, backfill with final backfill material. Final backfill shall not contain more than one-third (1/3) broken rock, of which no stone or boulder will be six (6) inches in diameter or weigh more than fifty (50) pounds. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

- In six (6) inch layers, if using light power tamping equipment such as a “jumping jack”.
 - In one (1) foot layers, if using heavy tamping equipment, use a hammer with tamping feet.
5. Settlement: If the trench settles, refill and grade the surface to conform to the adjacent surfaces. The Contractor will provide the service or an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

Section 1.15 – Removing and Replacing Pavement:

A. Removing Pavement:

Remove existing pavement as necessary for installing the pipeline and appurtenances. When pipeline crosses pavement at an angle other than perpendicular, then the pavement shall be overlaid at ninety (90) degrees to the pavement edge and replaced to the ends of the excavation. Saw cut pavement parallel to pipe as per Details A-4, A-4A and A-4B.

1. **Marking:**

Before removing any pavement, mark the pavement neatly paralleling pipe. Space the marks to the width of the trench.

2. **Breaking:**

Break asphalt pavement along the marks using jack hammers or other suitable tools as directed by CWW. Cut Portland cement concrete pavement along the marks by use of pavement saws.

3. **Machine Pulling:**

Do not pull pavement with machines until completely broken and separated from pavement to remain.

4. **Damage to Adjacent Pavement:**

Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

5. **Sidewalk:**

Remove and replace sidewalks for their full width, without installing additional joints.

6. Curbs:

Remove and replace or tunnel under any curb encountered. All pavement and/or curbing repairs or replacement will require Ft. Moore approval as a condition of acceptance.

B. Replacing Pavement:

During backfilling, arrange to have the compaction tested by an approved independent testing laboratory if required by CWW. After the compaction testing has been satisfactorily completed, then replace all pavements, sidewalks and curbs in accordance with Georgia Department of Transportation and/or Government standard details as required. Payment for all costs incurred for testing shall be the Contractor's responsibility.

Section 1.16 – Roadway Crossing:

Furnish and install pipe casing and install the pipeline therein in accordance with the drawings and in accordance with Georgia Department of Transportation specifications.

A. General:

Operate well points or drainage systems in the vicinity of the casing construction to prevent the accumulation of water in the casing and to maintain the ground water table below the casing invert.

B. Pipe Casing:

Furnish all material and equipment and perform all labor required to install steel pipe casing if required by CWW. Casings need to be placed at all roadway and driveway crossings by the Contractor for future service connections. All casings shall terminate at a three (3) foot minimum for in-line fitting or connection.

1. Boring:

The steel casing pipe shall be a minimum of Schedule 30 steel pipe manufactured from steel conforming to ASTM A-139, Grade B. Size and minimum wall thickness shall be as follows:

UNDER HIGHWAYS

<u>Pipe Diameter</u> <u>Inches</u>	<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Minimum Inches</u>
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
14	22	0.250
16	24	0.250
18	30	0.312
20	30	0.312
24	36	0.375
30	42	0.375

UNDER RAILROADS

<u>Pipe Diameter</u> <u>Inches</u>	<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Minimum Inches</u>
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.312
14	24	0.344
16	30	0.406
18	30	0.406
20	32	0.469
24	36	0.469
30	42	0.500

The outside of the casing pipe shall be primed and coated with a hot coal tar enamel a minimum of three thirty seconds (3/32) inch thick. Only new primed and coated pipe shall be used.

When casing depth exceeds fifteen (15) feet, it is the responsibility of the Contractor's Engineer to calculate the required casing wall thickness.

Install the steel pipe casing by the dry boring method. Bore the hole and install the casing through the soil simultaneously by using a cutting head on a continuous auger mounted inside the casing pipe. Lengths of casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedures. After the

boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

C. Installation of Pipe:

After installation of the casing is complete, install the pipelines as shown on the Drawings. Seal the ends of the casing with brick or End Seal manufactured by CCI models ESW or ESC. Piping inside casings shall be restrained at every joint. See Detail Drawing A-21 for restraining fittings to steel casing pipe.

D. Safety:

Provide all necessary bracing bulkheads and shields to ensure complete safety to all traffic at times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

Section 1.17 – Water Main and Accessory Abandonment:

- A. Pipelines six (6) inches in diameter or greater that are shown on the Drawings or otherwise specified to be abandoned shall be filled completely with flowable fill and plugged at all ends by use of concrete, a plug, a cap or other suitable means approved by the Engineer, in order to prevent flowable fill from escaping the pipe during flowable fill installation.
- B. Pipelines less than six (6) inches but two (2) inches or greater in diameter that are shown on the Drawings or otherwise specified to be abandoned shall be plugged at all ends by use of a plug or cap suitable for the pipe material, as approved by the Engineer, but are not required to be filled with flowable fill.
- C. Pipelines less than two (2) inches in diameter that are shown on the Drawings or otherwise specified to be abandoned shall not require any plugging of ends or filling with flowable fill.

Section 1.18 - Testing

When a length of pipe approved by CWW is ready for testing, fill the line with water, bleed out all air and conduct a leakage test. CWW will operate all valves.

A. Preparation:

Provide a test pump and all other accessories required to make the test. Provide a corporation stop at each high point on the pipe to bleed off air. Provide and remove all temporary bulkheads, plugs and flanges required to perform the pressure test.

B. Test Pressure and Leakage:

Test the pipeline at two hundred (200) psi measured at the lowest point for at least two (2) hours. Maintain the test pressure within five (5) psi of the specified test pressure for the test duration. Should the pressure drop more than five (5) psi at any time

during the test period, the pressure shall be restored to the specified test pressure. An accurate pressure gauge with graduations not greater than five (5) psi will be required. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section to maintain pressure within five (5) psi of the specified test pressure for the test duration, plus water required to the return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter or out of an approved container with a known volume.

C. Allowable Leak in Total Gallons during Water Pressure Test (AWWA C:600):

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

L = Allowable Leakage (Gallons)

S = Length of Pipe Tested (Feet)

D = Nominal diameter (inches)

P = Average Test Pressure (psi)

D. Existing Valves:

All existing valves are to be operated by CWW personnel only. Provide twenty-four (24) hours' notice for operation.

Section 1.19 – Disinfecting Pipe Lines:

A. Applicable Standard:

All water mains which are to be connected to the CWW water distribution system shall be disinfected according to Sections 1 through 7 of AWWA C-651, the AWWA Standard for Disinfecting Water Mains.

B. Form of Chlorine Used:

Acceptable forms of chlorine that may be used in the disinfecting operations are granular calcium hypochlorite and liquid sodium hypochlorite. Either material should be stored in a cool, dry and dark environment to minimize deterioration.

C. Method of Chlorination:

The only method approved for general use is the continuous Feed Method as described in the following paragraphs. The tablet method and the slug method are not acceptable alternatives. Please note that the option of placing calcium hypochlorite granules in the pipe during construction is not required.

1. It is of utmost importance that all precautions be taken during the construction phase to ensure that the new water mains are kept clean and dry. The entry of dirt and other contaminants shall be kept to a minimum. Pipe stored at the construction site must be stored with the ends elevated to ensure against entry of mud and dirt. No greater quantity of pipe shall be strung beside or in the trench than can be installed during the

current shift. At the close of each day's work, open pipe ends shall be sealed with water-tight and rodent proof plugs.

2. Before being chlorinated, the main shall be flushed to remove particulates. This flushing shall be accomplished at flow rates sufficient to produce a maximum velocity of two and one half (2.5) feet per second in the main. CWW Inspector must be notified twenty-four (24) hours in advance.
3. The chlorination shall be done in accordance with section 4.4 of AWWA C-651 Standard for Disinfecting Water Mains. The major points of this standard are summarized below.
4. Water shall be introduced into the new main from the existing distribution system at a constant, measured rate (or approximated by one of the listed means).
5. A chlorine solution shall be fed into the new main within ten (10) feet of the beginning of the new main. The concentration of the solution and the feed rate shall be adjusted so that the water in the main will have not less than twenty-five (25) mg/L of free chlorine.
6. Once the application of chlorine has begun, it shall not stop until the entire main is filled with heavily chlorinated water. The chlorinated water shall remain in the main for a minimum of twenty-four (24) hours. At the end of the twenty-four (24) hours, the chlorinated water must retain a residual of not less than ten (10) mg/L of free chlorine. Extreme care must be taken during the chlorine application and the following retention period that none of the highly chlorinated water is allowed to migrate into the existing distribution system. Valves at all fire hydrants shall be operated to ensure that every fire hydrant is disinfected.
7. The chlorinated water shall be flushed from the main as soon as practicable after the twenty-four (24) hour retention period to reduce possible corrosion damage to the pipes. All heavily chlorinated water must be dechlorinated prior to discharge to the environment. Acceptable reducing agents for neutralizing the chlorine residual include sulfur dioxide, sodium bisulfate, sodium sulfite and sodium thiosulfate. Recommended application rates vary with the chlorine residual and the chosen reducing agent but are summarized in Appendix B of AWWA C-651. A copy may be obtained from the CWW Inspector. The CWW Inspector, who will verify the neutralization of the chlorine residual in all discharged water, shall witness all dechlorinating activities.

D. Sampling and Testing:

The CWW Inspector shall obtain and transport the samples to the CWW lab. The samples must be kept on ice (if necessary) to remain below forty (40) degrees Fahrenheit. Typically, there will be one sample point at the end of each main line branch. If the samples fail bacteriological tests, the main may be re-flushed and resampled. If the resultant tests fail, the main shall be re-chlorinated until satisfactory results are obtained.

E. Fire Hydrant Flow Test:

After all testing is complete the Engineer shall coordinate flow testing of new Hydrants with the Fort Moore Fire Department and CWW. The top and caps shall be painted to indicate capacity as outlined in NFPA 291.

Light Blue = greater than 1500 gpm (5680 L/min).

Green = 1000 - 1499 gpm (3785-5875 L/min)

Orange = 500-999 gpm (1900-378)

Red = less than 500 gpm (1900 L/min)

F. Division of Responsibility:

A summary of the steps to follow and the responsible parties follows:

<u>Steps to follow</u>	<u>Responsible party</u>
1. Initial Washout	Contractor*
2. Pressure Test	Contractor*
3. Disinfect	Contractor*
4. Flush-out and dechlorinate	Contractor*
5. Water Samples	CWW

*Under CWW Inspector's supervision.

Section 1.20 – Protection and Restoration of Work Area:

A. General:

1. All work shall comply with Fort Moore's Record of Environmental Consideration (FB Form 144-R).
2. The Contractor shall use reasonable care to avoid damaging existing buildings, equipment, and vegetation on the Government installation. If the Contractor's failure to use reasonable care causes damage to any of this property, the Contractor shall replace or repair the damage at no expense to the Government as the Contracting Officer directs. If the Contractor fails or refuses to make such repair or replacement, the Contractor shall be liable for the cost, which may be deducted from the contract price.
3. Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

B. Man-Made Improvements:

Protect, or remove and replace, with CWW approval, all fences, piers, docks, walkways, mail boxes, pipelines, drain culverts, power, gas, telephone and television lines and cables and other improvements that may be encountered in the work.

C. Cultivated Growth:

Do not disturb cultivated trees or shrubbery unless approved by CWW and the Contracting Officer's Representative. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction on an experienced nursery person. If vegetation is not suitable for replanting, replace in kind.

D. Cutting of Trees:

Do not cut trees for the performance of the work unless specifically approved by CWW and the Contracting Officer's Representative. Removal and/or replacement of plantings on Fort Moore right-of-way must be approved by CWW and the Contracting Officer's Representative. Protect trees that remain in the vicinity of the work from damage by equipment. Do not store spoil from excavation against the trunks. Remove excavated material, stored over the root system of trees, within thirty (30) days to allow proper natural watering of the root system.

Repair any damaged tree more than three (3) inches in diameter, not to be removed, under the direction of an experienced nursery person. All trees and brush that required removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, woodpiles, or trash piles will be permitted on the work site.

E. Grassing:

Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of residential areas, plant the entire area disturbed by the work in Fescue, Bermuda, Clover, St. Augustine or mixtures of these or other suitable groundcover upon completion of work in any area. In all areas, promptly establish successful stands of grass. During non-seasonal months for establishment of permanent grassing, temporary grassing is required such as winter rye.

F. Erosion Control:

Plan all excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. Erosion control activities must comply with all Local, State and Federal requirements. Erosion control permitting is the responsibility of the Contractor or Engineer.

G. Disposal of Rubbish:

Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, City, State and Federal.

Section 1.21 – Requirements for As-Built Drawings:

A. The Contractor/Engineer is responsible for furnishing as-built drawings to CWW as soon as the water construction work has been completed.

B. As-built drawing guidelines are as follows:

1. It is the Engineer's responsibility to ensure that the necessary information is received from the Contractor to complete the as-built drawings.
2. As-built data must be in NAD 1983 State Plane Georgia West (U.S. feet) and North American Vertical datum of 1988 (NAVD 88).
3. As-built documents shall include horizontal dimensioning to all valves, hydrants, fittings, etc., referenced from permanent monuments such as property corners, right-of-way markers, or other physical and permanent markers.
4. As-built should be prepared on a copy of a recorded plat or on an otherwise prepared drawing with a reference to a recorded plat book and folio number. In this instance, a copy of the recorded plat should be supplied with the as-built submittal.
5. Water line as-builts should be on a separate plan sheet from other utilities.
6. The as-builts shall contain the name of the development.
7. The location of all water mains, Fire Hydrants, valves, meters, caps/plugs, stream crossings and road crossings shall be shown.
8. Road names shall be on plans.
9. The term "As-Built" in large clear print on the plans.
10. The "As-Built" drawings are to be submitted on 22" x 34" paper. Submit one (1) water as-built drawing for the initial review. After all corrections have been made, submit five (5) water as-built drawings, a pdf file containing all as-built documents, and one (1) digital copy. Acceptable formats include: DXF or DWG files, ESRI GIS shapefiles, ESRI GIS Geodatabase.
11. Minimum scale is one (1) inch equals one hundred (100) feet. The as-builts may be drawn on more than one sheet if necessary to obtain the minimum scale of one (1) inch equals one hundred (100) feet. If multiple sheets are used, then an overall key map shall be included.

12. When a phase of a project is completed, a location sketch of entire project with said phase outlines shown on plans.
13. Contour lines are acceptable as long as they are faint and do not interfere with or overpower details of the drawing.
14. Out-lots should be so noted.
15. As-built plans shall show by appropriate dimensions to the location of all plugged future connecting fittings to the nearest foot. The dimensions are to be parallel with and perpendicular to the property lines to the nearest foot.
16. No hand drawn or marked up construction plans will be accepted as an as-built drawing.
17. The as-built shall have a north arrow and legend.
18. The as-built shall show all necessary horizontal information in order to locate the system. Label lines with length, material, diameter, and depth.
19. The as-built drawings must be sharp, clear, clean and legible and must be suitable for filming as permanent records.
20. The following notes shall be placed on the water as-built drawings and quantities filled in:

CONTRACTOR FOR THIS JOB WAS _____

ADDRESS _____

PHONE NO. _____

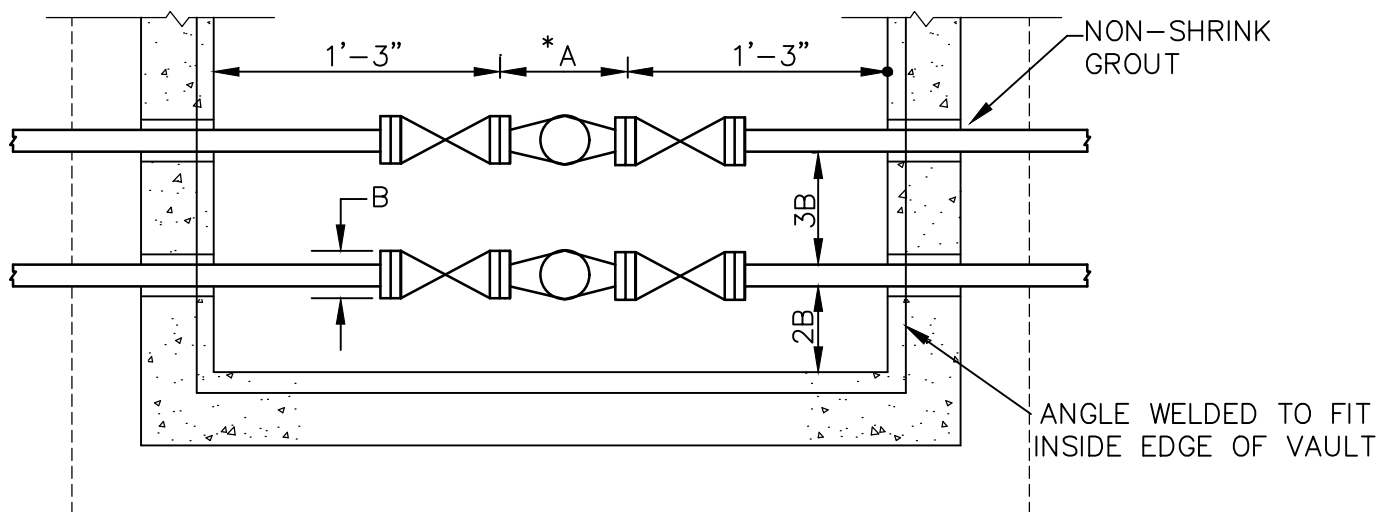
_____ LF Main (By Diameter)
_____ LF of Service Laterals (By Diameter)
_____ Valves
_____ Fire Hydrants
_____ Meters

**SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF WATER
SYSTEMS - FORT MOORE, GEORGIA**

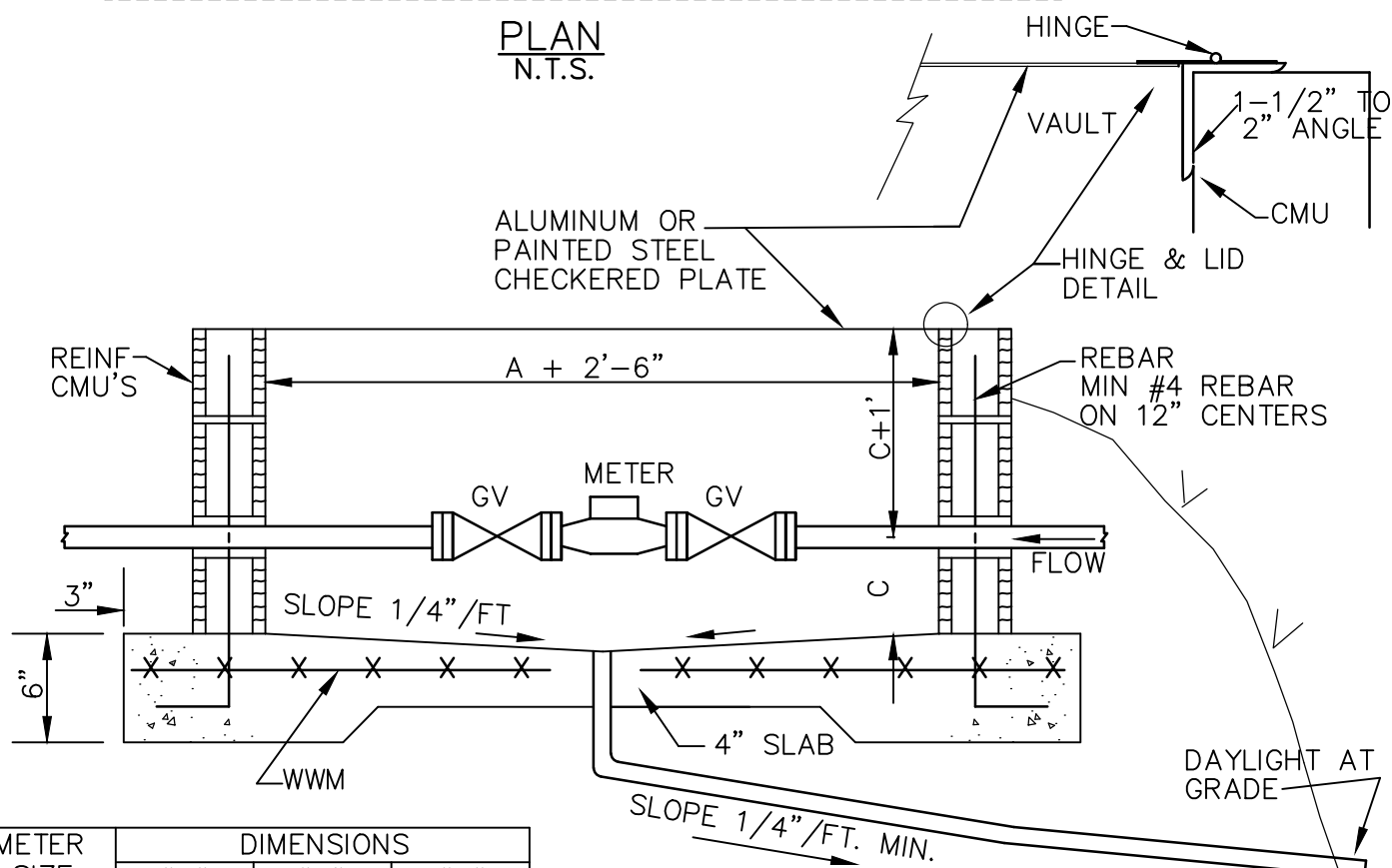
TABLE OF STANDARD DETAIL DRAWINGS

SUBJECT	DETAIL
TYPICAL METER VAULT (BANKED METERS)	A-1
TYPICAL METER VAULT (3" SIZES AND ABOVE)	A-2
INTERSECTION DETAILS FOR WATER MAINS, VALVES & HYDRANTS	A-3
ALLOWABLE TRENCH WIDTHS FOR SERVICE LINES AND WATER MAINS	A-4
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THRUST RESTRAINT: HORIZONTAL BLOCKING	A-13
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SUBJECT	DETAIL
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THRUST RESTRAINT: TIE-ROD CHART	A-20
THRUST RESTRAINT: TIE-ROD INSTALLATION	A-21
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RESTRAINED JOINTS (SLIP-ON PIPE)	A-31
PIPING SYMBOLS	A-32
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UTILITY LOCATIONS ALONG TYPICAL ROADWAY (60' R/W)	A-35
VALVE COVER	A-36



PLAN
N.T.S.



SECTION
N.T.S.

* METER ASSEMBLY DIMENSION WILL VARY WITH SIZE.
STRAINERS AND TEST TEES MAY BE REQUIRED.

NOTES:

1. ALTERNATE INSTALLATIONS MAY BE ALLOWED IF SUBMITTED BY ENGINEER AND APPROVED BY CWW.
2. PROVIDE POURED SOLID BOTTOM WITH DRAIN WHEN GROUND WATER IS PRESENT.

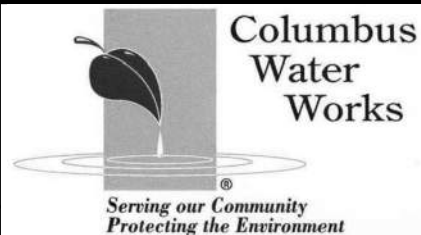
METER SIZE	DIMENSIONS		
	"A"	"B"	"C"
5/8"	7 1/2"	3 5/8"	8"
1"	10 3/4"	6 1/2"	10"
1 1/2"	10"	5 3/8"	10"
2"	10"	5 3/8"	12"
3"	12"	7 1/2"	12"
4"	14"	9"	14"
6"	18"	11"	16"
8"	20"	13 1/2"	18"
10"	26"	16"	24"

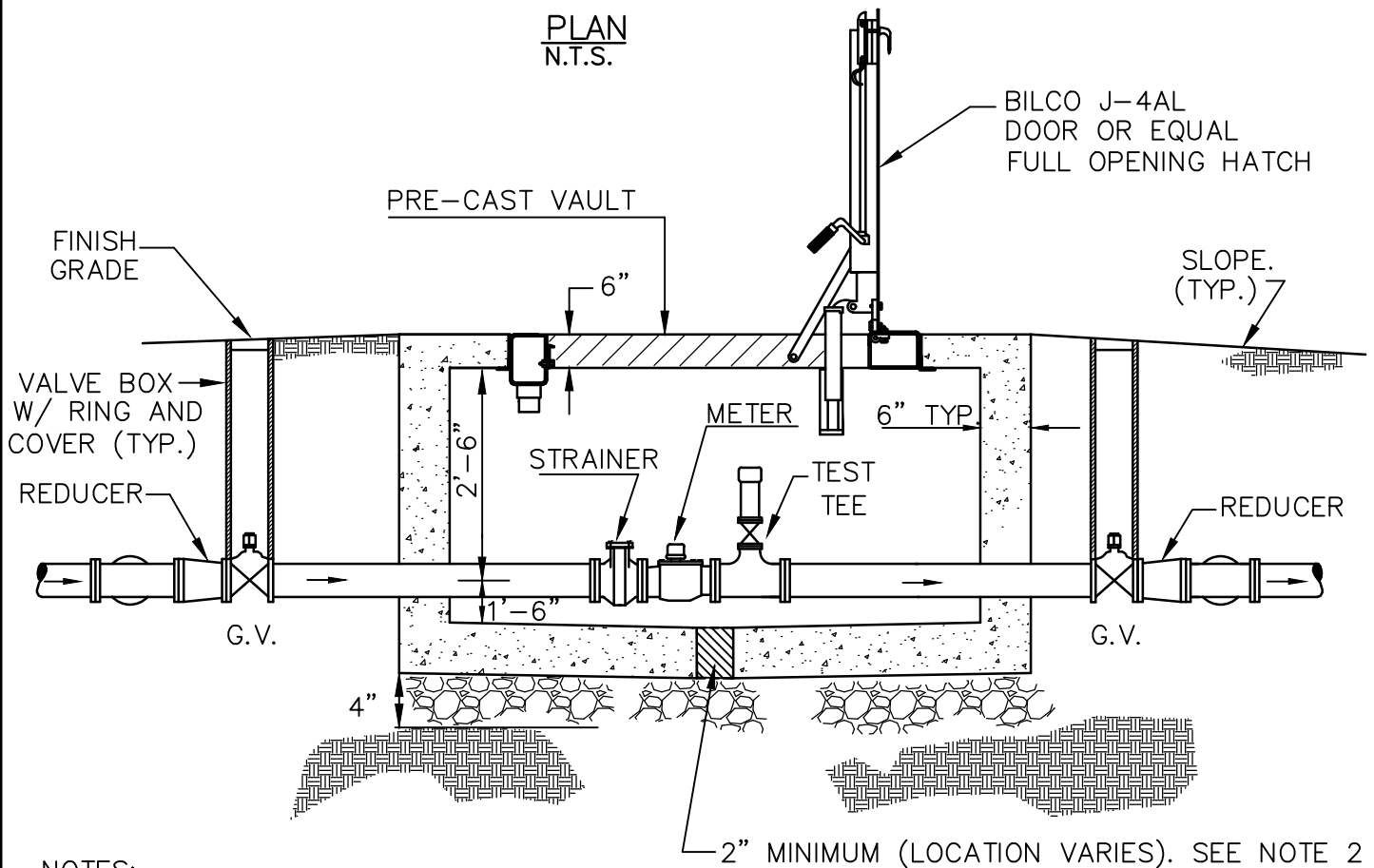
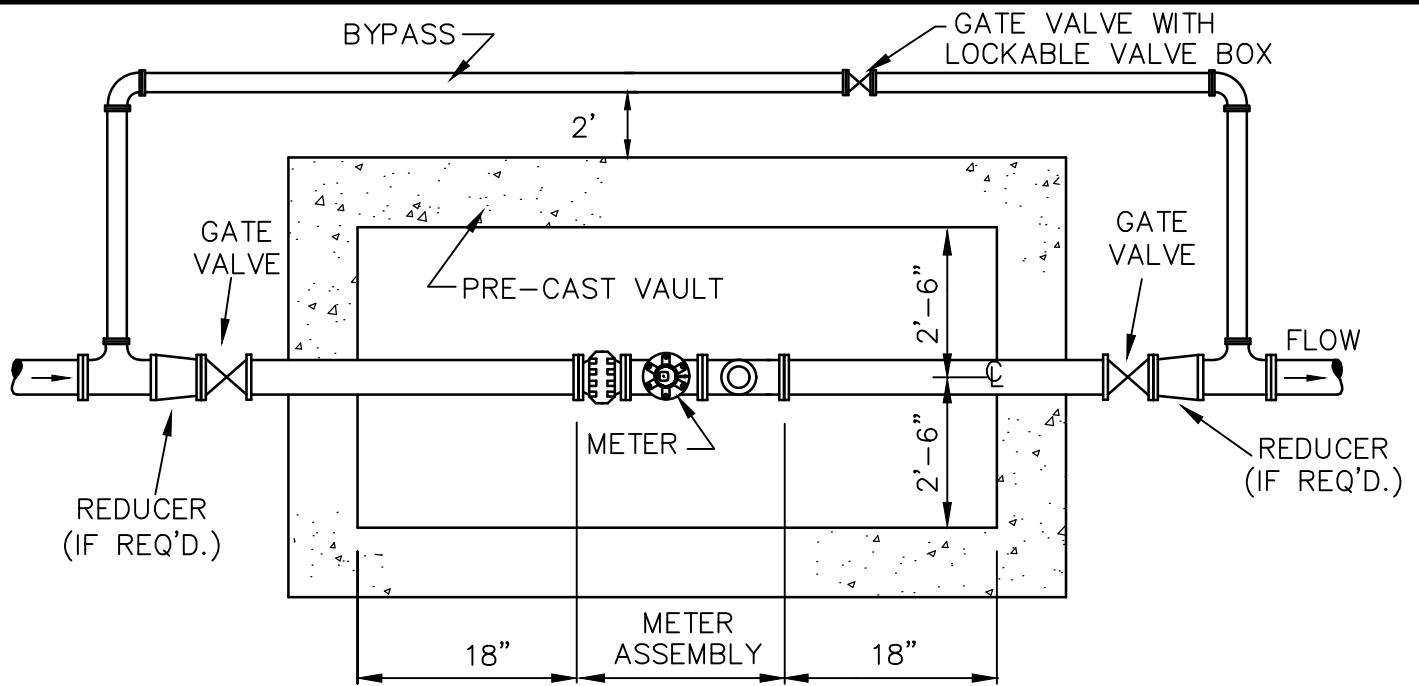
TYPICAL METER VAULT (BANKED METERS)

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-1





NOTES:

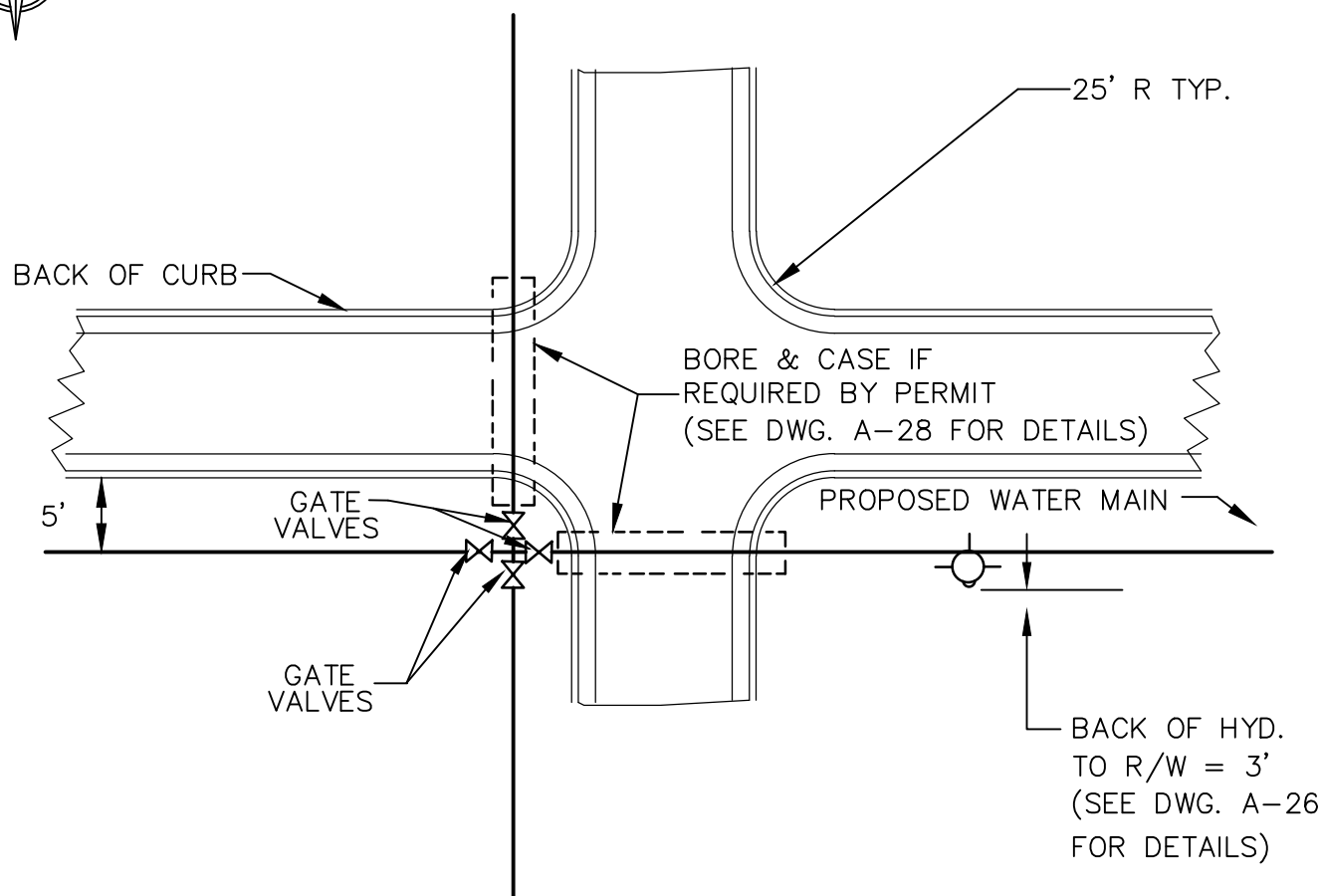
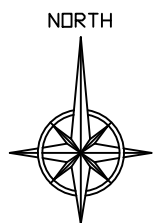
1. FULL OPENING DOORS REQUIRED
2. PROVIDE SOLID BOTTOM WITH DRAIN WHEN GROUND WATER IS PRESENT

TYPICAL METER VAULT
(3" SIZES AND ABOVE)

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-2



NOTES:

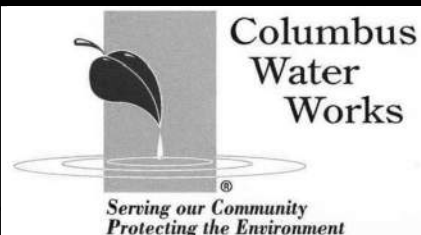
1. DEPTH OF COVER OVER WATER MAINS SHALL BE 4' AS MEASURED FROM TOP OF CURB OR EDGE OF PAVEMENT.
2. MIN. 6" COMPACTED SOIL BETWEEN BOTTOM OF PIPE AND ROCK MIN. 9" COMPACTED SOIL BETWEEN SIDES OF PIPE AND ROCK.
3. NO ROCK IN BACKFILL FOR FIRST 2' ABOVE TOP OF PIPE.
4. BORE AND CASING MAY BE REQ'D BY PERMITTING AGENCY.
5. ALL PIPE TO BE DUCTILE IRON OR STEEL AS REQ'D.
6. IF RADIUS IS NOT 25' ADJUST PIPE LENGTHS SO THAT VALVES ARE NOT IN STREET.

INTERSECTION DETAILS
FOR WATER MAINS,
VALVES & HYDRANTS

SCALE: N.T.S.

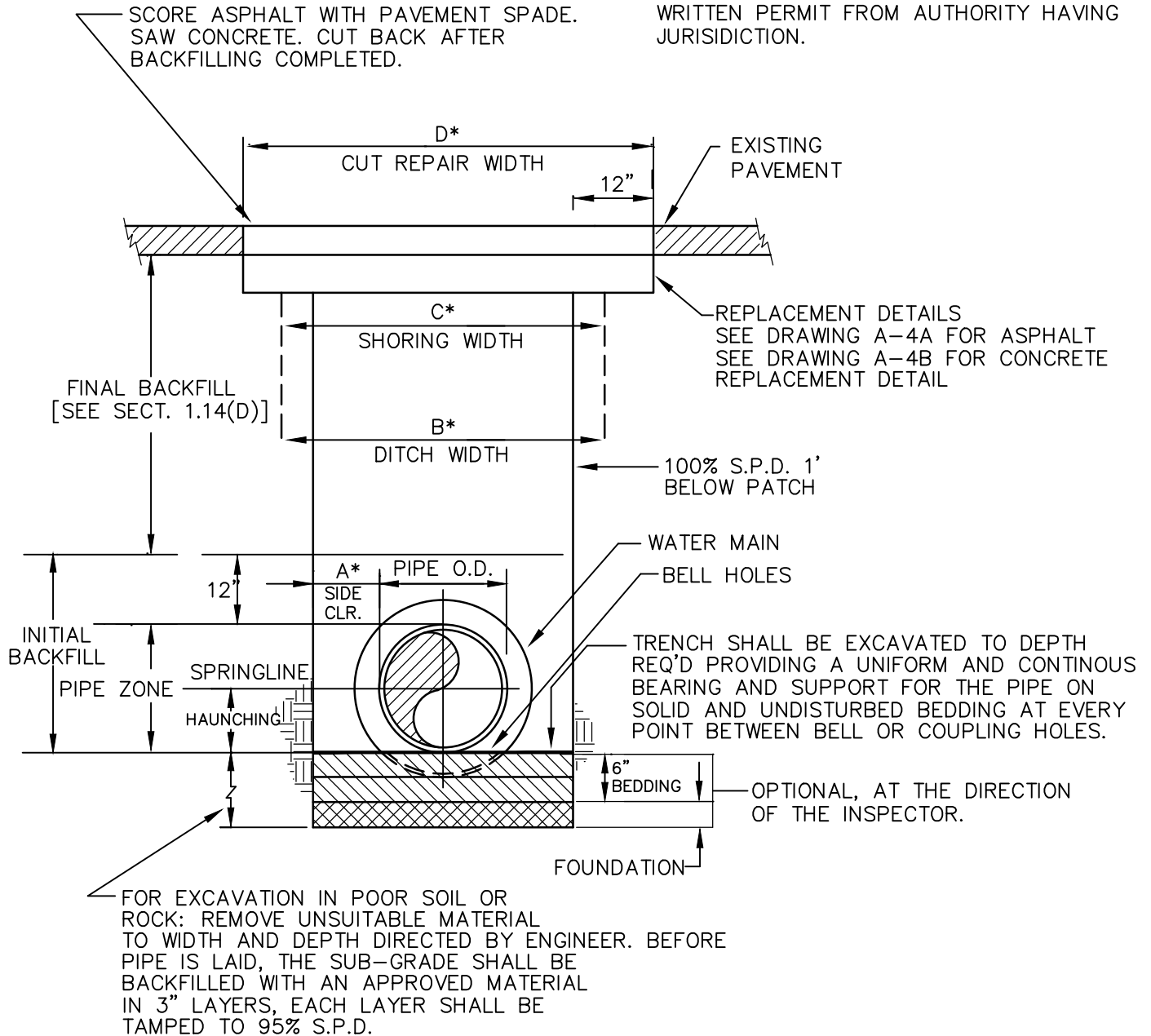
DATE: NOVEMBER 2019

A-3



NOTES:

NO PAVEMENT CUTS PERMITTED WITHOUT APPROVAL OF C.W.W. INSPECTOR AND WRITTEN PERMIT FROM AUTHORITY HAVING JURISDICTION.



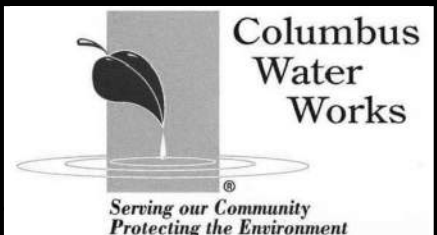
* SEE DRAWING A-5 FOR TRENCH WIDTH DIMENSIONS

ALLOWABLE TRENCH WIDTHS FOR SERVICE LINES & WATER MAINS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-4



PIPE SIZE (NOM)	A SIDE CLEAR- ANCE-INCH.		B DITCH WIDTH -INCH.				C SHORING WIDTH (ADDITIONAL -INCH.)	D CUT REPAIR WIDTH -FEET			
	SOIL	ROCK	SOIL		ROCK			SOIL		ROCK	
			MJ	SJ	MJ	SJ		AS APPROVED	MJ	SJ	MJ
3/4"-2"	2	6	NA	8	NA	14	AS APPROVED	NA	3.00	NA	3.17
4"	9	12	25	23	27	25	AS APPROVED	4.08	3.92	4.25	4.08
6"	9	12	28	28	30	30	AS APPROVED	4.33	4.33	4.50	4.50
8"	9	12	32	30	34	32	AS APPROVED	4.67	4.50	4.83	4.67
10"	9	12	34	32	36	34	AS APPROVED	4.83	4.67	5.00	4.83
12"	9	12	36	34	38	36	AS APPROVED	5.00	4.83	5.17	5.00
14"	9	14	39	36	41	38	AS APPROVED	5.25	5.00	5.42	5.17
16"	9	14	42	38	44	40	AS APPROVED	5.50	5.17	5.67	5.33
20"	9	14	45	44	47	46	AS APPROVED	5.75	5.67	5.92	5.83
24"	9	14	50	48	52	50	AS APPROVED	6.17	6.00	6.33	6.17
30"	9	18	58	54	60	56	AS APPROVED	6.83	6.50	7.00	6.67
36"	9	18	64	61	66	63	AS APPROVED	7.33	7.08	7.50	7.25
42"	9	18	72	64	74	66	AS APPROVED	8.00	7.33	8.17	7.50
48"	9	18	78	73	80	75	AS APPROVED	8.50	8.08	9.34	8.25

NOTES:

1. COMPACTION: BACKFILLS SHALL BE BUILT UP IN LAYERS AND EACH LAYER SHALL BE THOROUGHLY COMPACTED BEFORE BEGINNING ANOTHER LAYER. LAYERS SHALL BE NO MORE THAN 6" TO 1' IN DEPTH. PUDDLING WILL NOT BE PERMITTED, NOR WILL FROZEN OR WET MATERIAL BE PLACED IN TRENCHES.
2. COMPACTION STANDARDS: ALL BACKFILL MATERIALS USED SHALL CONTAIN A SUFFICIENT AMOUNT OF MOISTURE FOR PROPER COMPACTION AND THESE MATERIALS SHALL BE COMPACTED AT NOT LESS THAN 95% OF THEIR OPTIMUM COMPACTION FOR ANY SPECIFIC SOIL CLASSIFICATION AS DETERMINED BY THE MODIFIED PROCTOR TEST. ASTM. D698
3. COMPACTION TESTS: COMPACTION TESTS MAY BE REQUIRED IN EXISTING OR PROPOSED STREETS, SIDEWALKS, DRIVES AND OTHER EXISTING OR PROPOSED PAVED AREAS AT VARYING DEPTHS AND AT INTERVALS AS DETERMINED BY THE CWW WITH A MINIMUM OF ONE TEST ON EACH JOB, AND A MAXIMUM OF ONE REQUIRED TEST FOR EACH 400' OR LESS OF WATER MAIN CONSTRUCTION, UNLESS SOIL CONDITIONS OR CONSTRUCTION PRACTICES, WARRANT THE NEED FOR ADDITIONAL TESTS.
4. REFER TO SECTION 1.13 FOR DETAILED SPECIFICATIONS ON BACKFILLING TRENCHES.
5. NO BOULDERS, LOOSE ROCKS, OR ORGANIC MATERIALS ARE PERMITTED IN THE INITIAL BACKFILL.
6. ALL DESIGNS ARE BASED ON FULLY COMPACTED BACKFILL AND UNIFORMLY SUPPORTED PIPE.
7. FOR SERVICE AND MAIN PAVEMENT CUT REPAIRS SEE DWG. A-4A & A-4B.
8. REFER TO DWG. A-33 FOR BEDDING DETAILS.

TABLE & NOTES FOR ALLOWABLE TRENCH WIDTHS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-5



SIZE (NOM)	PUSH-ON JOINT (20' NOMINAL LAYING LENGTH)		MECHANICAL JOINT (20' NOMINAL LAYING LENGTH)	
	DEGREE	MAX. OFFSET	DEGREE	MAX. OFFSET
6"	5°	21"	7° – 07'	30"
8"	5°	21"	5° – 21'	22"
10"	5°	21"	5° – 21'	22"
12"	5°	21"	5° – 21'	22"
14"	5°	21"	3° – 35'	15"
16"	5°	21"	3° – 35'	15"
18"	5°	21"	3° – 00'	12"
20"	5°	21"	3° – 00'	12"
24"	5°	21"	2° – 23'	10"
30"	5°	21"		
36"	4°	17"		
42"	3°	12"		
48"	3°	12"		

NOTES:

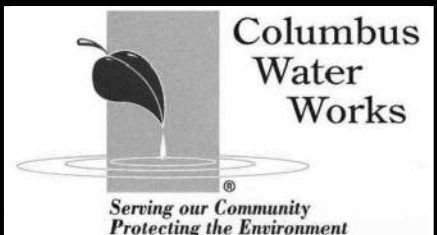
1. WHEN A PIPE IS DEFLECTED, THE PIPE SHALL FIRST BE ASSEMBLED IN A STRAIGHT LINE, BOTH HORIZONTALLY AND VERTICALLY BEFORE THE DEFLECTION IS MADE.
2. FOR MECHANICAL JOINT PIPE, THE BOLTS SHALL BE PARTIALLY TIGHTENED BEFORE THE LENGTH OF PIPE IS DEFLECTED, ANY SUPPORTED PIPE, SHALL BE SO SUPPORTED THAT THERE IS ZERO DEFLECTION EXCEPT WHERE THERE IS A HORIZONTAL OR VERTICAL CURVE ON A BRIDGE OR ANOTHER STRUCTURE IS INVOLVED.
3. THRUST RESTRAINTS MAY BE REQUIRED ON THE DEFLECTED JOINTS.
4. IF PIPE MANUFACTURER DEFLECTION LIMITS DIFFER FROM CWW STANDARDS THE MANUFACTURER RECOMMENDATIONS SHOULD BE USED

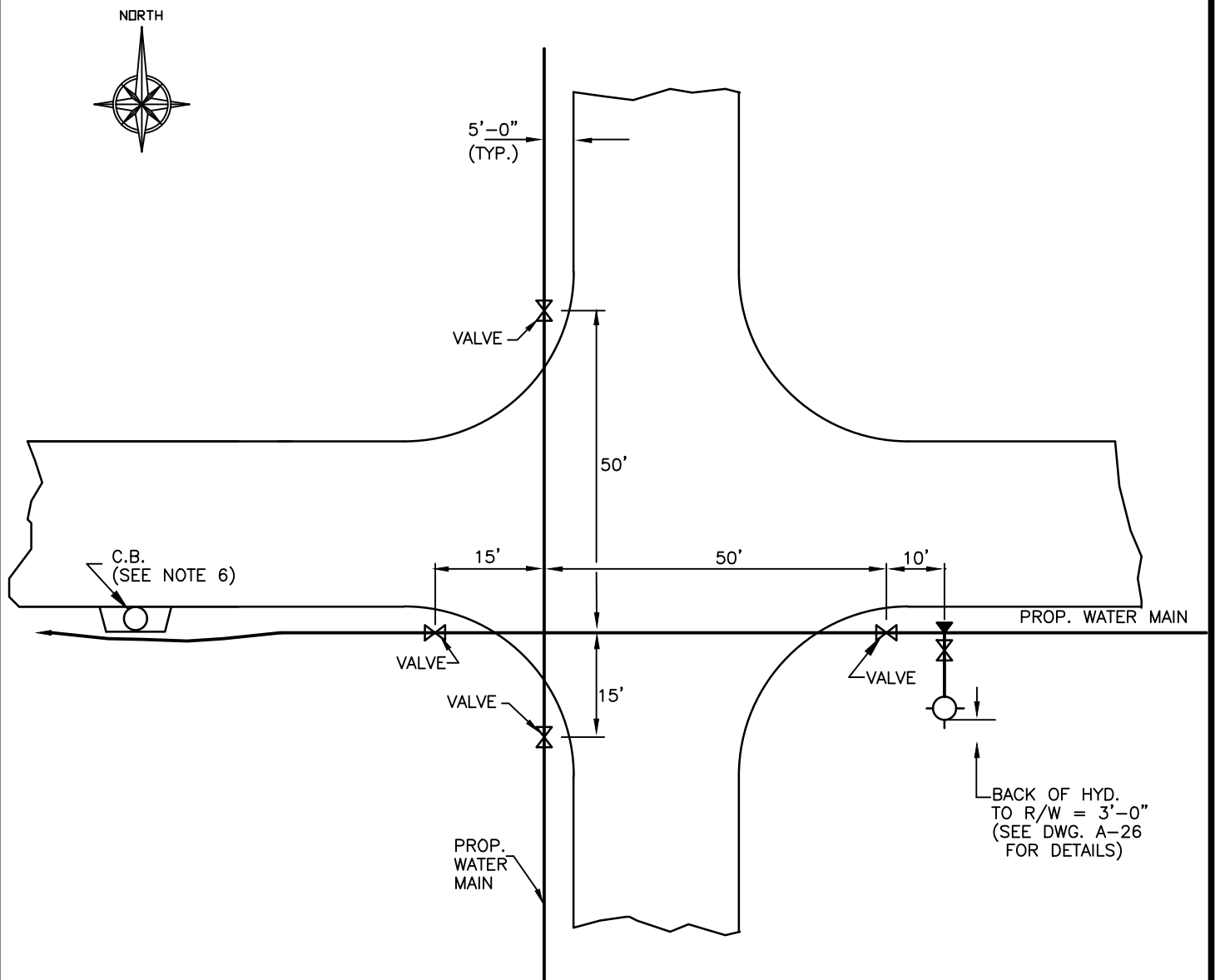
MAXIMUM PERMISSABLE JOINT DEFLECTIONS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-6





NOTES:

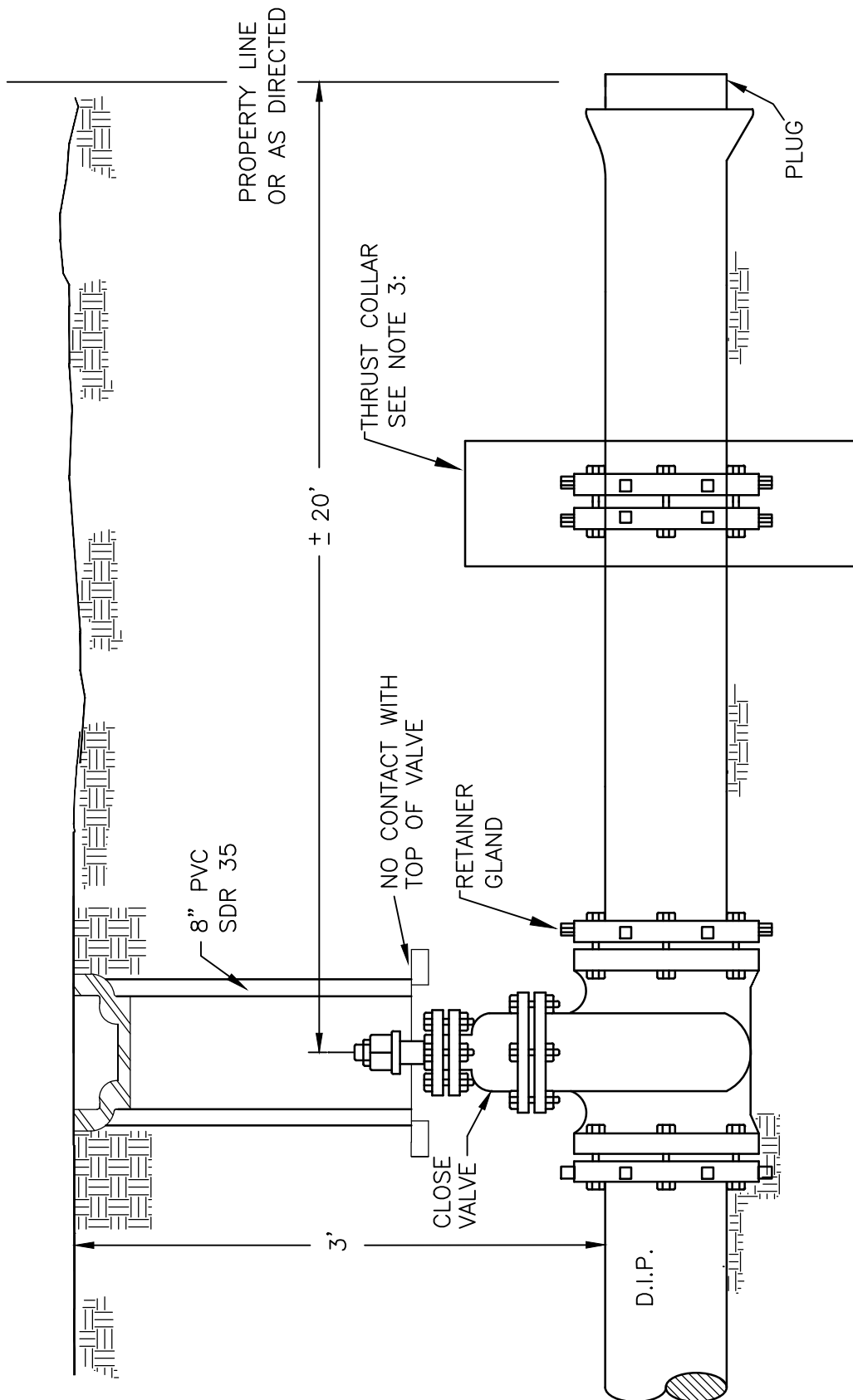
1. DEPTH OF COVER OVER WATER MAINS SHALL BE 4' AS MEASURED FROM TOP OF CURB OR EDGE OF PAVEMENT.
2. MIN. 6" COMPACTED SOIL BETWEEN BOTTOM OF PIPE AND ROCK. MIN. 9" COMPACTED SOIL BETWEEN SIDES OF PIPE AND ROCK.
3. NO ROCK IN BACKFILL FOR FIRST 2' ABOVE TOP OF PIPE.
4. IF RADIUS IS NOT 25' ADJUST PIPE LENGTHS SO THAT VALVES ARE NOT IN STREET.
5. VALVES TO BE A MIN. OF 2' FROM BACK OF CURB.
6. PIPE SHALL CLEAR OUTSIDE WALL OF CATCH BASIN BY 4" MIN.

INTERSECTION DETAILS: WATER MAINS, VALVES & FIRE HYDRANTS

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-8



NOTES:

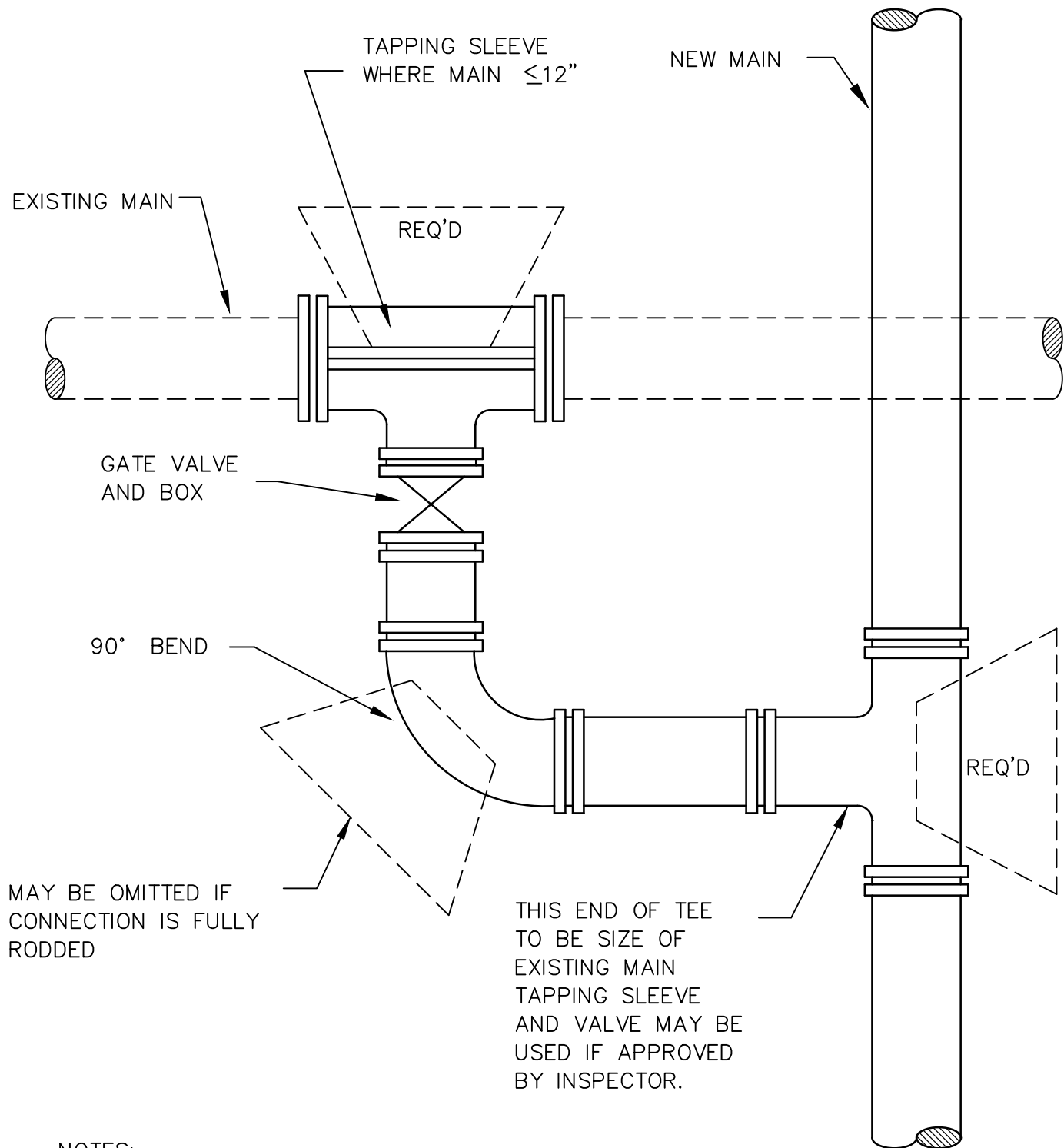
1. IN LIEU OF SLIP-JOINT AND COMPRESSION PLUG,
A M.J. JOINT MAY BE USED WITH A M.J. PLUG.
2. LEAVE VALVE IN CLOSED POSITION.
A M.J. JOINT MAY BE USED WITH A M.J. PLUG.
3. THRUST COLLAR TO BE PROPERLY SIZED PER DETAIL A-19

STUB OUT OR
END DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-9



NOTES:

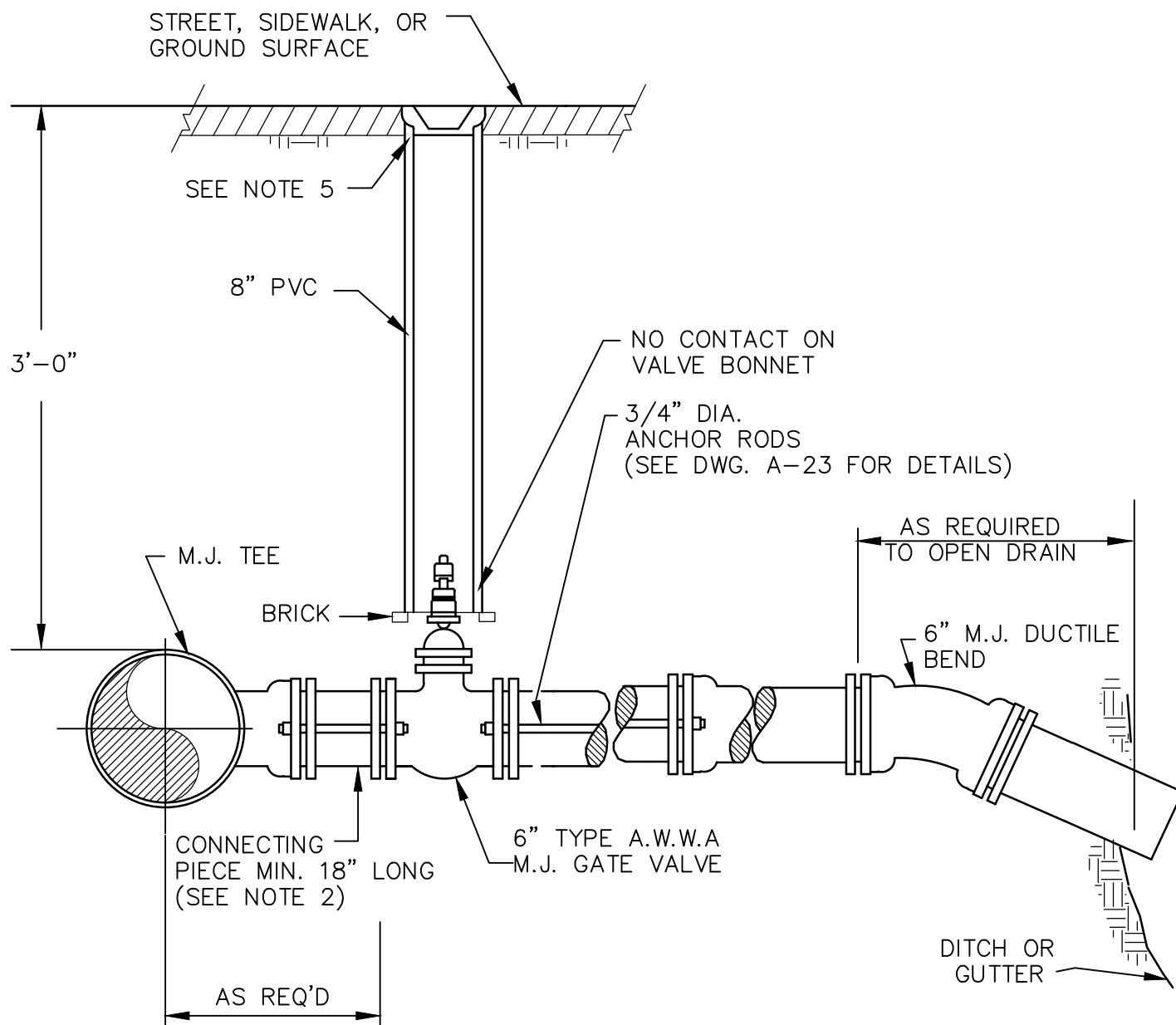
GATE VALVES AND FITTINGS USED IN THIS CONNECTION TO BE SAME SIZE AS EXISTING MAIN WHERE EXISTING MAIN IS 12" OR SMALLER.

ROUND CONNECTION DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-10



NOTES:

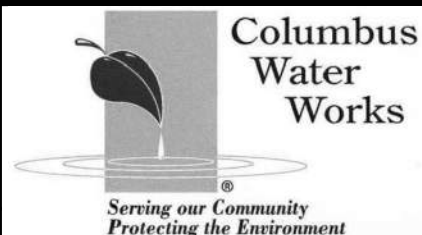
1. FOR MAIN SIZE 6"-16"Ø, USE 6" BLOW-OFF PIPING & VALVE. FOR MAIN SIZE 20"-48"Ø, USE 8" BLOW-OFF PIPING & VALVE.
2. ALL FITTINGS, EXCLUSIVE OF VALVES AND VALVE BOXES, SHALL BE D.I.P.
3. RODS TO BE HIGH TENSILE, HOT ROLLED STEEL WITH TENSILE STRENGTH OF 150,000 P.S.I. AND MIN. YIELD STRENGTH OF 130,000 P.S.I.
4. BLOW-OFF OUTLETS MAY NOT BE SUBMERGED IN ANY STREAM OR GUTTER, NOR DISCHARGE DIRECTLY INTO ANY SEWER.
5. IF NO PAVEMENT OR SIDEWALK, POUR 2' CONCRETE COLLAR AROUND TOP OF VALVE BOX. SEE DWG. A-7 FOR DETAILS.

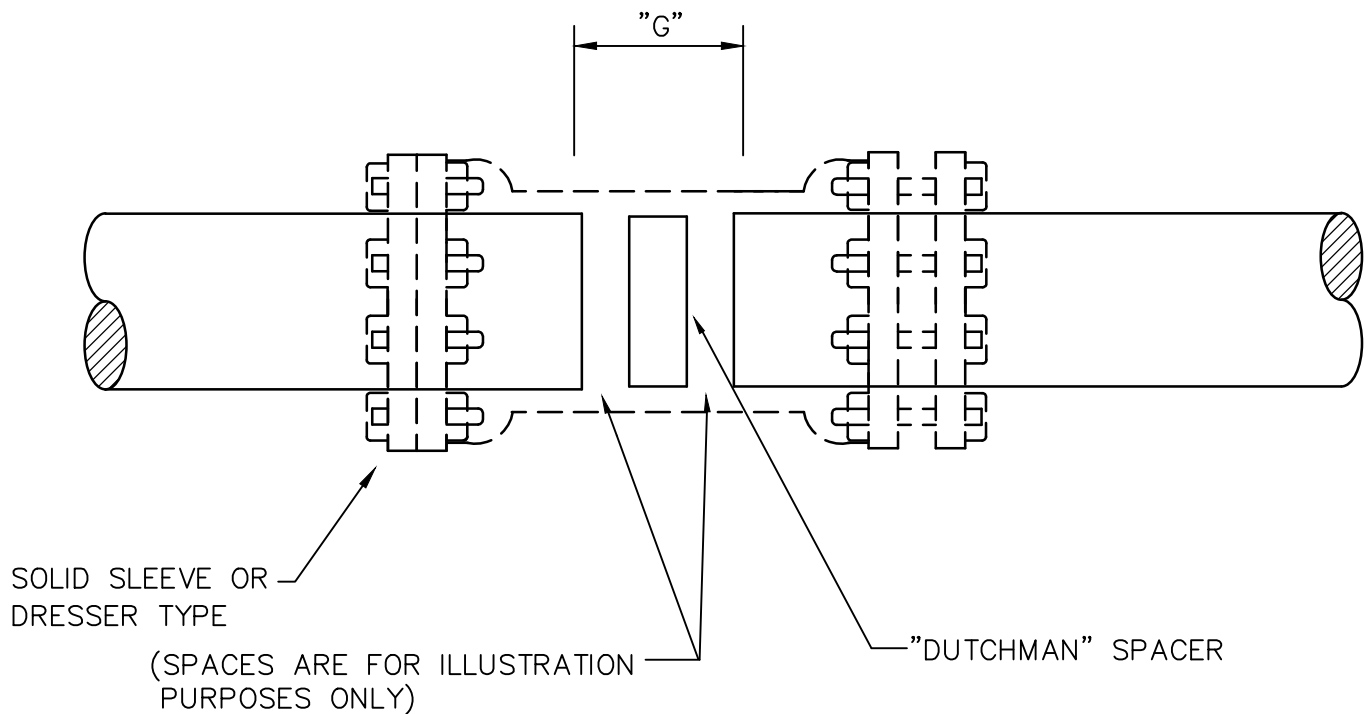
BLOW OFF DETAIL

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-11





NOTES:

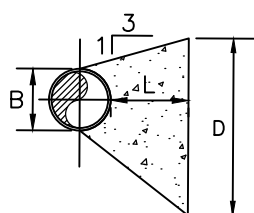
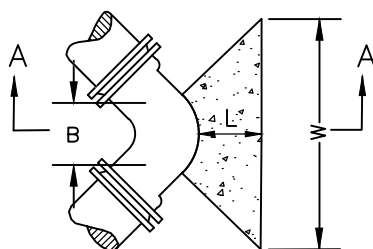
1. IF "G" IS GREATER THAN $1/2$ ", AT ITS NARROWEST POINT, THEN A FULL CIRCLE SPACER OR "DUTCHMAN" MUST BE CUT AND PLACED IN THE GAP BEFORE THE SLEEVE IS USED TO CLOSE THE JOINT.
2. THE "DUTCHMAN" SPACER SHALL BE CUT TO A WIDTH NO LESS THAN $1/4$ " LESS THAN THE NARROWEST WIDTH OF "G".
3. EACH PIPE SPIGOT SHALL BE MARKED TO INDICATE WHERE THE SLEEVE WILL BE PROPERLY CENTERED OVER THE POINT.
4. "FULL-CIRCLE" REPAIR CLAMPS ARE NOT APPROVED FOR JOINING PIPE, SUCH CLAMPS ARE SPECIFICALLY DESIGNED FOR REPAIRS ONLY.
5. IF "STEEL" SLEEVE IS USED, PROPERLY COAT BEFORE BACKFILLING. SEE NOTE 5, DWG. A-25 FOR COATING DETAILS.

PIPE JOINING USING SOLID SLEEVE

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-12



SECTION A-A

NOTES:

1. POUR BLOCKING AGAINST UNDISTURBED EARTH WHEN OVEREXCAVATION OCCURS.

DESIGN DATA:

1. DIMENSION OF THRUST BLOCK IN FEET BASED ON 2000 POUNDS PER SQUARE FOOT SOIL BEARING PRESSURE. ACTUAL OUTSIDE DIA. OF DIP, 250 PSI TEST PRESSURE.
2. UNDER ADVERSE CONSTRUCTION CONDITIONS, CONCRETE SHALL BE "HIGH EARLY" TYPE.

MINIMUM DIMENSIONS IN FEET FOR CONCRETE BLOCKING						
PIPE SIZE	END AREA OF BLOCK AT FITTING (B x B)	FITTING	L	END DIMENSIONS OF BLOCK AGAINST UNDISTURBED SOIL, IN FEET		CU. YDS.
				D	W	
6"	0.25 (6" x 6")	11.25'	0' - 6"	1.0	1.4	0.02
		22.5'	0' - 9"	1.2	2.3	0.04
		45'	1' - 3"	1.6	3.2	0.13
		90'	1' - 6"	2.2	4.4	0.28
		TEE OR DE	1' - 3"	1.8	3.7	0.16
8"	0.44 (8" x 8")	11.25'	0' - 6"	1.1	2.1	0.02
		22.5'	1' - 0"	1.6	3.1	0.10
		45'	1' - 6"	2.2	4.3	0.27
		90'	2' - 0"	2.9	5.9	0.66
		TEE OR DE	1' - 9"	2.5	4.9	0.40
10"	0.69 (10" x 10")	11.25'	0' - 9"	1.4	2.7	0.06
		22.5'	1' - 3"	1.9	3.8	0.18
		45'	1' - 9"	2.6	5.3	0.47
		90'	2' - 6"	3.6	7.1	1.21
		TEE OR DE	2' - 0"	3.0	6.0	0.69
12"	1.00 (12" x 12")	11.25'	0' - 9"	1.6	3.1	0.08
		22.5'	1' - 3"	2.3	4.5	0.26
		45'	2' - 0"	3.1	6.2	0.76
		90'	3' - 0"	4.3	8.5	2.08
		TEE OR DE	2' - 6"	3.6	7.1	1.23
14"	1.36 (14" x 14")	11.25'	1' - 0"	1.8	3.7	0.15
		22.5'	1' - 6"	2.6	5.2	0.41
		45'	2' - 3"	3.6	7.2	1.15
		90'	3' - 6"	4.9	9.8	3.22
		TEE OR DE	2' - 9"	4.1	8.3	1.81
16"	1.78 (16" x 16")	11.25'	1' - 0"	2.1	4.2	0.19
		22.5'	1' - 9"	2.9	5.9	0.62
		45'	2' - 9"	4.1	8.2	1.81
		90'	4' - 0"	5.6	11.2	4.80
		TEE OR DE	3' - 3"	4.7	9.5	2.79
18"	2.25 (18" x 18")	11.25'	1' - 0"	2.2	4.5	0.23
		22.5'	2' - 0"	3.2	6.4	0.83
		45'	3' - 0"	4.5	9.0	2.35
		90'	4' - 3"	6.1	12.2	5.99
		TEE OR DE	3' - 6"	5.9	11.7	4.59
20"	2.78 (20" x 20")	11.25'	1' - 3"	2.6	5.2	0.38
		22.5'	2' - 0"	3.7	7.4	1.10
		45'	3' - 3"	5.1	10.2	3.33
		90'	4' - 9"	7.0	13.9	8.79
		TEE OR DE	3' - 9"	5.9	11.7	4.96
24"	4.00 (24" x 24")	11.25'	1' - 6"	3.1	6.2	0.64
		22.5'	2' - 6"	4.4	8.8	1.96
		45'	4' - 0"	6.1	12.2	5.81
		90'	5' - 9"	8.3	16.7	15.60
		TEE OR DE	4' - 6"	7.0	14.0	8.48
30"	6.25 (30" x 30")	11.25'	1' - 9"	3.8	7.7	1.16
		22.5'	3' - 0"	5.4	10.8	3.62
		45'	4' - 9"	7.6	15.2	10.71
		90'	7' - 0"	10.3	20.7	28.47
		TEE OR DE	5' - 9"	8.7	17.4	16.72
36"	9.00 (36" x 36")	11.25'	2' - 0"	4.6	9.2	1.90
		22.5'	3' - 6"	6.5	13.0	6.05
		45'	5' - 9"	9.1	18.2	18.57
		90'	8' - 3"	12.4	24.7	48.36
		TEE OR DE	6' - 9"	10.4	20.8	28.13

THRUST RESTRAINT:
HORIZONTAL
BLOCKING

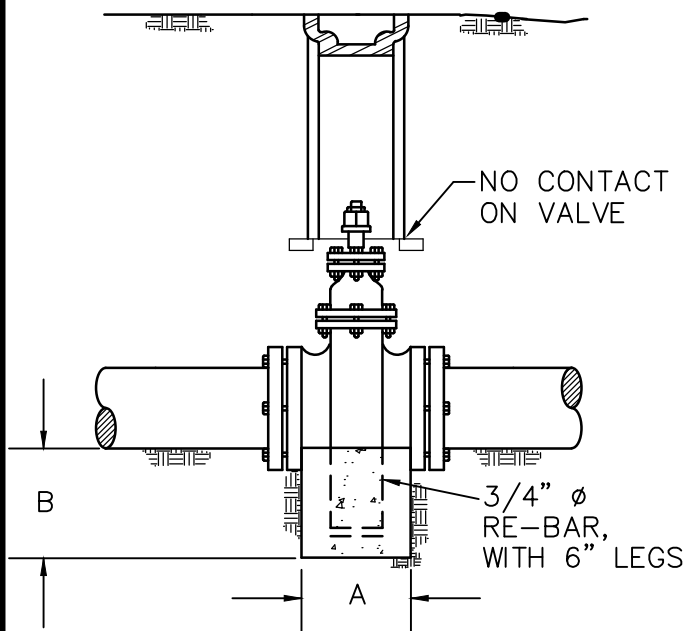
SCALE: N.T.S.

DATE: NOVEMBER 2019

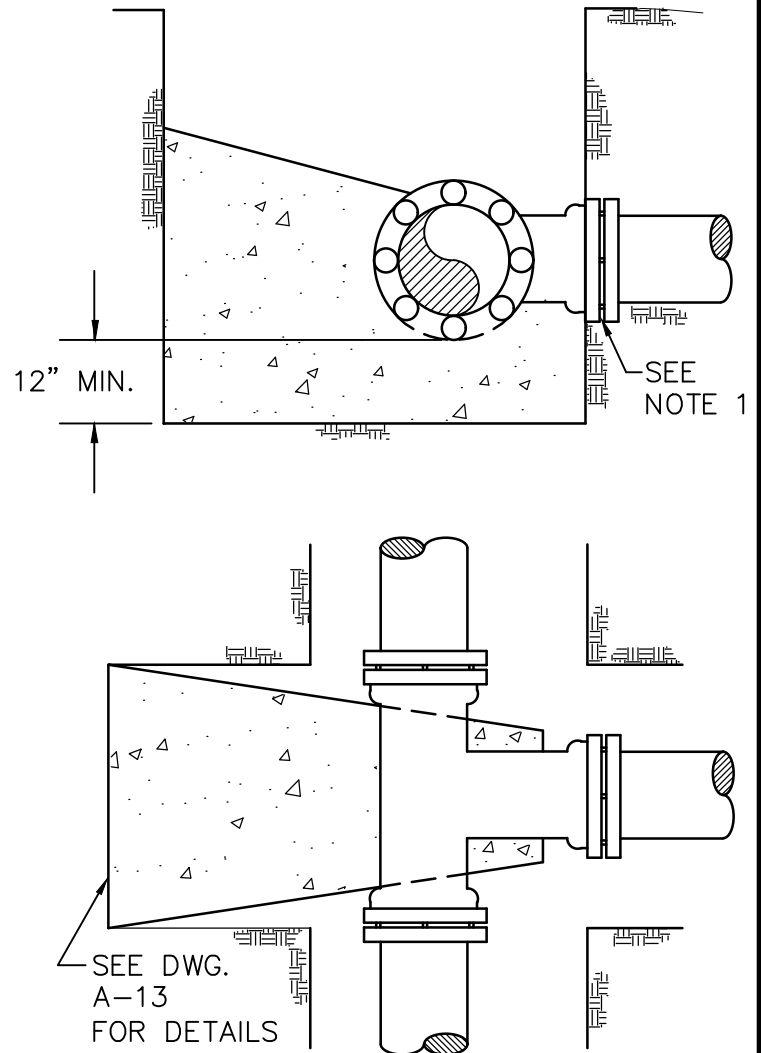
A-13



VALVE BLOCKING/SUPPORT



TEE BLOCKING/SUPPORT



BLOCK DIMENSIONS				
VALVE SIZE	A LENGTH (IN.)	B LENGTH (IN.)	C WIDTH (IN.)	VOLUME CONC. (Q.Y.)
6"	10.50	20.00	24.00	0.11
8"	12.00	20.00	24.00	0.12
10"	13.25	24.00	30.00	0.20
12"	14.75	24.00	30.00	0.23

NOTES:

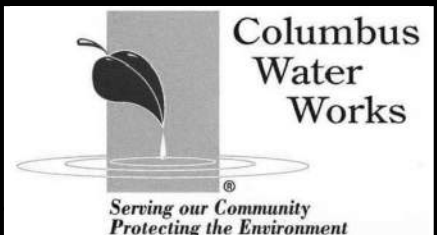
1. COVER GLAND AND BOLTS WITH POLYETHELENE BEFORE PLACING CONCRETE.
2. COAT STRAPS AND RODS WITH AN APPROVED BITUMASTIC COATING BEFORE BACKFILLING. SEE NOTE 5, DWG A-25 FOR COATING DETAILS.
3. ALLOW CONCRETE TO SET UP A MINIMUM OF 6 HOURS BEFORE PLACING BACKFILL.
4. CONCRETE SHALL BE 3000 P.S.I., CLASS A.
5. VERTICAL BENDS WITH AN UPWARD RESULTANT FORCE SHALL BE RESTRAINED AS SHOWN ON DWG. A-15.
6. VERTICAL BENDS WITH A DOWNWARD RESULTANT FORCE SHALL BE RESTRAINED AS SHOWN ON DWG. A-18.

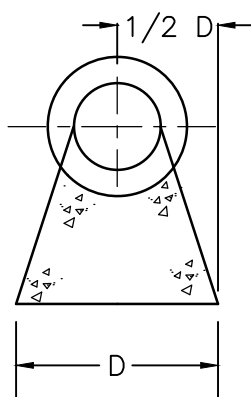
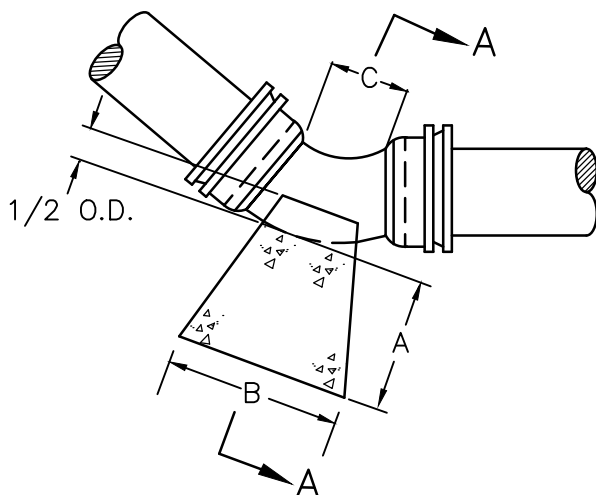
THRUST RESTRAINT:
HORIZONTAL BLOCKING
SUPPORT

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-14





SECTION A-A

NOTE:

ENGINEER SHALL VERIFY SOIL CONDITIONS BEFORE THRUST BLOCK DESIGN IS IMPLEMENTED.

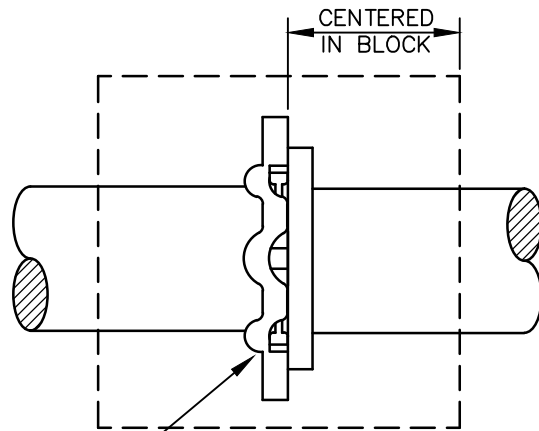
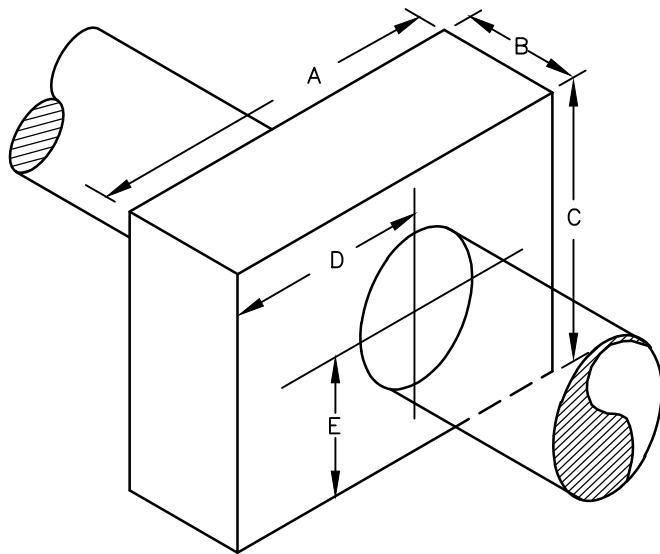
DESIGN DATA

1. DIMENSION OF THRUST BLOCK IN FEET BASED ON 2000 POUNDS PER SQUARE FOOT SOIL BEARING PRESSURE. ACTUAL INSIDE DIA. OF D.I.P., CLASS 51 USED AS STANDARD.
2. CONCRETE SHALL BE CLASS A, 3000 P.S.I. UNDER ADVERSE CONSTRUCTION CONDITIONS, CONCRETE SHALL BE HIGH EARLY.

MINIMUM DIMENSIONS FOR CONCRETE BLOCKING

SIZE (NOM)	SIZE	A (FT.)	B (FT.)	C (IN.)	D (FT.)	VOLUME (CU. YDS.)
11 1/4°	6"	1.0	2.0	6	1.0	0.05
	8"	1.0	2.0	7	1.0	0.05
	10"	1.0	2.0	9	1.0	0.05
	12"	1.0	2.0	11	1.0	0.50
	14"	2.0	2.0	11	1.5	0.16
	16"	2.0	2.0	12	2.0	0.22
	20"	2.0	3.0	15	2.0	0.32
	24"	2.0	3.0	18	3.0	0.50
22 1/2°	6"	1.0	2.0	6	1.0	0.05
	8"	1.0	2.0	7	1.0	0.05
	10"	1.0	2.0	9	1.5	0.08
	12"	1.0	2.0	11	2.0	0.11
	14"	2.0	3.0	11	2.0	0.29
	16"	2.0	4.0	12	2.0	0.37
	20"	2.0	4.0	15	3.0	0.58
	24"	3.0	4.5	18	4.0	1.33
45°	6"	1.0	2.0	6	1.0	0.05
	8"	1.0	2.0	6	1.0	0.05
	10"	2.0	3.0	9	2.0	0.28
	12"	2.0	3.0	11	3.0	0.44
	14"	2.0	4.0	11	3.0	0.55
	16"	3.0	5.0	12	3.0	1.00
	20"	4.0	6.0	15	4.0	2.15
	24"	4.0	7.0	18	5.0	3.15
90°	6"	1.0	2.0	12	2.0	0.11
	8"	2.0	3.0	13	2.4	0.37
	10"	2.6	3.7	18	3.0	0.72
	12"	2.0	4.0	20	4.0	0.84
	14"	3.0	5.0	24	4.4	1.71
	16"	4.0	6.0	26	4.7	2.84
	20"	4.0	7.0	32	6.8	4.51
	24"	5.0	8.0	40	8.0	5.40
TEES AND PLUGS	6"	1.0	2.0	12	1.5	0.08
	8"	1.7	2.5	14	2.0	0.23
	10"	2.0	4.0	18	2.0	0.23
	12"	2.5	3.7	20	3.0	0.75
	14"	3.0	5.0	24	3.0	1.17
	16"	3.0	5.0	26	4.0	1.59
	20"	4.0	6.0	32	5.0	3.21
	24"	6.0	9.0	40	5.0	6.85

THRUST RESTRAINT:
DOWNWARD THRUST



MINIMUM DIMENSIONS IN FEET FOR CONCRETE COLLAR
ON DUCTILE IRON PIPE TO BE USED WITH EMBEDDED DUCTILE IRON RETAINER GLAND

PIPE SIZE	A	B	C	D	E	VOLUME CU. YDS.	CONC. WT.	THRUST
4"	3'-6"	3'-0"	1'-5"	1'-6"	1'-0"	0.55	2230	3,150
6"	4'-0"	3'-0"	2'-7"	2'-0"	1'-0"	1.15	4650	7,070
8"	4'-6"	3'-0"	3'-0"	2'-3"	1'-3"	1.50	6075	12,570
10"	5'-2"	3'-0"	3'-2"	2'-7"	1'-3"	1.81	7330	19,635
12"	5'-9"	3'-0"	3'-8"	2'-10 1/2"	1'-8"	2.34	9475	28,775
14"	6'-6"	3'-0"	4'-0"	3'-3"	1'-9"	2.89	11,700	38,490
16"	6'-9"	3'-0"	4'-9"	3'-3"	2'-3"	3.56	14,410	50,270

NOTES

1. ALL WATER MAINS GREATER THAN 16" I.D. SHALL BE INDIVIDUALLY CALCULATED BY ENGINEER.
2. SOIL CONDITIONS SHALL BE VERIFIED BY THE ENGINEER BEFORE THRUST RESTRAINT DESIGN IS IMPLEMENTED.
3. PIPE MUST BE DUCTILE IRON.

DESIGN DATA:

1. DIMENSION OF THRUST RESTRAINT IN FEET BASED ON 2000 POUNDS PER SQUARE FOOT SOIL BEARING PRESSURE AND 250 P.S.I. TEST PRESSURE. ACTUAL INSIDE DIAMETER OF DUCTILE IRON PIPE, CLASS 51, USED AS STANDARD.
2. CONCRETE SHALL BE CLASS A, 3000 P.S.I.
3. UNDER ADVERSE CONSTRUCTION CONDITIONS, CONCRETE SHALL BE "HIGH EARLY" TYPE.

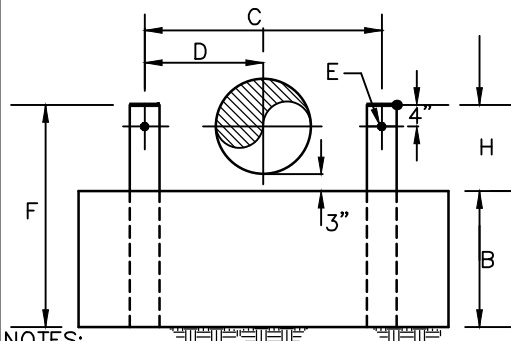
THRUST RESTRAINT: CONCRETE COLLAR

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-16

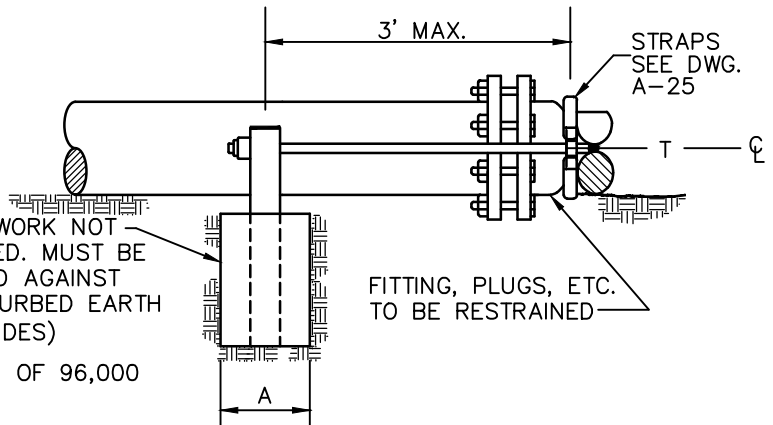
BEND	SIZE	A	B	C	D	VOL. YDS ³	N	T	ROD. DIA.	E (IN.)	F
TEES PLUGS & VALVES	6"	2'-0"	3'-0"	3'-0"	1'-0"	0.67	0'-10"	5,700	3/4"	6X6X3/8	3'-10"
	8"	3'-0"	3'-0"	5'-0"	1'-1"	1.67	0'-11"	10,000	3/4"	6X6X3/8	3'-11"
	10"	4'-0"	3'-0"	5'-0"	1'-2"	2.67	1'-0"	16,000	3/4"	6X6X3/8	4'-0"
	12"	5'-0"	4'-0"	6'-0"	1'-5"	4.44	1'-1"	22,650	3/4"	10X10X1/2	5'-1"
	14"	6'-0"	4'-0"	7'-0"	1'-6"	6.22	1'-2"	31,000	3/4"	10X10X1/2	5'-2"
	16"	7'-0"	4'-0"	8'-0"	1'-8"	6.30	1'-3"	40,250	3/4"	10X10X1/2	5'-3"
	20"	9'-0"	4'-8"	9'-0"	1'-11"	13.50	1'-5"	62,850	3/4"	W12X190	5'-11"
	24"	11'-0"	4'-8"	10'-0"	2'-2"	18.33	1'-7"	90,500	3/4"	W14X136	6'-1"
	30"	14'-8"	5'-6"	10'-0"	2'-6"	26.85	1'-10"	141,375		W14X398	6'-10"
11 1/4°	36"	18'-0"	5'-6"	10'-0"	2'-9"	36.67	2'-1"	203,575		W14X665	7'-7"
	6"	2'-0"	3'-0"	3'-0"	1'-0"	0.67	0'-10"	1,110	3/4"	6X6X3/8	3'-10"
	8"	2'-0"	3'-0"	3'-0"	1'-1"	0.67	0'-11"	2,000	3/4"	6X6X3/8	3'-11"
	10"	2'-0"	3'-0"	3'-0"	1'-2"	0.67	1'-0"	3,100	3/4"	6X6X3/8	4'-0"
	12"	2'-0"	3'-0"	3'-6"	1'-5"	0.78	1'-1"	4,450	3/4"	10X10X1/2	4'-1"
	14"	2'-0"	3'-0"	3'-6"	1'-6"	0.78	1'-2"	6,050	3/4"	10X10X1/2	4'-2"
	16"	3'-6"	3'-0"	4'-0"	1'-8"	1.56	1'-3"	7,900	3/4"	10X10X1/2	4'-3"
	20"	4'-0"	3'-0"	5'-6"	1'-11"	2.44	1'-5"	12,350	3/4"	W12X190	4'-5"
	24"	5'-0"	3'-6"	6'-0"	2'-2"	3.89	1'-7"	17,750	3/4"	W14X136	5'-1"
22 1/2°	30"	6'-0"	4'-0"	8'-0"	2'-6"	7.11	1'-10"	27,750	1"	W14X398	5'-10"
	36"	7'-6"	4'-0"	9'-0"	2'-9"	10.00	2'-1"	40,000	1"	W14X665	6'-1"
	6"	2'-0"	3'-0"	3'-0"	1'-0"	0.67	0'-10"	2,250	3/4"	6X6X3/8	3'-10"
	8"	2'-0"	3'-0"	3'-0"	1'-1"	0.67	0'-11"	4,000	3/4"	6X6X3/8	3'-11"
	10"	2'-0"	3'-0"	3'-0"	1'-2"	0.78	1'-0"	6,150	3/4"	6X6X3/8	4'-0"
	12"	3'-6"	3'-0"	3'-6"	1'-5"	1.56	1'-1"	8,850	3/4"	10X10X1/2	4'-1"
	14"	4'-0"	3'-0"	3'-6"	1'-6"	2.22	1'-2"	12,050	3/4"	10X10X1/2	4'-2"
	16"	4'-0"	3'-6"	4'-0"	1'-8"	3.11	1'-3"	15,700	3/4"	10X10X1/2	4'-9"
	20"	5'-0"	4'-0"	5'-6"	1'-11"	5.19	1'-5"	24,550	3/4"	W12X190	5'-3"
45°	24"	6'-6"	4'-0"	6'-0"	2'-2"	8.19	1'-7"	35,400	3/4"	W14X136	5'-7"
	30"	9'-0"	4'-0"	8'-0"	2'-6"	12.00	1'-10"	55,200	1"	W14X398	5'-10"
	36"	11'-0"	4'-0"	9'-0"	2'-9"	16.30	2'-1"	80,000	1"	W14X665	6'-1"
	6"	2'-0"	3'-0"	3'-0"	1'-0"	0.67	0'-10"	4,350	3/4"	6X6X3/8	3'-10"
	8"	2'-0"	3'-0"	4'-0"	1'-1"	0.89	0'-11"	7,700	3/4"	6X6X3/8	3'-11"
	10"	4'-0"	3'-0"	5'-0"	1'-2"	2.22	1'-0"	12,050	3/4"	6X6X3/8	4'-0"
	12"	4'-0"	4'-0"	5'-6"	1'-5"	3.26	1'-1"	17,350	3/4"	10X10X1/2	5'-1"
	14"	5'-6"	4'-0"	6'-0"	1'-6"	4.89	1'-2"	23,600	3/4"	10X10X1/2	5'-2"
	16"	6'-0"	4'-0"	7'-6"	1'-8"	6.67	1'-3"	30,000	3/4"	10X10X1/2	5'-3"
90°	20"	7'-0"	4'-6"	9'-0"	1'-11"	10.50	1'-5"	48,100	3/4"	W12X190	5'-11"
	24"	9'-6"	4'-6"	9'-6"	2'-2"	15.04	1'-7"	70,000	3/4"	W14X136	6'-1"
	30"	12'-6"	4'-6"	10'-0"	2'-6"	20.83	1'-10"	108,250	1"	W14X398	6'-4"
	36"	15'-8"	5'-0"	10'-0"	2'-9"	28.70	2'-1"	155,850		W14X665	7'-1"
	6"	2'-6"	3'-0"	4'-0"	1'-0"	1.11	0'-10"	8,000	3/4"	6X6X3/8	3'-10"
	8"	4'-0"	3'-0"	5'-6"	1'-1"	2.44	0'-11"	14,250	3/4"	6X6X3/8	3'-11"
	10"	5'-0"	3'-0"	7'-6"	1'-2"	4.17	1'-0"	22,250	3/4"	6X6X3/8	4'-0"
	12"	6'-0"	3'-0"	8'-0"	1'-5"	5.33	1'-1"	32,000	3/4"	10X10X1/2	4'-1"
	14"	7'-6"	3'-0"	9'-0"	1'-6"	7.50	1'-2"	43,550	3/4"	10X10X1/2	4'-2"
	16"	9'-0"	3'-6"	9'-0"	1'-8"	10.50	1'-3"	56,900	3/4"	10X10X1/2	4'-9"
	20"	12'-0"	3'-6"	9'-0"	1'-11"	14.00	1'-5"	88,900	3/4"	W12X190	4'-11"
	24"	14'-0"	4'-0"	10'-0"	2'-2"	20.74	1'-7"	128,000		W14X136	5'-7"
	30"	18'-0"	4'-6"	10'-0"	2'-6"	30.00	1'-10"	200,000		W14X398	6'-4"
	36"	22'-0"	5'-0"	10'-0"	2'-9"	40.74	2'-1"	287,900		W14X665	7'-1"



NOTES:

1. BASED ON ROD AND NUT HAVING YIELD STRENGTH OF 96,000 P.S.I.
2. SOIL BEARING CAPACITY OF 2000 P.S.F.
3. RODS TO HAVE 6" OF THREAD ON ENDS.
4. ALL METAL TO BE CLEANED AND COATED WITH APPROVED PROTECTIVE COATING FOLLOWING INSTALLATION AND PRIOR TO BACKFILLING. (SEE NOTE 5, DWG A-25 FOR COATING DETAILS)

FORM WORK NOT ALLOWED. MUST BE POURED AGAINST UNDISTURBED EARTH (ALL SIDES)

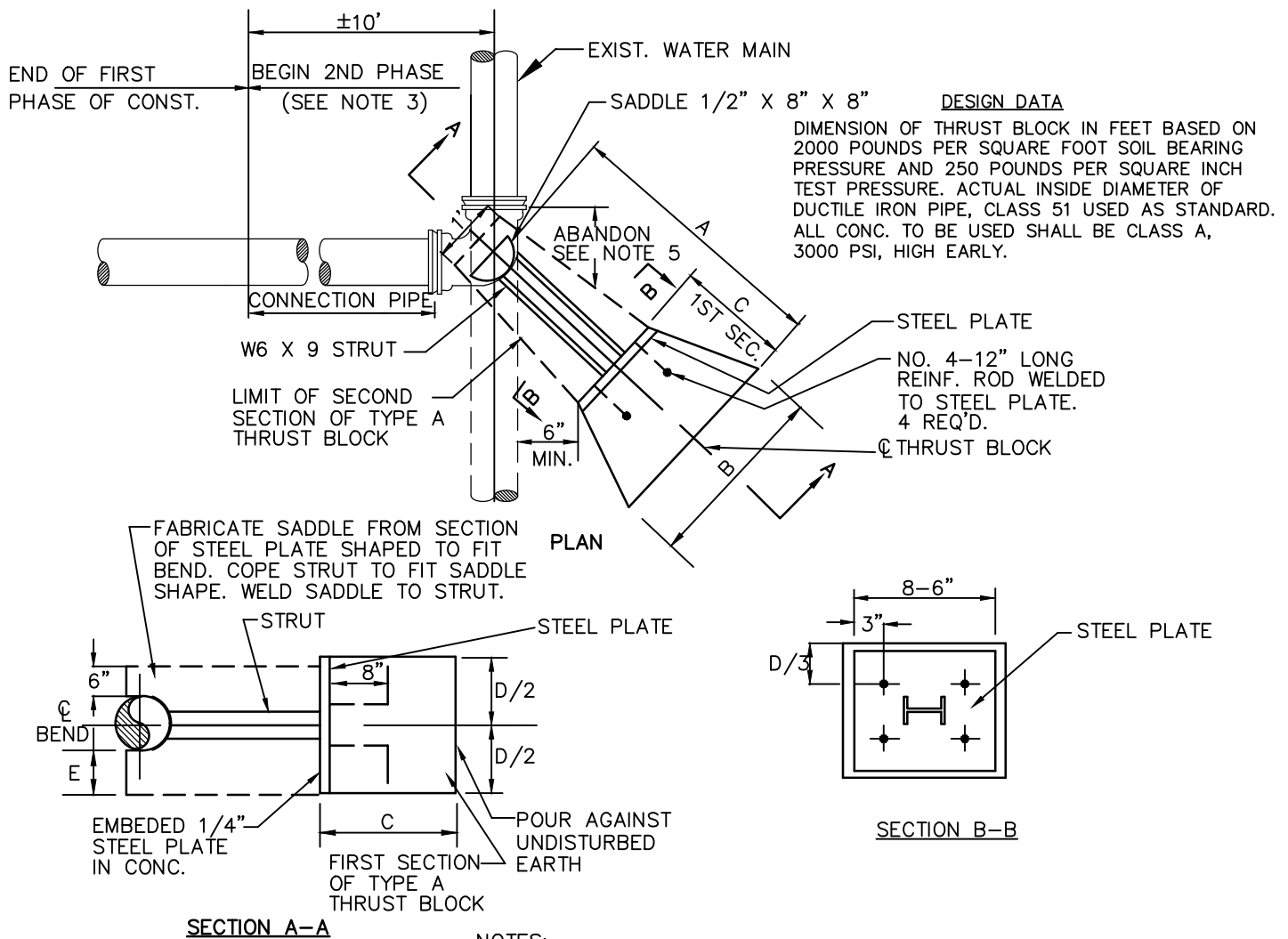


THRUST RESTRAINT:
HORIZ. BLOCK SUPPORT
AT PLUG ANCHOR

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-17



NOTES:

1. TYPE A THRUST BLOCK SHALL ONLY BE USED IN SITUATION WHERE NEW WATER MAIN CONSTRUCTION IS TO BE CONNECTED TO AN EXISTING WATER MAIN AND SHUT DOWN TIME ALLOWED WILL NOT PERMIT CONCRETE TO PROPERLY CURE FOR STANDARD THRUST BLOCK CONSTRUCTION.
2. CONTRACTOR WILL INSTALL NEW WATER MAIN TO A POINT APPROXIMATELY 10' FROM THE POINT OF CONNECTION TO THE EXISTING WATER MAIN AND INSTALL THE FIRST SECTION OF THRUST BLOCK. AFTER THE NEW WATER MAIN HAS BEEN SATISFACTORILY TESTED FOR HYDROSTATIC PRESSURE, BACTERIOLOGICALLY CHECKED AND ALL TEMPORARY THRUST BLOCKING HAS BEEN REMOVED, THE CONNECTION WILL BE COMPLETED.
3. ALL SECOND PHASE WORK IS TO BE COMPLETED BY THE C.W.W., EXCEPT EXCAVATING, BACKFILLING, REPAVING THE CONSTRUCTION AREA AND CONSTRUCTION OF FIRST SECTION OF TYPE A THRUST BLOCK.
4. INSTALLATION OF NEW BEND AND WIDE FLANGE STRUT SHALL BE PERFORMED AFTER THE FIRST SECTION OF THRUST BLOCK IS PROPERLY CURED.
5. CUT AND REMOVE PORTION OF EXISTING WATER MAIN AS REQ'D. TO ALLOW FOR INSTALLATION OF STEEL STRUTS AND SECOND SECTION OF TYPE A THRUST BLOCK. REMAINING UNUSED SECTION OF EXISTING WATER MAIN TO BE ABANDONED.
6. WATER MAY BE TURNED ON AFTER WIDE FLANGE STRUTS HAVE BEEN SECURELY WELDED TO THE BEARING PLATE EMBEDDED IN THE FIRST SECTION OF THRUST BLOCK AND TO THE BEND SADDLE.
7. SECOND SECTION POUR OF CONCRETE TO PROTECT STEEL STRUTS TO BE COMPLETED BEFORE BACKFILL.
8. PIPE SADDLES AND STRUTS MAY BE FIELD FABRICATED.
9. SOIL CONDITIONS SHALL BE VERIFIED BY THE ENGINEER BEFORE THRUST BLOCK DESIGN IS IMPLEMENTED.

DIMENSIONS IN FEET FOR CONCRETE BLOCKING-HORIZONTAL THRUST

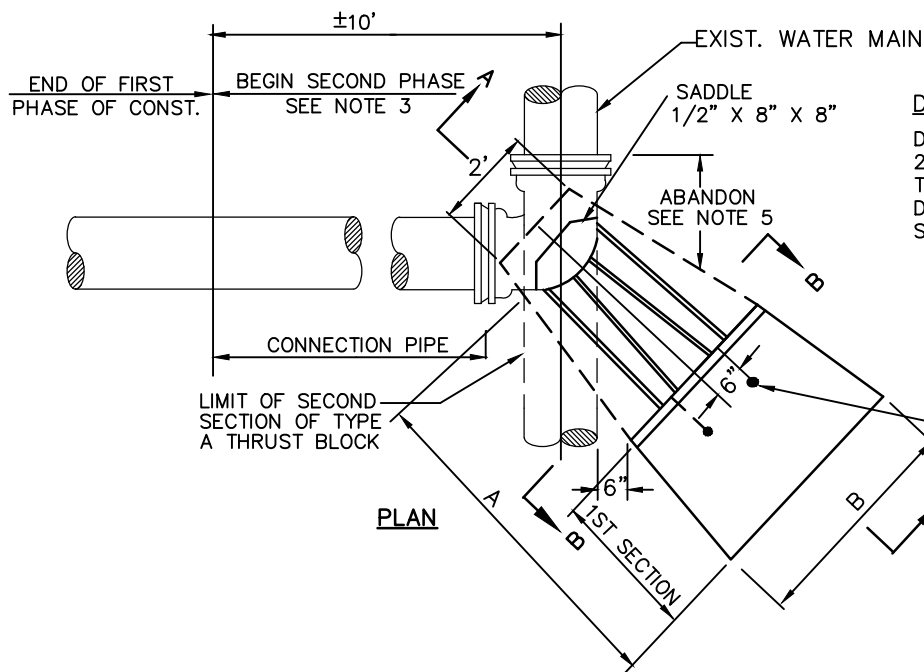
BEND	SIZE	A	B	C	D	E
45°	6"	3'-6"	2'-0"	1'-6"	1'-6"	0'-6"
	8"	4'-0"	2'-6"	2'-0"	2'-0"	0'-8"
	10"	4'-6"	3'-0"	2'-0"	2'-0"	0'-7"
	12"	5'-0"	4'-0"	2'-6"	3'-0"	1'-0"
	14"	5'-6"	4'-0"	2'-6"	3'-0"	0'-10"
90°	6"	3'-6"	2'-6"	1'-6"	2'-0"	0'-9"
	8"	4'-0"	3'-6"	2'-0"	2'-6"	0'-11"
	10"	4'-6"	4'-0"	2'-6"	3'-0"	1'-0"
	12"	5'-0"	5'-0"	2'-6"	4'-0"	1'-6"
	14"	5'-6"	5'-6"	3'-0"	4'-0"	1'-4"

**THRUST RESTRAINT:
 HORIZONTAL 6"-14"
 MAINS (TYPE A)**

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-18

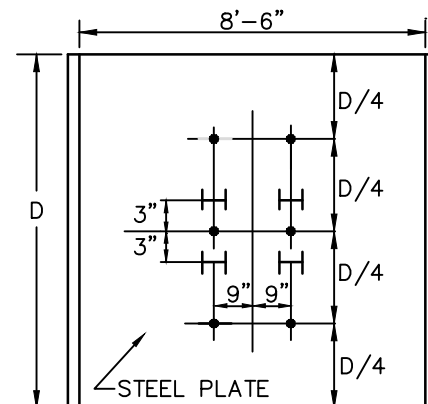
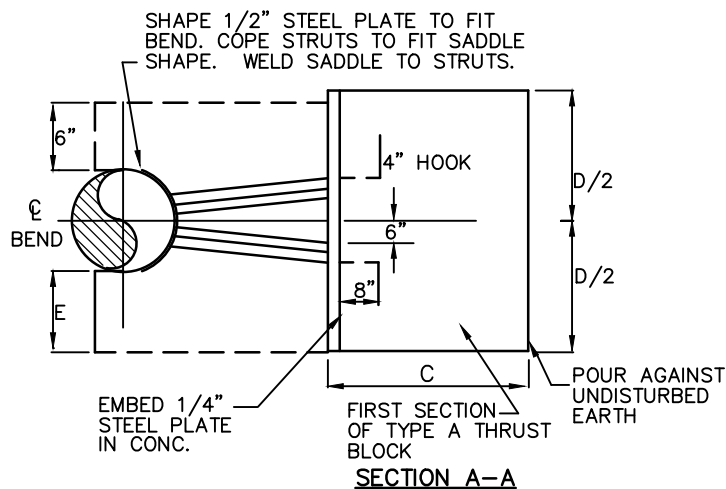


DESIGN DATA:

DIMENSION OF THRUST BLOCK IN FEET BASED ON 2000 PSF SOIL BEARING PRESSURE AND 250 PSI TEST PRESSURE. ACTUAL INSIDE DIAMETER OF D.I.P. CLASS 51 USED AS STANDARD. ALL CONC. SHALL BE 3000 PSI, HIGH EARLY TYPE.

DIMENSIONS FOR CONCRETE BLOCKING HORIZONTAL THRUST

BEND	SIZE	A	B	C	D	E
45°	16"	7'-0"	5'-0"	3'-0"	4'-0"	1'-5"
	20"	7'-6"	6'-0"	3'-6"	5'-0"	1'-7"
	24"	9'-0"	8'-0"	4'-6"	5'-6"	1'-9"
90°	16"	7'-0"	6'-6"	3'-0"	5'-6"	2'-0"
	20"	7'-0"	8'-0"	3'-6"	7'-0"	2'-9"
	24"	9'-0"	9'-0"	4'-9"	9'-0"	3'-5"



SECTION B-B

NOTES:

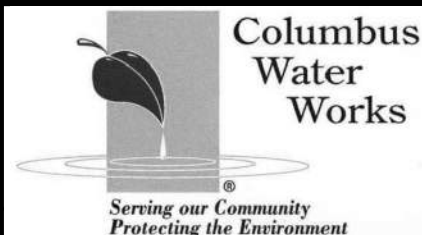
1. TYPE A THRUST BLOCK SHALL BE USED IN SITUATIONS WHERE NEW WATER MAIN CONSTRUCTION IS TO BE CONNECTED TO AN EXISTING WATER MAIN AND SHUT DOWN TIME ALLOWED WILL NOT PERMIT CONCRETE TO PROPERLY CURE FOR STANDARD THRUST BLOCK CONSTRUCTION.
2. CONTRACTOR WILL INSTALL NEW WATER MAIN TO A POINT APPROXIMATELY 10' FROM THE POINT OF CONNECTION TO THE EXISTING WATER MAIN. AFTER THE NEW WATER MAIN HAS BEEN SATISFACTORILY TESTED FOR HYDROSTATIC PRESSURE, BACTERIOLOGICALLY CHECKED AND ALL TEMPORARY THRUST BLOCKING HAS BEEN REMOVED, THE CONNECTION WILL BE COMPLETED.
3. ALL SECOND PHASE WORK IS TO BE COMPLETED BY THE CWW EXCEPT EXCAVATING, BACKFILLING, REPAVING THE CONSTRUCTION AREA AND CONSTRUCTION OF FIRST SECTION OF TYPE A THRUST BLOCK.
4. INSTALLATION OF NEW BEND AND WIDE FLANGE STRUT SHALL BE PERFORMED AFTER THE FIRST SECTION OF THRUST BLOCK IS PROPERLY CURED.
5. CUT AND REMOVE PORTION OF EXISTING WATER MAINS REQ'D TO ALLOW INSTALLATION OF STEEL STRUTS AND SECOND SECTION OF TYPE A THRUST BLOCK. REMAINING UNUSED SECTION OF EXISTING WATER MAIN TO BE ABANDONED.
6. WATER MAY BE TURNED ON AFTER WIDE FLANGE STRUTS HAVE BEEN SECURELY WELDED TO THE BEARING PLATE EMBEDDED IN THE FIRST SECTION OF THRUST BLOCK AND TO THE BEND SADDLE.
7. SECOND SECTION POUR OF CONCRETE TO PROTECT STEEL STRUTS TO BE COMPLETED BEFORE BACKFILL.
8. PIPE SADDLES AND STRUTS MAY BE FIELD FABRICATED.
9. SOIL CONDITIONS SHALL BE VERIFIED BY THE ENGINEER BEFORE THRUST BLOCK DESIGN IS IMPLEMENTED.

THRUST RESTRAINT:
HORIZONTAL 16"-24"
MAINS (TYPE A)

SCALE: N.T.S.

DATE: NOVEMBER 2019

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	PIPE SIZE	ROD DIA.	NO. RODS	TOTAL THRUST (lbs)
TEES, PLUGS & VALVES	6"	3/4"	2	5,655
	8"	3/4"	2	10,055
	10"	3/4"	2	15,710
	12"	3/4"	2	22,620
	14"	3/4"	2	30,800
	16"	3/4"	2	40,215
	20"	3/4"	2	62,835
	24"	3/4"	2	90,480
	30"	1"	4	141,375
	36"	1"	4	203,595
11 1/4° BEND	6"	3/4"	2	1,110
	8"	3/4"	2	1,970
	10"	3/4"	2	3,080
	12"	3/4"	2	4,435
	14"	3/4"	2	6,035
	16"	3/4"	2	7,885
	20"	3/4"	2	12,320
	24"	3/4"	2	17,740
	30"	1"	2	27,720
	36"	1"	2	39,910
22 1/2° BEND	6"	3/4"	2	2,210
	8"	3/4"	2	3,925
	10"	3/4"	2	6,130
	12"	3/4"	2	8,825
	14"	3/4"	2	12,015
	16"	3/4"	2	15,690
	20"	3/4"	2	24,515
	24"	3/4"	2	35,305
	30"	1"	2	55,160
	36"	1"	2	79,435
45° BEND	6"	3/4"	2	4,430
	8"	3/4"	2	7,700
	10"	3/4"	2	12,025
	12"	3/4"	2	17,312
	14"	3/4"	2	23,565
	16"	3/4"	2	30,780
	20"	3/4"	2	48,090
	24"	3/4"	2	69,250
	30"	1"	2	108,205
	36"	1"	4	155,810
90° BEND	6"	3/4"	2	8,000
	8"	3/4"	2	14,220
	10"	3/4"	2	22,214
	12"	3/4"	2	32,000
	14"	3/4"	2	43,540
	16"	3/4"	2	56,870
	20"	3/4"	2	88,860
	24"	3/4"	4	127,960
	30"	1"	4	199,930
	36"	1"	4	287,900

NOTES:

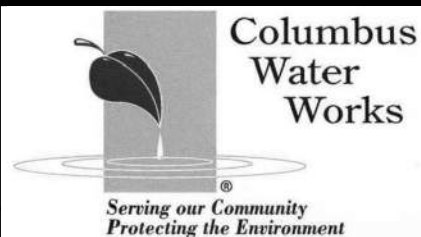
1. BASED UPON ROD & NUT HAVING MIN. YIELD STRENGTH OF 95,000 P.S.I.
2. RODS HAVE 6" OF THREAD ON EACH END.
3. ALL METAL TO BE CLEANED AND COATED WITH AN APPROVED PROTECTIVE COATING FOLLOWING INSTALLATION AND PRIOR TO BACKFILLING. (SEE NOTE 5, DWG. A-25 FOR COATING DETAILS).

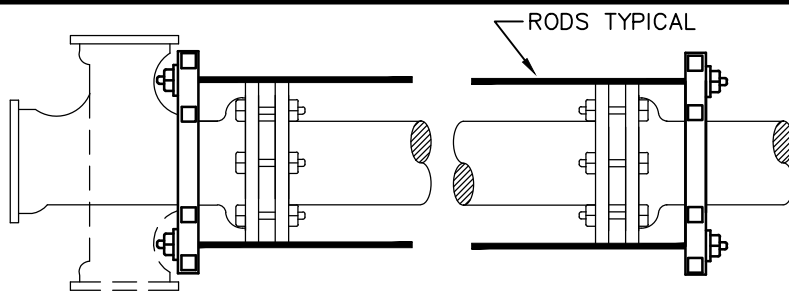
THRUST RESTRAINT: TIE-ROD CHART

SCALE: N.T.S.

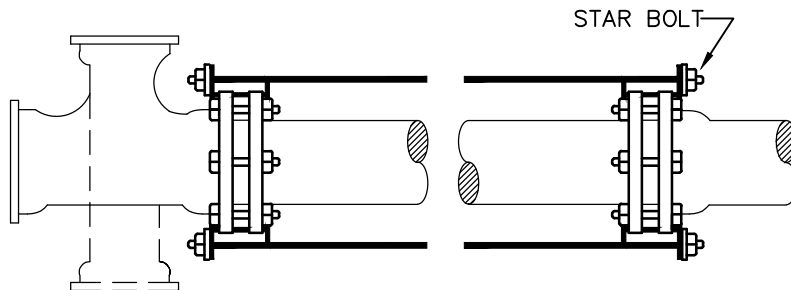
DATE: NOVEMBER 2019

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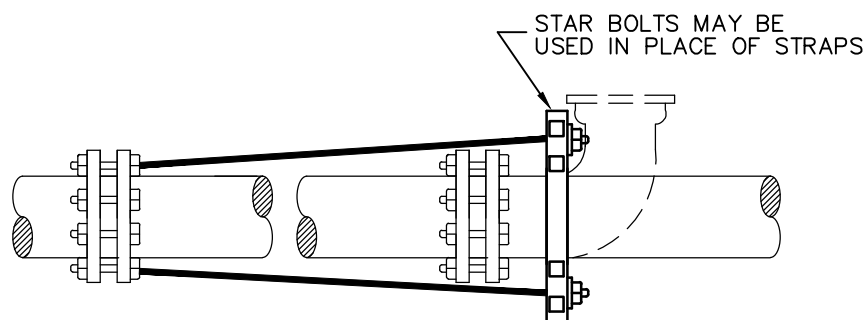




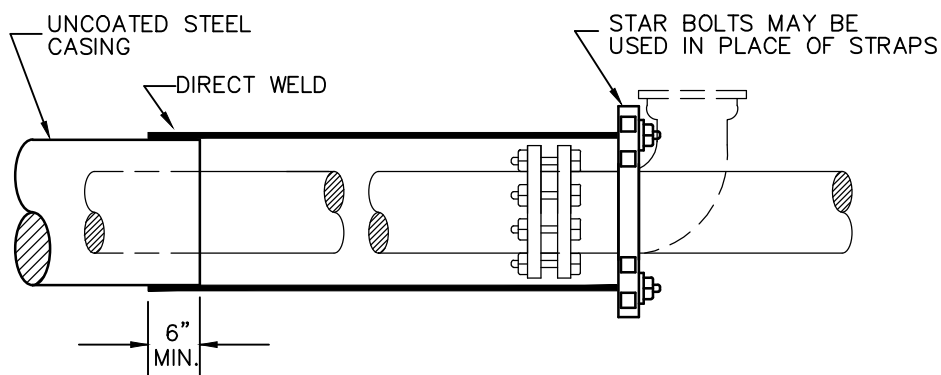
I.
FITTING RESTRAINT
STRAPS & RODS



II.
FITTING RESTRAINT
STAR BOLTS AND RODS



III.
FITTING RESTRAINT
FLANGE-MJ



IV.
FITTING RESTRAINT
DIRECT WELD TO STEEL CASING
(10" OR LESS MAINS, ONLY)

NOTES:

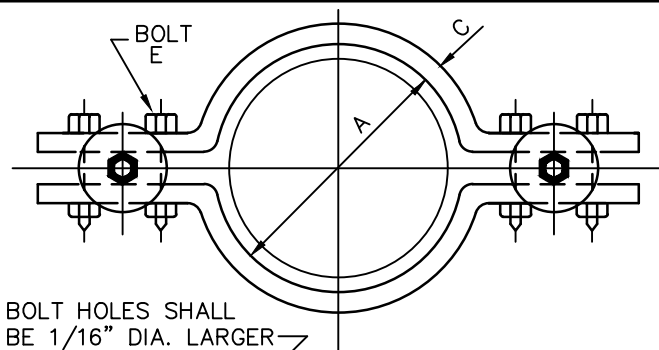
1. SEE DWG. A-23 FOR NUMBER AND DIAMETER OF RODS REQUIRED.
2. NO FLANGED JOINTS ARE TO BE BURIED.
3. AFTER INSTALLATION, TIE-RODS AND CLAMP ASSEMBLIES SHALL BE CLEANED AND THOROUGHLY COATED WITH ROYSTON LABORATORIES, INC. ROSKOTE PLASTIC NO. A939 OR KOPPERS CO. INC. BITUMASTIC SUPERSERVICE BLACK OR APPROVED EQUIVALENT.
4. WHEN RESTRAINING FITTINGS TO STEEL CASING PIPE, THE TIE-RODS MUST BE DIRECT WELDED TO THE CASING. USE OF STAR BOLTS PROHIBITED. CASING MUST BE FULLY WELDED THROUGHOUT ITS LENGTH AND BE A MINIMUM OF 30' IN LENGTH. AREA TO BE WELDED MUST BE COMPLETELY BARE AND FREE OF ANY COATING MATERIAL.

THRUST RESTRAINT: TIE-ROD INSTALLATION

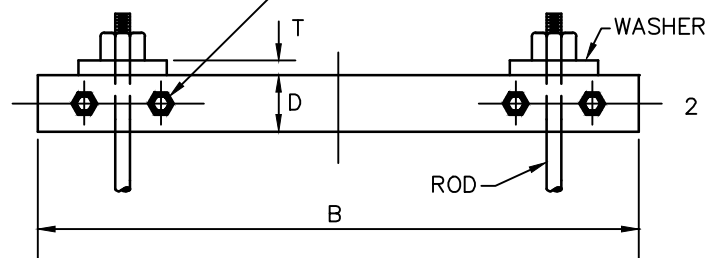
SCALE: N.T.S.

DATE: NOVEMBER 2019

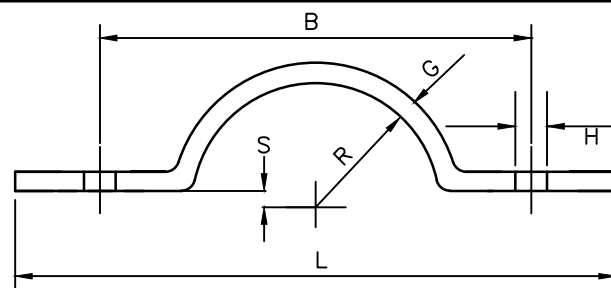
A-21



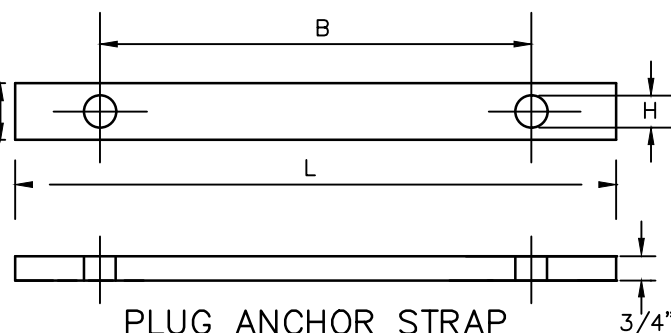
BOLT HOLES SHALL BE 1/16" DIA. LARGER THAN BOLTS.



JOINT STRAP & ROD ARRANGEMENT



TEE ANCHOR STRAP AT PLUG



PLUG ANCHOR STRAP

STEEL SOCKET CLAMP DIMENSIONS (INCHES)

SIZE	A	B	C	D	E	T	ROD, C & WASH. SIZE
6	7 1/8	17 7/8	1/2	2	5/8 X 3 1/2	5/8	3/4
8	9 5/16	19 1/8	5/8	2 1/2	5/8 X 3 3/4	5/8	3/4
10	11 1/2	21 3/8	5/8	2 1/2	3/4 X 3 3/4	3/4	3/4
12	13 1/2	25 1/8	5/8	3	7/8 X 4 1/2	3/4	3/4
14	15 3/4	28 1/4	3/4	3	7/8 X 4 1/2	7/8	3/4
16	17 7/8	31 3/8	3/4	4	1 X 4 1/2	7/8	3/4
20	22 1/8	37 3/4	3/4	4 1/2	1 1/4 X 5	1 1/8	3/4
24	26 3/8	44 1/4	3/4	5	1 1/2 X 5 1/2	1 1/4	3/4

ABOVE ANCHOR STRAP DIMENSIONS (INCHES)

SIZE	B	G	H	L	R	S
6	12 1/8	5/8 X 2 1/2	13/16	14 1/2	3 9/16	3/4
8	14 3/8	5/8 X 2 1/2	13/16	16 3/4	4 21/32	3/4
10	16 11/16	5/8 X 2 1/2	1 1/16	19 1/16	5 3/4	3/4
12	19 3/16	5/8 X 3	1 1/16	22 5/16	6 3/4	7/8

NOTES:

1. INSTALLATION OF AND MATERIALS FOR RODS, CLAMPS, STRAPS, BOLTS AND WASHERS SHALL CONFORM TO THE NATIONAL FIRE CODES – NFFA NO. 24 LATEST REVISION.
2. YOKES AND ANCHOR STRAPS FOR FITTINGS LARGER THAN 12" SHALL BE DESIGNED AND APPROVED FOR SPECIFIC INSTALLATION.
3. RODS TO BE HIGH TENSILE, HOT ROLLED STEEL WITH TENSILE STRENGTH OF 110,000 P.S.I. AND A MIN. OF 95,000 YIELD STRENGTH.
4. NUTS TO HAVE HEAVY DUTY SEMI-FINISH WITH NATIONAL COURSE THREADS.
5. AFTER INSTALLATION TIE RODS AND CLAMP ASSEMBLY SHALL BE THOROUGHLY COVERED WITH ROYSTON LABS, INC. ROSKOTE MASTIC NO A939, OR KOPPERS CO., INC. BITUMASTIC SUPERSERVICE BLACK OR APPROVED EQUIVALENT.

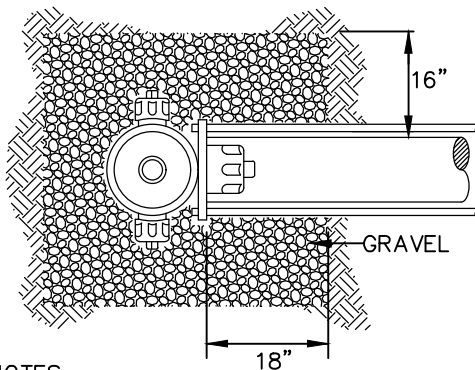
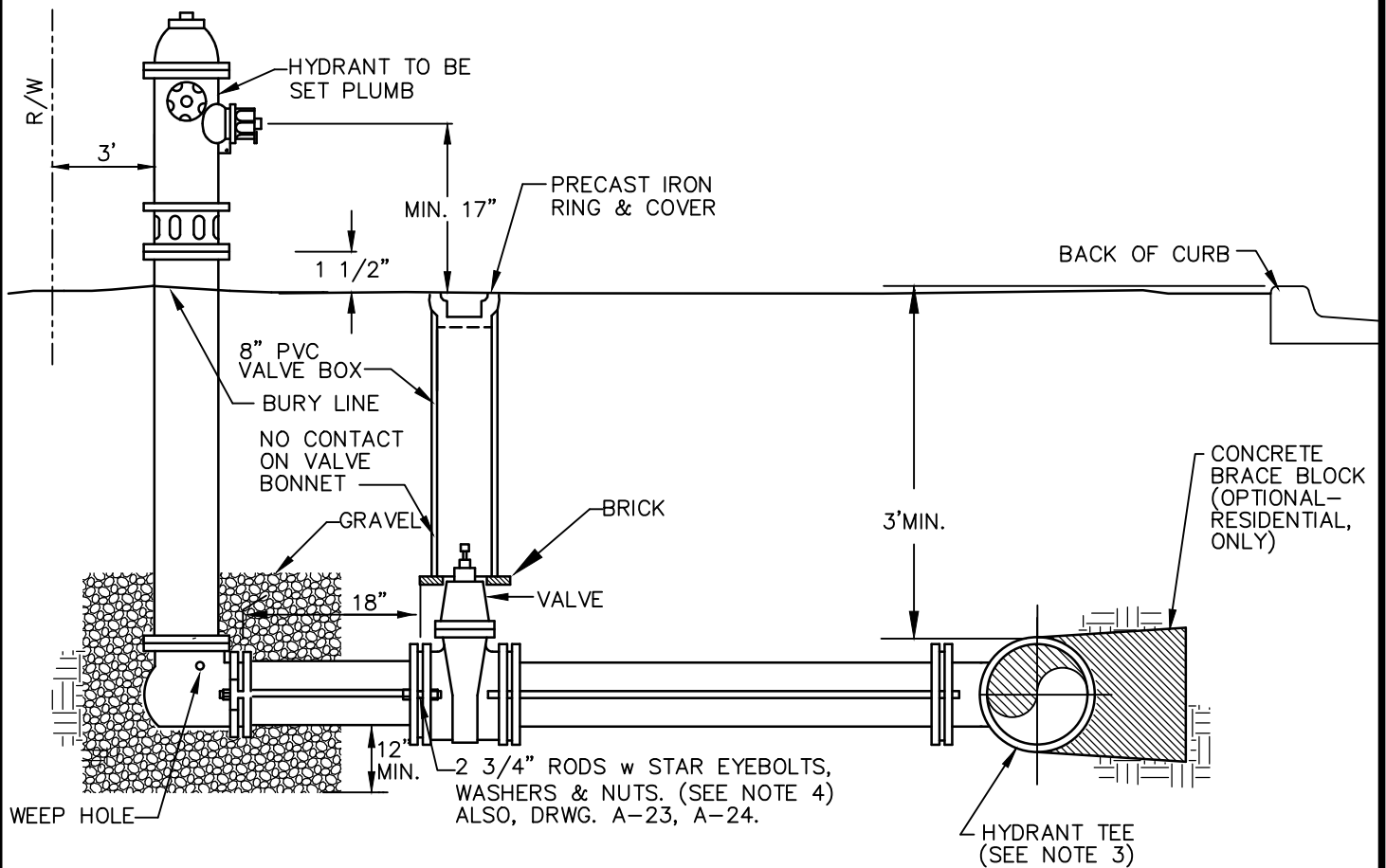
THRUST RESTRAINT: STRAP & ROD DETAILS

SCALE: N.T.S.

DATE: NOVEMBER 2019

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PLACE GRAVEL TO 6" ABOVE WEEP HOLES, 18" BELOW WEEP HOLES AND 18" TOWARDS THE MAIN. ALSO 16" Laterally ON EACH SIDE. COMPACT GRAVEL UNDER HYDRANT.

NOTES:

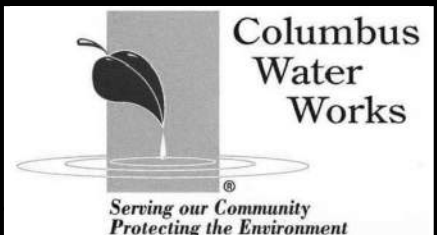
1. RODS TO BE HIGH TENSILE, HOT ROLLED STEEL WITH TENSILE STRENGTH OF 110,000 P.S.I. AND A MINIMUM YIELD STRENGTH OF 95,000 P.S.I.
2. FOR ALL WATER MAINS IN COUNTY, STATE, OR FEDERAL R/W'S - MINIMUM TRENCH DEPTH SHALL BE 4' FROM TOP OF CURB.
3. IF REGULAR TEE USED, MINIMUM NIPPLE LENGTHS SHALL BE 12".
4. IF SUITABLE LENGTH ANCHOR COUPLINGS ARE USED, RODS MAY BE OMITTED.
5. SPACE HYDRANTS AS SHOWN ON APPROVED PLAN
6. FIRE HYDRANTS SHALL BE PROVIDED WITH A 5 INCH STORZ CONNECTION. THE STORZ CONNECTION SHALL BE A 5" METAL FACE x 4-1/2" NH (F) SET SCREW, HIGH VISIBILITY WITH HYDRANT NUT CAP. THE COLOR SHALL BE POWDER COATED YELLOW WITH HIGH VISIBILITY REFLECTIVE TAPE.

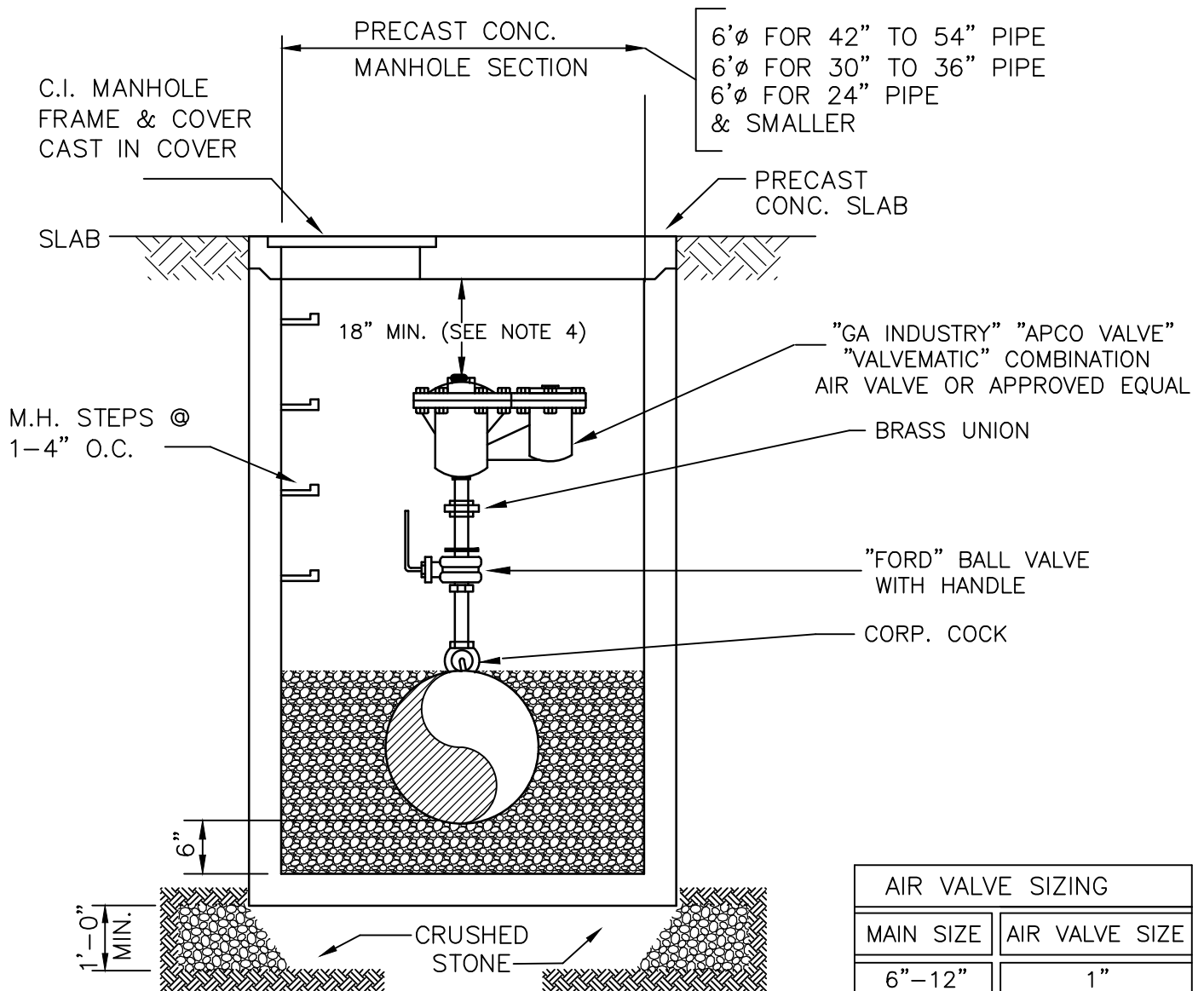
FIRE HYDRANT INSTALLATION

SCALE: N.T.S.

DATE: NOVEMBER 2019

A-23





AIR VALVE SIZING	
MAIN SIZE	AIR VALVE SIZE
6"-12"	1"
14"-16"	1 1/2"
20"-30"	2"
36"-42"	2"

NOTES:

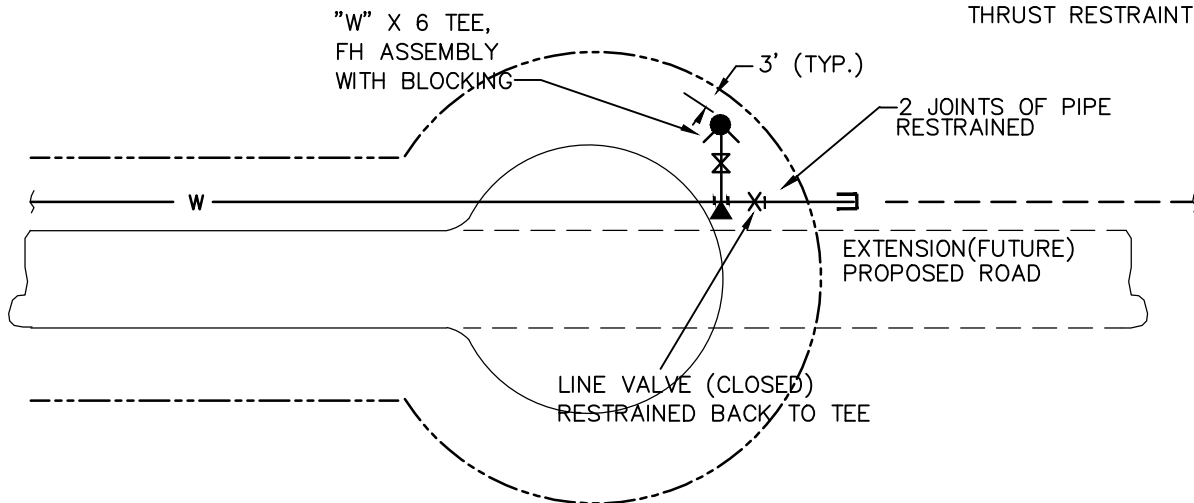
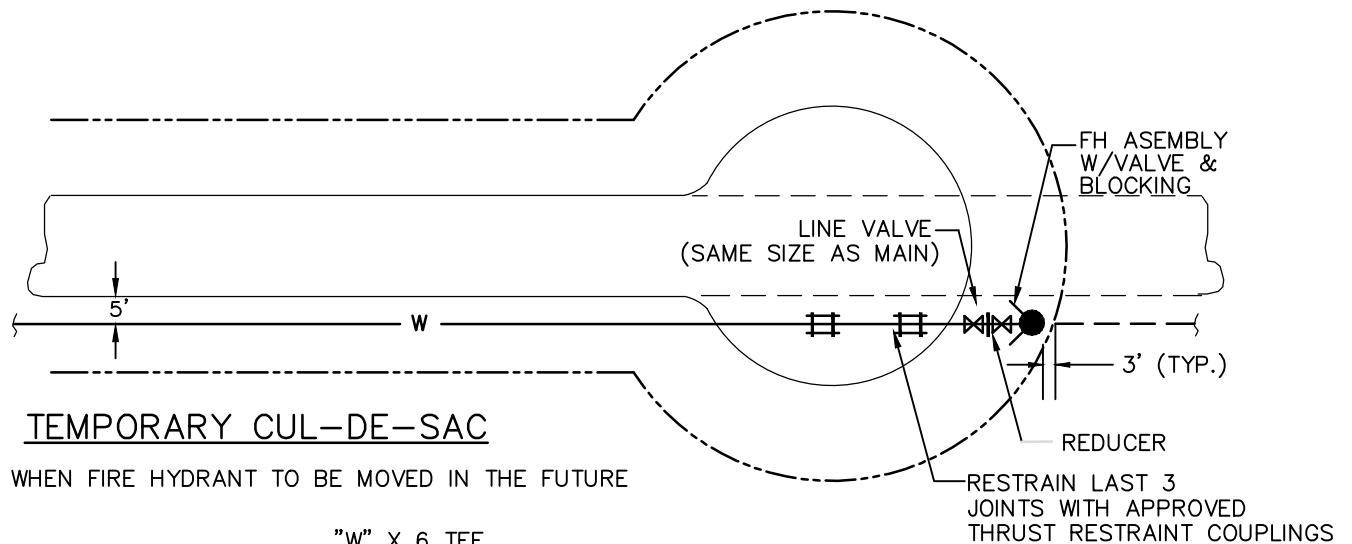
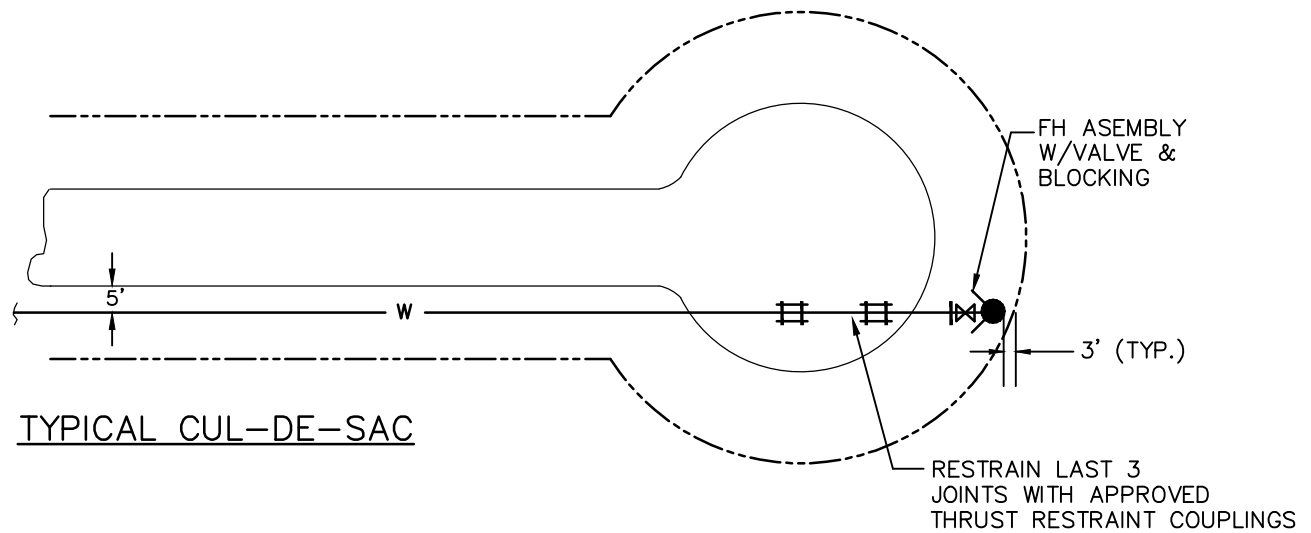
1. ALL NIPPLES TO BE "ALL THREADED" MINIMUM LENGTH.
2. ALL PIPE TO BE RED BRASS.
3. ALL FITTINGS TO BE BRASS.
4. WHERE DIMINSIONS WILL BE LESS THAN 18", CONTACT CWW ENGINEERING DEPT. FOR SPECIAL DESIGN.
5. STANDARD METER BOXES WITH EXTENSIONS MAY BE SUBSTITUTED FOR MANHOLES WHEN APPROVED BY CWW ENGINEERING DEPT.
6. AIR VALVES SHALL BE "GA INDUSTRY" "APCO VALVE" OR "VALVEMATIC COMBINATION AIR VALVES WITH SCREWED CONNECTIONS.

AIR VALVE INSTALLATION

SCALE: N.T.S.

DATE: NOVEMBER 2019

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FIRE HYDRANT IN A CUL-DE-SAC

SCALE: N.T.S.

DATE: NOVEMBER 2019

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APPROVED TAPPING SADDLE SIZES

MAIN SIZE		3/4"	1"	1-1/4"	1-1/2"	2"
	3"	NO	YES	YES	YES	YES
	4"	NO	NO	YES	YES	YES
	6"	NO	NO	NO	YES	YES
	8"	NO	NO	NO	NO	YES
	10"	NO	NO	NO	NO	YES
	12"	NO	NO	NO	NO	NO

DESIGN CRITERIA FOR SPECIFYING USE OF TAPPING SADDLE MINIMUM 2 FULL THREADS

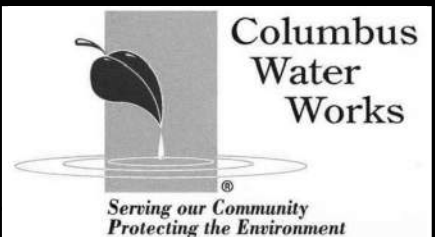
MAIN SIZE		NO. FULL THREADS ENGAGED				
		3/4"	1"	1-1/4"	1-1/2"	2"
	3"	2.4	1.6	0.6	0	0
	4"	2.7	2.0	1.1	0.5	0
	6"	3.3	2.6	2.0	1.5	0.4
	8"	3.7	3.0	2.5	2.2	1.3
	10"	4.1	3.4	2.9	2.6	1.9
	12"	4.4	3.7	3.3	3.0	2.5

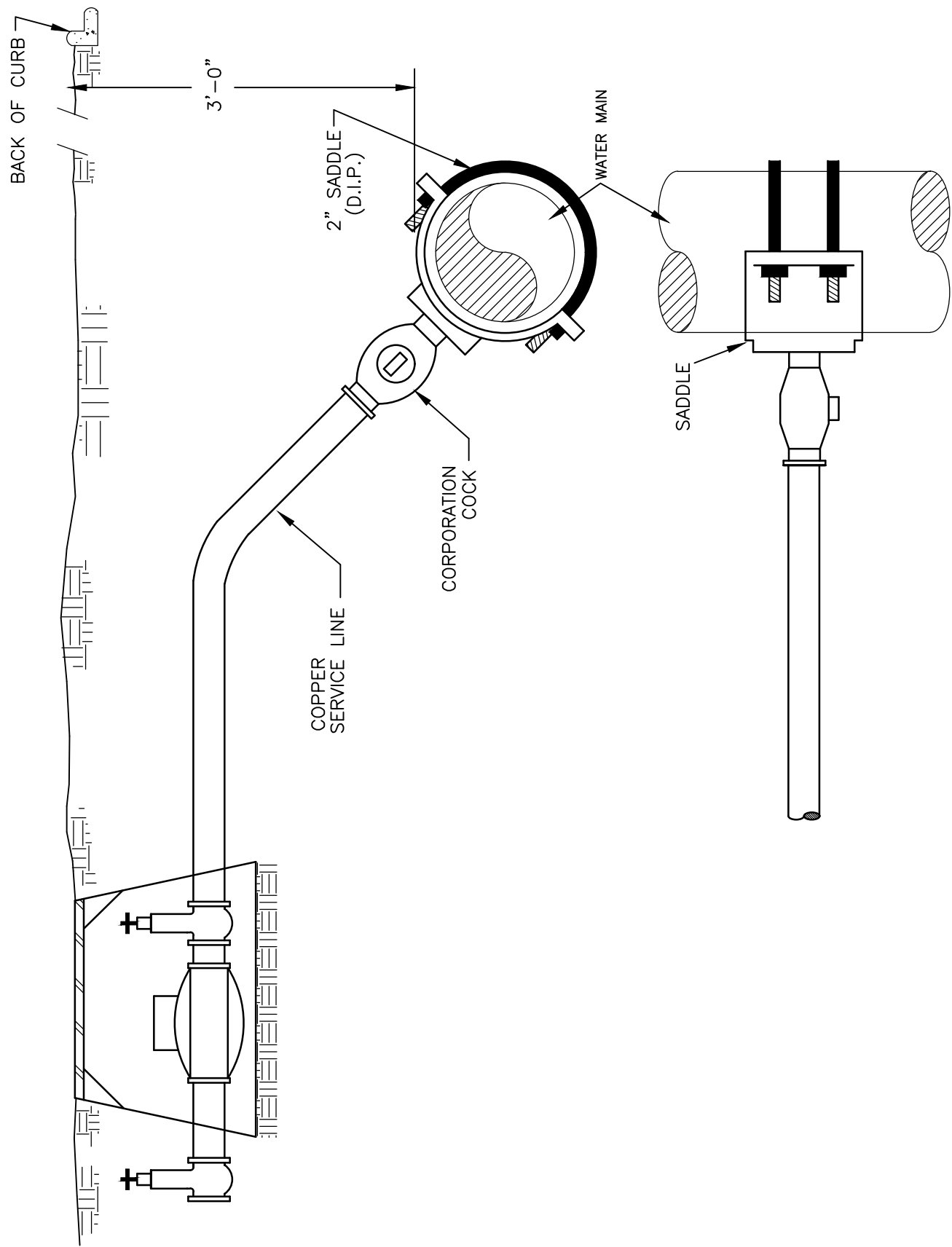
SERVICE CONNECTION REQUIREMENTS

SCALE: N.T.S.

DATE: NOVEMBER 2019

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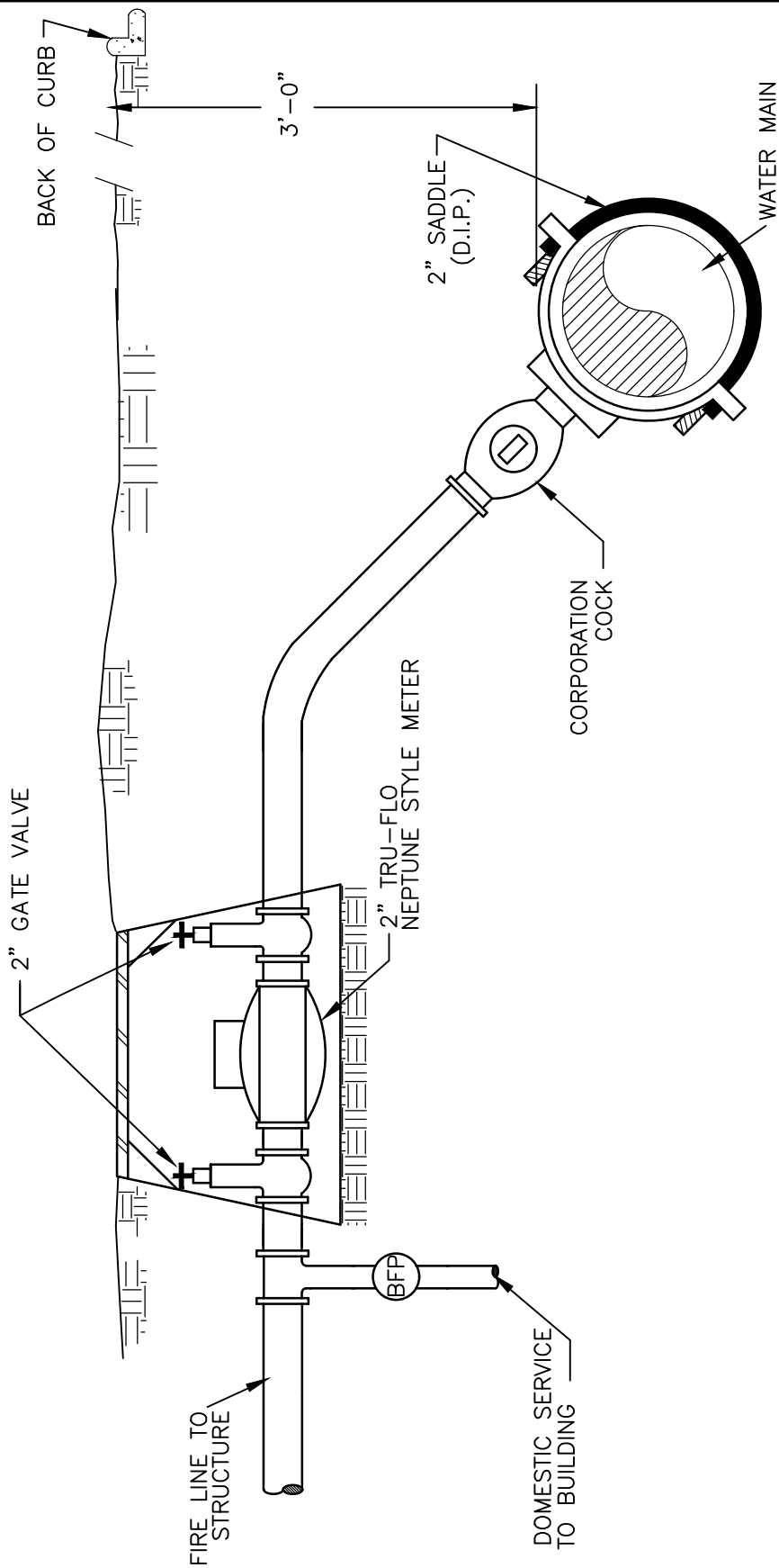


2" METER SETTINGS

SCALE: N.T.S.

DATE: NOVEMBER 2019

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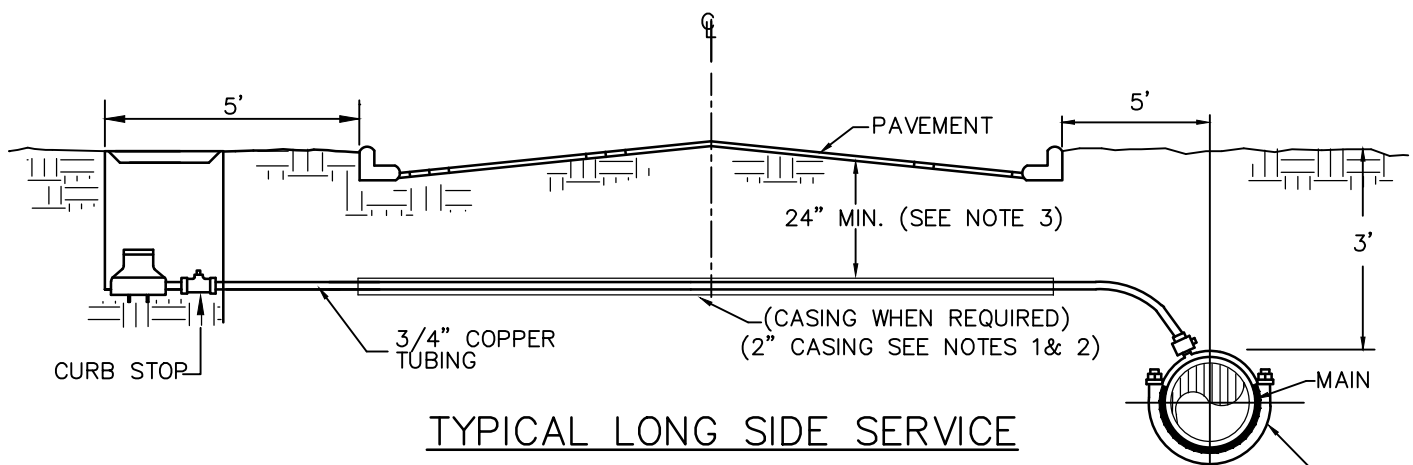
- NOTES:
1. THIS WORK MUST COMPLY WITH NFPA - 13R
 2. SINGLE METER WILL SERVE BOTH DOMESTIC AND FIRE SERVICE
 3. 2" GATE VALVE TO CONTROL WATER SUPPLY TO BOTH DOMESTIC AND FIRE SERVICE

TYPICAL 2" DOMESTIC/FIRE

SCALE: N.T.S.

DATE: NOVEMBER 2019

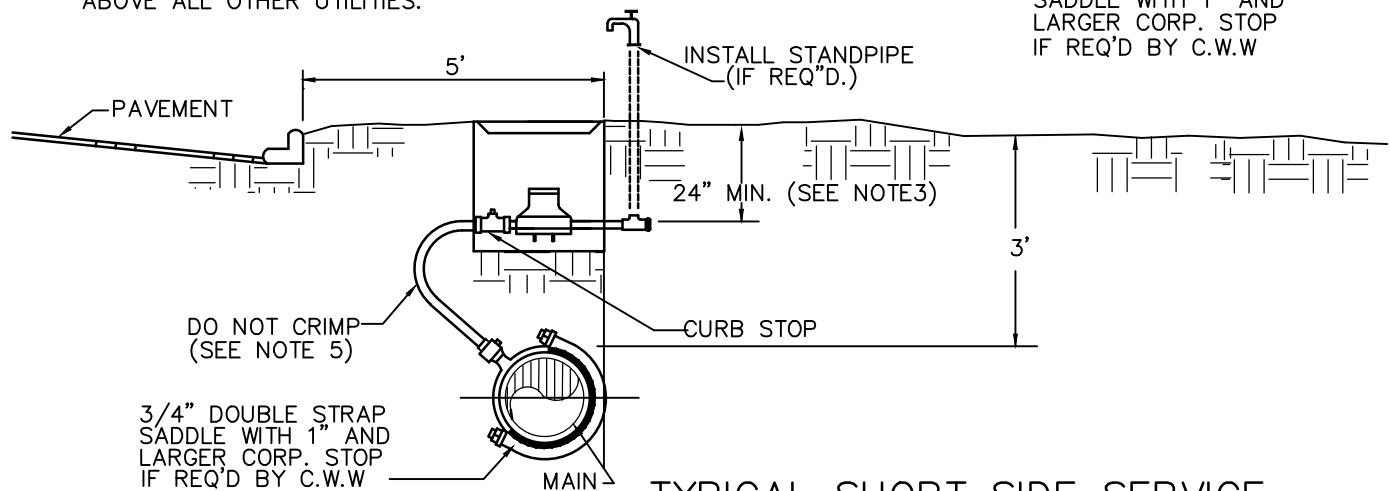
A-28



TYPICAL LONG SIDE SERVICE

NOTE: WATER SERVICE LINE IS LOCATED ABOVE ALL OTHER UTILITIES.

USE DOUBLE STRAP SADDLE WITH 1" AND LARGER CORP. STOP IF REQ'D BY C.W.W



TYPICAL SHORT SIDE SERVICE

NOTES:

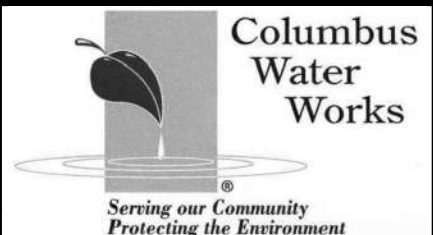
1. IN THE EVENT CASING IS NOT PRESENT ON LONG SIDE LOT, BORING SHALL BE PERMITTED. WHEN CASING DOES EXIST—1" OR 3/4" PIPE SHALL BE INSERTED THROUGH CASING TO COMPLETE THE INSTALLATION FROM THE MAIN TO THE METER.
2. NO ROAD CUT WILL BE PERMITTED UNTIL 3 ATTEMPTS HAVE BEEN MADE AT BORING. THE SPECIFIC APPROVAL OF THE WATER SYSTEM'S INSPECTOR SHALL BE OBTAINED PRIOR TO CUTTING THE PAVEMENT.
3. 24" COVER (MIN.) FROM SURFACE TO TOP OF SERVICE PIPE, FOR MAJOR ROADS MINIMUM COVER SHALL BE 48".
4. ALL CUTS IN PAVEMENT SHALL BE REPAIRED IN ACCORDANCE WITH EITHER GA. D.O.T. OR CITY OF COLUMBUS STANDARDS. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER DITCH COMPACTION, CUT BACK OF DITCH SIDES AND PAVING OF THE REQUIRED CONCRETE SUB-BASE AND PLATING THE DITCH TO ALLOW TRAFFIC FLOW WHILE CONCRETE IS SETTING UP. STEEL TRAFFIC PLATES WILL COVER POURED CONCRETE FOR A MINIMUM OF 24 HOURS.
5. WHEN CHANGING OVER A METER FROM A MAIN TO BE ABANDONED TO A NEW MAIN, THE ENTIRE SERVICE LINE FROM THE NEW MAIN TO THE METER SHALL BE REPLACED WITH COPPER TUBING IF THE EXISTING MATERIAL IS PB OR GALVANIZED. IF THE EXISTING MATERIAL IS COPPER, AN APPROVED COUPLING MAY BE USED TO ADD SUFFICIENT COPPER LENGTH TO THE SERVICE LINE TO CONNECT IT TO THE NEW WATER MAIN. SERVICE LINE SHALL BE LOCATED OVER ALL OTHER UTILITIES.
6. FINAL METER BOX SHALL BE PLACED 5 FEET OFF THE BACK OF CURB OR EDGE OF PAVEMENT.

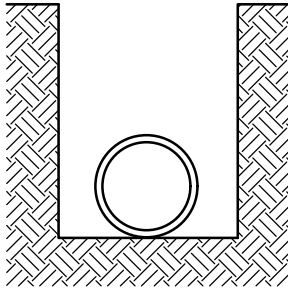
3/4"–1" METER
SETTINGS
SHORT & LONG SIDES

SCALE: N.T.S.

DATE: NOVEMBER 2019

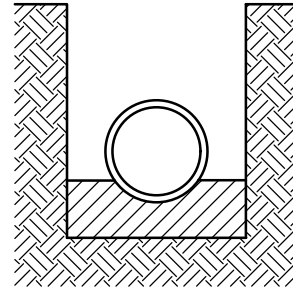
A-29





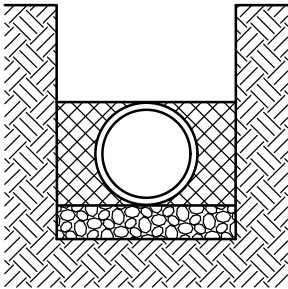
TYPE 1*

FLAT BOTTOM TRENCH . + LOOSE BACKFILL



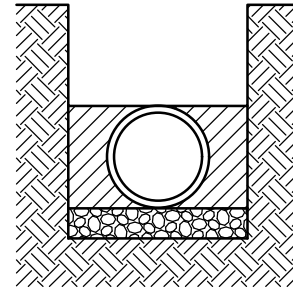
TYPE 2

FLAT-BOTTOM TRENCH. + BACKFILL LIGHTLY CONSOLIDATED TO CENTERLINE OF PIPE.



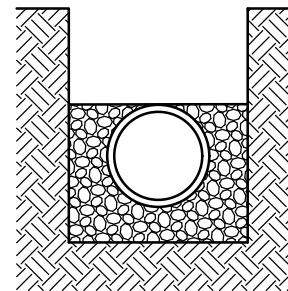
TYPE 3

PIPE BEDDED IN 4" MINIMUM LOOSE SOIL.++ BACKFILL LIGHTLY CONSOLIDATED TO TOP OF PIPE.



TYPE 4

PIPE BEDDED IN SAND, GRAVEL OR CRUSHED STONE TO DEPTH OF 1/8 PIPE DIAMETER 4" MINIMUM. BACKFILL COMPACTED TO TOP OF PIPE. (APPROXIMATELY 80% STANDARD PROCTOR, AASHTO T-99.)



TYPE 5

PIPE BEDDED TO ITS CENTERLINE IN COMPACTED GRANULAR MATERIAL, 4" MINIMUM UNDER PIPE. COMPACTED GRANULAR OR SELECT MATERIAL++ TO TOP OF PIPE. (APPROXIMATELY 90% STANDARD PROCTOR, AASHTO T-99.)

NOTES:

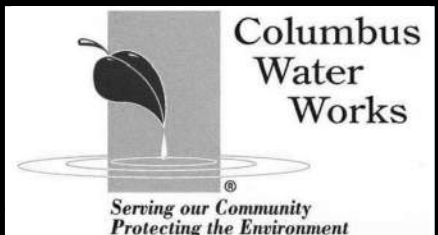
- * FOR 30" AND LARGER PIPE, CONSIDERATION SHOULD BE GIVEN TO THE USE OF LAYING OTHER THAN TYPE 1.
- + "FLAT-BOTTOM" IS DEFINED AS UNDISTURBED EARTH.
- ++ "LOOSE SOIL" OR "SELECT MATERIAL" IS DEFINED AS NATIVE SOIL EXCAVATED FROM THE TRENCH, FREE OF ROCKS, FOREIGN MATERIAL AND FROZEN EARTH.

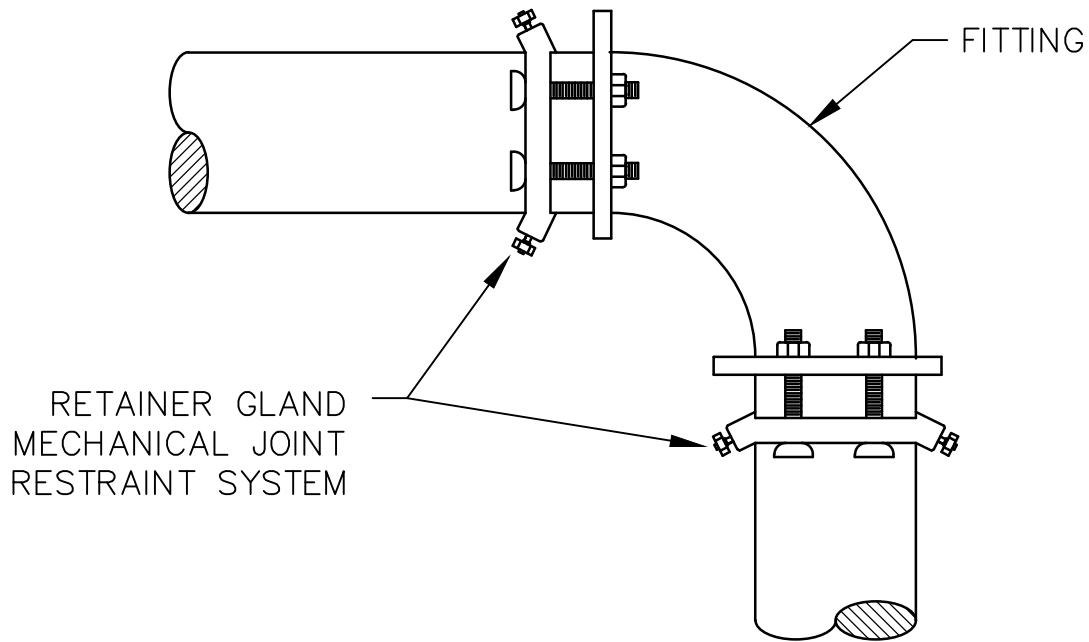
STANDARD PIPE LAYING CONDITIONS

SCALE: N.T.S.

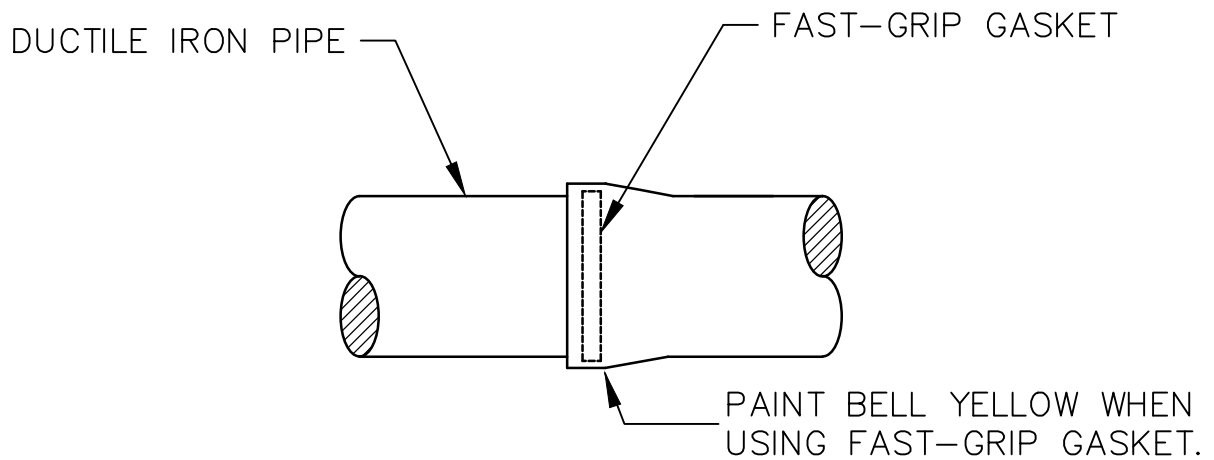
DATE: NOVEMBER 2019

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PIPE TO FITTING JOINT RESTRAINT



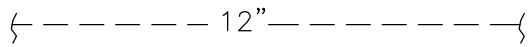
PIPE TO PIPE JOINT RESTRAINT

RESTRAINED JOINTS (SLIP-ON PIPE)

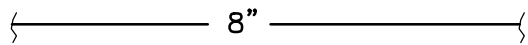
SCALE: N.T.S.

DATE: NOVEMBER 2019

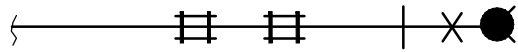
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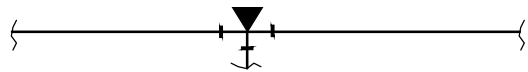
EXISTING 12" DIA. WATER LINE



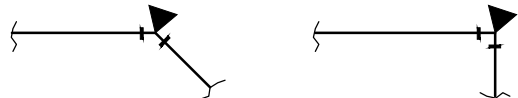
PROPOSED 8" DIA. WATER LINE



FIRE HYDRANT ASSEMBLY
W/ THRUST RESTRAINTS



TEE & BLOCKING



45° BEND & 90° BEND W/ BLOCKING



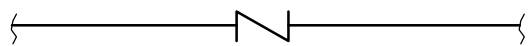
CLOSED VALVE



AIR RELEASE VALVE



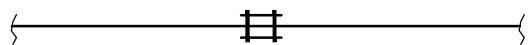
GATE VALVE



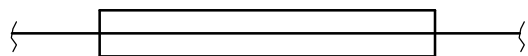
CHECK VALVE



REDUCER



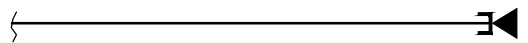
RESTRAINED JOINT



CASING

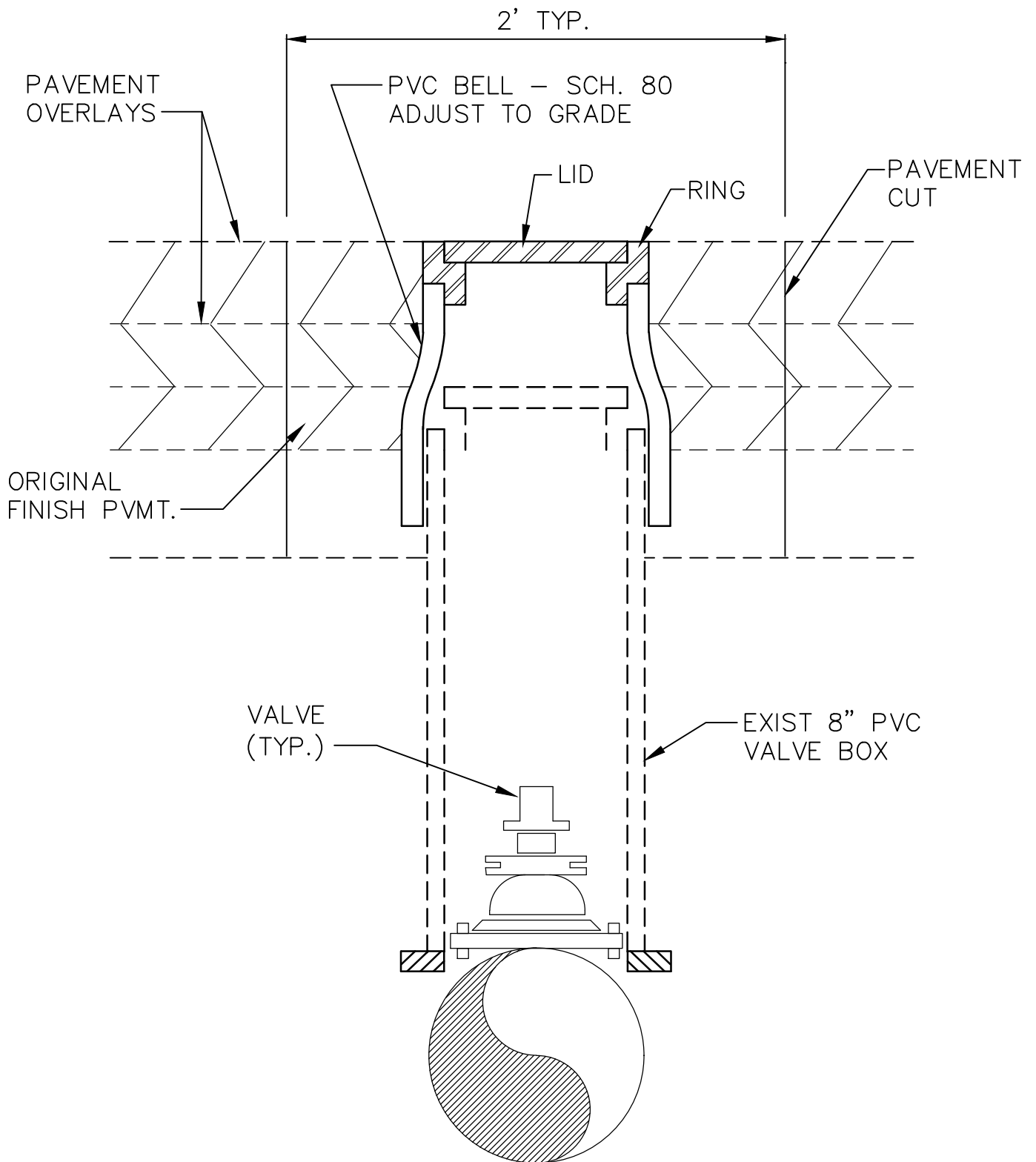


BACKFLOW PREVENTOR



PLUG & BLOCKING

PIPING SYMBOLS



TYPICAL VALVE BOX ADJUSTMENT

SCALE: N.T.S.

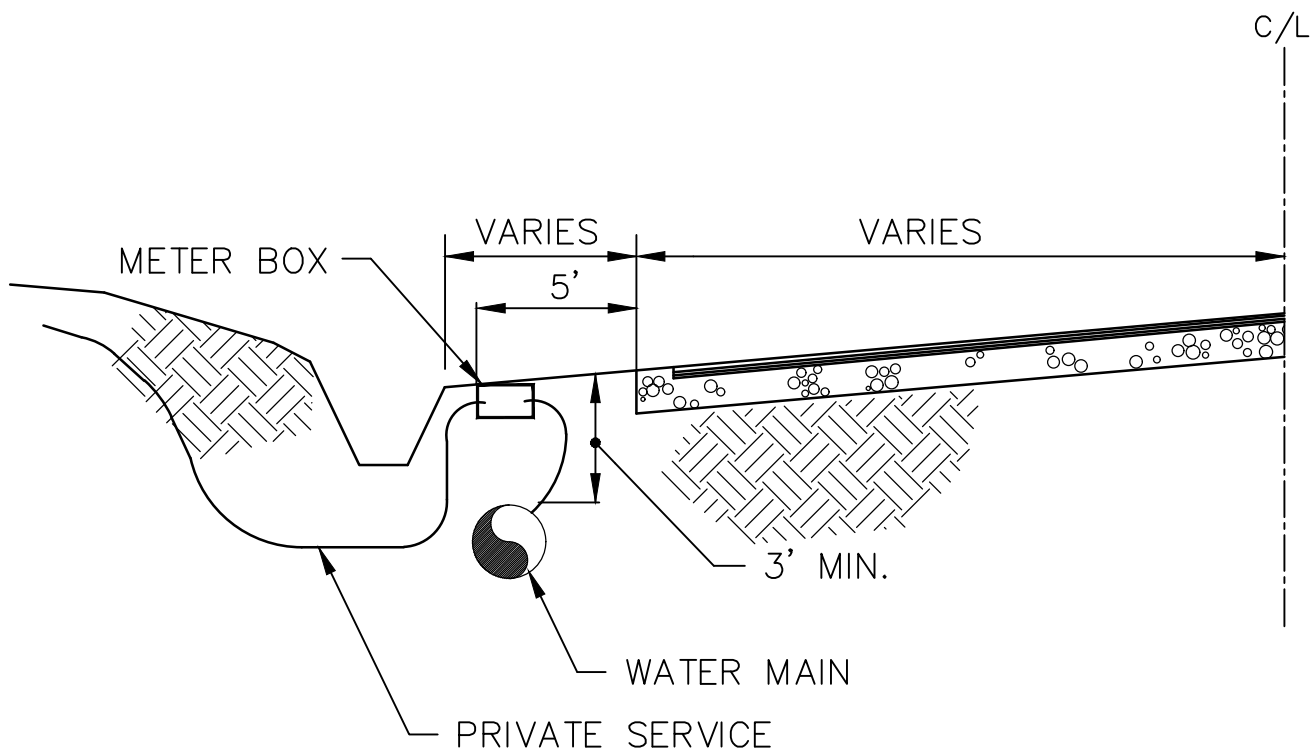
DATE: NOVEMBER 2019

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**Columbus
Water
Works**

*Serving our Community
Protecting the Environment*

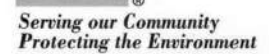


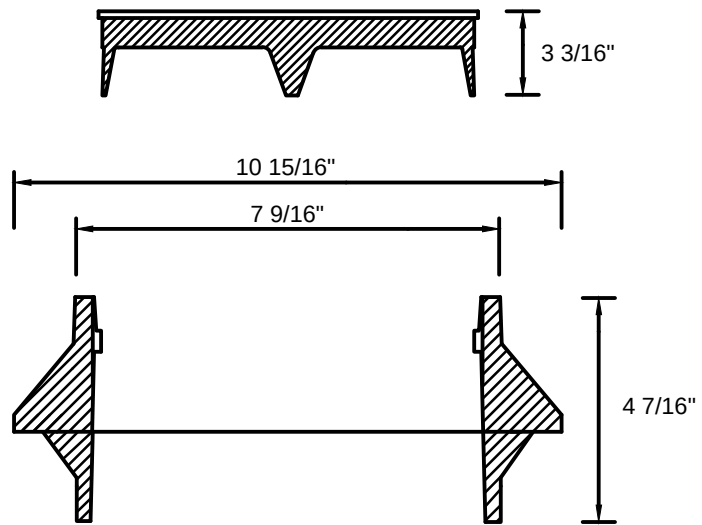
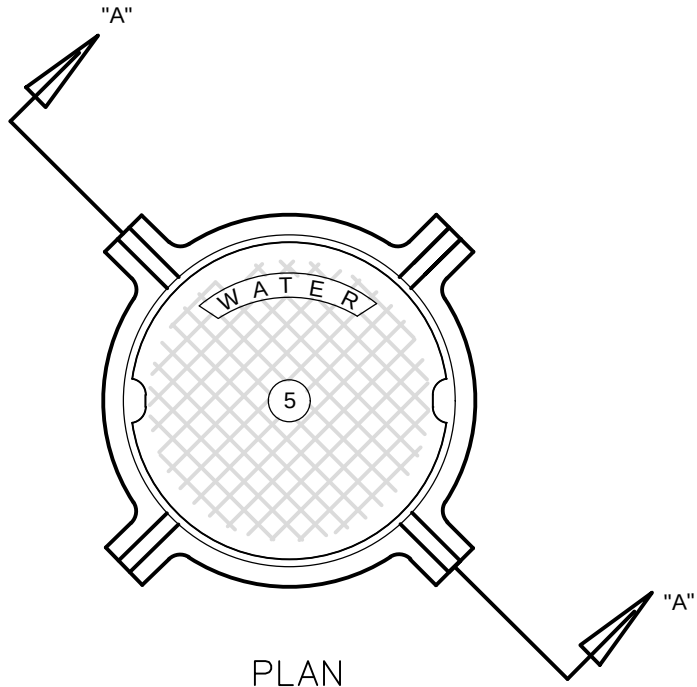
WATER SERVICE DETAIL FOR RURAL STREET SECTION

SCALE: N.T.S.

DATE: NOVEMBER 2019

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VALVE COVER

SCALE: N.T.S.

DATE: NOVEMBER 2019

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