



Greater Augusta Utility District

Water | Wastewater | Stormwater

Construction Specifications and Procedures

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Section I: General Information

1. ENGINEERING REQUIREMENTS

a. GENERAL

The applicant, upon submission of a project to construct a water and/or sewerage system for the public use and/or dedication to the Greater Augusta Utility District shall provide one (1) set of plans and specifications to the District. The plans shall show plan and profile of the proposed water or sewer main, pump station plans and details (if applicable), right-of-way boundaries, other utilities, ledge profile or test borings and any other physical or topological features relevant to the project. Other requirements are as follows:

1. All drawings shall be drawn with the title designating the name of the project, location, and the names of the person(s) preparing the drawings and the date prepared, including the latest revision date. Drawings, specifications and engineer's reports shall be stamped and signed by a duly qualified Registered Professional Engineer in Maine.
2. An 8 1/2 x 11 photocopy of the U.S.G.S. quad sheet showing the location of the proposed activity and the outline of the area in which the activity is located.
3. An 8 1/2 x 11 section of the City of Augusta, City of Hallowell, Towns of Winthrop, Manchester, Chelsea and Vassalboro property map on which the site of the proposed activity is outlined.
4. Final design plans approved by the District for construction must be submitted to the District in a format compatible with AutoCAD; a minimum of one (1) week prior to the start of construction.
5. The District may under special circumstances consider alternative designs to those specified here.
6. All private subdivision or development engineered plans shall be submitted to the District for review and comment a minimum of 3 weeks prior to any public planning board or approval meetings. Final development plans, including building floor and plumbing plans shall be submitted in PDF and AutoCAD format at least 1 week prior to the start of construction.

b. WATER MAINS AND APPURTENANCES

1. Plan sheet shall be 24" x 36".
2. Scale: 1" = 40' or 20' horizontal and 1" = 4' vertical. Other scales may be considered upon request.
3. Profile – Elevations for existing ground elevation and finish grade shall be at centerline of pipe. Plan and profile shall be on same drawing.
4. Location of all existing or proposed underground utilities shall be shown in plan and in profile where utility crosses water main.
5. Stationing of water main and appurtenances shall correspond with the roadway centerline stationing and shall be stated as station and offset from centerline left or right.
6. Minimum of five and one-half (5.5) feet of cover to finish grade elevation is required over the top of all water mains, hydrant branches, services etc.

c. SANITARY SEWERS

1. For design purposes it shall be assumed that each single family home shall contribute 250 gallons per day (GPD) and each apartment unit shall contribute 175 GPD to the sanitary sewer. Design flows for all other types of development shall be determined on an individual basis.
2. Plan sheet shall be 24" x 36".
3. Scale: 1" = 40' or 20' horizontal and 1" = 4' vertical. Other scales may be considered upon request.
4. Number and Station each manhole.
5. Profile – Elevations for existing ground elevation and finish grade shall be at centerline of pipe. Plan and profile shall be on same drawing.
6. Station 0+00 shall be at the low point in each system (for example Pump Station, Lowest MH or Outfall), and stationing shall be along centerline of pipe.
7. Location of all existing or proposed underground utilities shall be shown in plan and in profile where utility crosses sewer.
8. Sanitary manholes shall be installed at all changes in grade and /or alignment of the pipe. Maximum distance between manholes shall be 350 feet.
9. Minimum of five (5) feet of cover is required over the tops of all gravity sewers.
10. Paved aprons around all manhole frames and covers are required when sewer is installed in the shoulder of the road.
11. Service connections shall be at a manhole when possible.
12. Benchmarks shall be shown on all drawings.
13. All sanitary sewer main extensions require Maine Department of Environmental Protection (DEP) approval. GAUD will deliver plans to DEP after receiving GAUD approval.

d. PRESSURE SEWERS AND FORCE MAINS

1. Minimum of six (6) feet of cover will be required over the tops of all force mains and pressure sewers.
2. A cleanout manhole will be required at the end of all pressure sewers. See Detail.
3. All pressure sewer lead connections at the pressure main shall be in a precast valve box. See Detail.

e. STORM DRAINS

1. Plan sheet shall be 24" x 36".
2. Scale: 1" = 40' or 20' horizontal and 1" = 4' vertical. Other scales may be considered upon request.
3. Number and Station each catch basin.

4. Profile – Elevations for existing ground elevation and finish grade shall be centerline of pipe. Plan and Profile shall be on same drawing.
5. Station 0+00 shall be at the low point in each system (Lowest CB, Outfall, etc.) and stationing shall be along centerline of pipe, or correspond to the centerline of Road.
6. Location of all existing or proposed underground utilities shall be shown in plan and in profile where utility crosses storm drain.
7. For design purposes it shall be assumed that the maximum inlet flow for a standard frame and grate shall be 1.5 cubic feet per second (cfs). Multiple grates or oversized grates must be provided for inlet flows in excess of 1.5 cfs.
8. When Storm Drain pipes cross over or under water pipes and there is less than two (2) feet of clearance between the pipes the Contractor shall install 2 inch thick x width of sewer trench x 8 feet long insulation between the two pipes.
9. Drain manholes or catch basins shall be installed at all changes in grade and/or alignment of the pipe. Maximum distance between catch basins or drain manholes shall be 350 feet.
10. Drain manholes shall be either supplied with channels connecting all inlet pipes with the exit pipe or provided with a two (2) -foot sump.
11. Minimum of four (4) feet of cover is required over the tops of all storm drains.

12. DRAINAGE CHANNELS/SWALES

Drainage channels may be utilized to convey stormwater through a project area if designed for the peak flow generated by a 25-year storm (24-hour event as shown in Appendix B of TR-55). The size of the channel must be adequate to convey this storm event without exceeding 80 percent of the channel depth.

- a. If channels are utilized for relocation of existing streams or constructed in existing streambeds, provide them with an interior stone lined channel to carry the normal dry weather flow of the existing stream (as defined by calculation or field measurement). Developer must obtain all State and Federal permits required to relocate all existing streambeds.
- b. Design drainage channels with a stable bottom and slope that will resist erosion.
- c. Use grass-lined channels if velocities during the design storm event is less than 6 feet per second (fps). If channels have a design velocity greater than 6 fps, provide them with stone riprap on the bottom and side slopes at a depth of 90 percent of the channel height.
- d. Ensure that all stone riprap used in channels has a minimum D50 stone of six (6) inches and is provided with a 6-12 inch filter layer of three-fourths (3/4) inch stone.
- e. In channel construction use stone that is angular in shape. Rounded stones shall not exceed 10 percent of the number of stones in the channel.
- f. Design channel side slopes for a drop of no more than one vertical foot to three horizontal feet (1V:3H). In the event that steeper slopes are required due to project constraints, the slopes must be stabilized with riprap.

- g. If using gabion stone walls in the design of stone lined channels, follow the manufacturer's design criteria.
- h. Ensure that all stone riprap has a minimum D50 stone of six inches minimum and is supported by calculation as to D50 stone size.

13. Benchmarks shall be shown on all drawings.

f. DETENTION BASINS

Detention basins must be of a size and shape as to fit into the project site in accordance with established performance criteria. Design and performance is the sole responsibility of the design engineer.

1. Design basins with grassed bottoms and side slopes.
2. Design side slopes with a maximum vertical drop of one vertical foot per three horizontal feet (1V:3H). Steeper slopes will not be allowed without adequate justification, satisfactory to the District. Steeper slopes may require slope stabilization at the discretion of the District.
3. Provide all basins with a flow channel designed to accommodate the two-year storm peak runoff flow from the tributary area. The low-flow channel must be stone-lined in accordance with previous criteria.
4. Ensure that basin outlet structures are designed to maintain predevelopment peak outflow rated for the 2, 10 and 25 year storm events at the predevelopment level. The use of non-restricted pipes of varying size and at varying elevation is the preferred control strategy. Outlet weirs are acceptable if constructed of durable, maintenance free material. Restricted outlet or orifice type outlets may be allowed in some cases.
5. Provide all detention basins with a stone-lined overflow spillway designed to pass the 100-year storm event, peak discharge with a minimum of six (6) inches of freeboard in the channel. (The stone-lined channel must be designed as previously outlined).

Other types of detention facilities, such as in-line storage or underground storage will be considered on a case by case basis. These facilities must meet the performance criteria for detention basins.

6. All detention basins to be maintained by the District shall have a minimum 12 foot wide by 18 inch deep gravel based roadway from the public roadway to the basin. A turn around at the basin may be required and a fence around the basin may be required.

g. EASEMENTS AND LAND ACQUISITION

1. The District will require clear title to any land on which water or sewer pump stations to be owned and operated by the District are installed and also for detention ponds. Size requirements will be evaluated on a case by case basis.
2. Drainage easements will be required for all inlets and outlets of pipe on private property. Easement widths will be dependent upon the depth of pipe.
3. Easements will be required for all water mains, sewer lines and appurtenances except where installed within the public way of the State or the Municipality. Such easements shall not be less than forty (40) feet in width. Combined water and sewer easements shall

be not less than forty (40) feet in width with both pipes located per the requirements of separation. The District reserves the right to require additional easement width if construction and maintenance activities require it. All appurtenances to be maintained by the District (blow-offs, hydrants, structures, discharge pipes etc.), if not within the pipeline easement limits, shall be provided with an easement centered around the appurtenance, of a width determined by the District.

4. The required easements may either be shown on the Subdivision Plot Plan or a separate mylar for easements only, which must be recorded in the Kennebec County Registry of Deeds. Master mylars (2 master mylars shall be supplied for each drawing being recorded) shall be supplied to GAUD and this office will take the drawing to the Registry for recording. Cost of registering the drawing(s) will be borne by the owner and/or developer.

h. AS BUILT DRAWING

At the completion of all water, sanitary and storm sewer construction projects as-built drawings at a scale of 1" = 40' or 20' horizontally and 1"= 4' vertically or other approved scale shall be supplied to the District in PDF and AutoCAD format. Drawing shall show all pertinent information shown on the construction drawing plus ties to all valves, fittings, wyes, services and service leads, location of any ledge encountered during the installation, and rim and invert elevations on all structures.

For individual water and/or sewer services installed by a Contractor for a property owner, the Contractor or owner shall submit a sketch of the service(s) on the form provided with the Water or Sewer Connection Application permit. Sketch shall include a minimum of two (2) lateral measurement "swing ties", as close to 90 degrees opposed as practical, prior to backfilling pipeline, from permanent fixtures such as house corners, telephone poles, fire hydrants, catch basins, manholes etc. to all fittings, corporations, couplings, wyes, tees, bends, valves etc. for purposes of future location. Sketch shall also indicate the slope the sewer service was installed at. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. Failure to submit sketch is a violation against the permit and could result in the District denying the use of the sewer service and / or any new water service not being activated to the property.

i. SEPARATION OF WATER AND SEWER LINES

1. Parallel Installation:

- A. Normal conditions – Water mains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer, or sewer manhole whenever possible; the distance shall be measured edge-to-edge.
- B. Unusual conditions – When local conditions (such as ledge, bridges, etc.) prevent a horizontal separation of 10 feet, a water main may be laid closer to a sanitary or storm sewer provided that:
 - I. The bottom of the water main is at least 18 inches above the top of the sewer and a minimum of 5 feet edge-to-edge horizontally is provided.
 - II. Where the vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water tightness prior to backfilling.
 - III. The Department of Health & Human Services agrees that local conditions warrant less than 10 feet horizontal separation and approves the plans and specifications for the work.

2. Crossings:

- A. Normal conditions – Water mains crossing house sewers, storm sewer, or sanitary sewers shall be laid to provide a vertical separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.
- B. Unusual conditions – When local conditions prevent a vertical separation as described in 1.i.B.I. the following construction shall be used:
- a. Sewers passing over or under water mains shall be constructed of the materials described in 1.i.B.II above.
 - b. Water mains passing under sewers shall, in addition, be protected by providing:
 - i. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main.
 - ii. Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains.
 - iii. That one full length of water pipe (minimum 18 feet) be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.
3. The following minimum separations from water mains, water services and hydrants shall be observed at all times unless directed by GAUD personnel:

Horizontal Separation from Water Mains

- a. Sanitary Sewers – refer to requirements outlined above
- b. Storm Drains – 3' face to face for mains; 1' at contact points for CBs and DMHs
- c. Gas mains – 6' face to face
- d. Underground electric and telephone – 6' face to face
- e. Utility poles – 6' face to face

Vertical Separation from Water Mains

- a. Sanitary Sewers – refer to requirements outlined above
- b. Storm Drains – 6" over and under
- c. All other crossings – 12" minimum

Horizontal Separation from Water Services

- a. Sanitary Sewers - refer to requirements outlined above
- b. Storm drains – 3' face to face; 2' at contact points for CBs and DMHs
- c. Gas mains – 6' face to face
- d. Underground electric and telephone – 6' face to face
- e. Property lines – 10'
- f. Utility poles – 6' face to face
- g. Curb stops for multiple services – 18"

Horizontal Separation from Hydrants

- a. Gas mains – 4' face to face from hydrant branches
- b. Underground electric and telephone – 3' behind hydrant; 6' face to face from branch

Section II: Work Associated with Water Main Construction

1 - DESIGN CRITERIA

1.1 Pipe Size and Type:

- i. All distribution mains four (4) inch and larger shall be ductile iron per material specifications except under special site conditions where the District may specify a different pipe material. All main distribution pipe lines shall be of a size to adequately serve the needs of the proposed development and any potential extension thereof, but in any event shall not be less than eight (8) inches in diameter except as may be permitted by the District.
- ii. The minimum size of the pipe where public fire protection is to be provided or required shall be eight (8) inches in diameter. Dead-ends shall be minimized by looping all mains where practical. Where dead-ends are necessary they shall be terminated with a fire hydrant or blow-off assembly. The nominal pipe diameter of water mains without fire protection shall not be less than four (4) inches unless pre-approved by the District.
- iii. The District may request that the size of the main be increased beyond the required size for the project if necessary to facilitate the future expansion of the system beyond the scope of the developer's project. In such case, the District will pay to the developer the difference in cost of the materials between the two sizes.
- iv. The minimum service line size shall be one (1) inch inside diameter. The District will calculate and/or verify all service line, meter and backflow prevention device sizes based on the proposed plumbing fixtures in each building.

Depth of Cover:

Water pipe shall be laid with a minimum cover of five and one-half (5 ½) feet as measured from established finished grade to the top of the pipe and a maximum cover of seven (7) feet to the top of the pipe. The Contractor shall establish adequate elevation control to ensure that upon final grading the appropriate cover over water lines has been maintained. It shall be the Contractor's responsibility and expense to verify the cover at any location questioned by the District. Any potential changes in alignment or grade of roadways shall be considered in the original utility design. Any deviation from the required cover must be approved by the District.

Gate Valve Locations:

Gate valves shall be located at all pipe junctions and street intersections in such a manner as to control and isolate flows in all segments of the system. A minimum of two (2) valves are required at tees. A valve will be required beyond the last service if the main can be extended in the future. In all other areas, gate valves will be required every 1000 feet, except as otherwise determined by the District. The District shall make the final determination as to the number of valves required and their location.

Hydrants:

The design engineer shall consult with the fire department having jurisdiction during the design process as to the number of fire hydrants that may be required for public fire protection and their probable location if the project is within the public way. All hydrants within the public way will be considered as public fire hydrants and will be owned and maintained by the District after the initial installation and acceptance by the District. All proposed public fire hydrants within a project must receive written approval of their addition to existing public fire protection from the municipality having jurisdiction. Such written approval shall be addressed to and submitted to the District prior to project approval by the

District. All hydrant installations located within the public way shall be paid for by the Owner-Developer-Contractor and must meet the specifications of the District.

Private hydrants (those installed on private property for the sole purpose of the owner-developer) shall be owned and maintained by the owner-developer. It is highly recommended that private hydrants meet the specifications of the District for simplicity of maintenance should the owner / developer contract with the District for maintenance. All private hydrants connected to mains owned and maintained by the District will be considered as an individual fire protection service and be billed accordingly.

Air Release Valves:

Air release valve assemblies shall be installed at all high points of the new main as determined by the District. The size and design of the valve and piping will be determined by the District.

2 - DESCRIPTION OF WORK:

The work to be done consists of trenching, laying water mains, services, hydrants and other necessary appurtenances, backfilling the trench, and properly completing the work of water main construction at locations called for in accordance with plans and specifications approved by and at a time required by the District.

3 - DUTIES OF THE DISTRICT:

The District will furnish and perform the following services at the Contractor's expense:

- 3.1 The District will locate for the Contractor terminal points or connection points of the work and will also locate for the contractor any of its facilities lying in close proximity to the work which would in any way be a hazard to the contractor's operations. (Generally no charge for this work).
- 3.2 The District will review all required contractor submittals of plans, specifications, and material specifications. (Generally no charge for this work, except for re-submittals)
- 3.3 The District will provide on site inspection and approval of materials and installation procedures, including leak repairs. Filling will **always** be completed by the District. The Contractor will be billed on a direct time and materials basis for such work.
- 3.4 The District will operate **all** valves which may be found desirable or necessary to be used for any purpose. The Contractor will be billed on a direct time and materials basis for such work.
- 3.5 The District will generally conduct all pressure testing and disinfecting operations in accordance with AWWA standards. See sections 10.1 and 11.1. The Contractor will be billed on a direct time and materials basis for such work. The District reserves the right to require the Contractor to hire an independent certified third party to perform the testing.
- 3.6 The District will conduct all required bacteriological tests on water samples from the completed new mains and appurtenances. All tests will be paid for by the Contractor on a direct time and materials basis.

4 - DUTIES OF THE CONTRACTOR:

The Contractor will:

- 4.1 Submit for District approval a set of plans showing plan and profile of the proposed main,

right-of-way boundaries, other utilities, limits of paving (existing and/or proposed), ledge profile or test borings and any other physical or topographic feature relevant to the installation and maintenance of the water main. All plans must be submitted to the District per the requirements of Section I, 1, a and b unless otherwise specifically requested by the District. All final approved plans must also be submitted in AutoCAD format prior to construction.

- 4.2 Install the water mains so as to supply the District, upon completion, with a satisfactory, watertight pipeline, laid to the proper grade and alignment as shown on the plans and in accordance with these specifications. Submit a copy of scaled "as built" drawings upon completion of the job per requirements of Section I, 1, h.
- 4.3 For water mains and appurtenances to be owned and maintained by the District, the Contractor-Developer shall turn said water mains and appurtenances over to the District free and clear of liens, damage, claims or lawsuits. In addition, the Contractor shall provide the District with easements for all water mains and appurtenances that will be within the public right-of-way of newly constructed streets and roadways. Said easements shall be granted to the District prior to the acceptance of said streets by the authority having jurisdiction and shall be in the form specified by the District.
- 4.4 Obtain all street opening permits from cities, towns, or Maine Department of Transportation (MDOT), as may be applicable, covering any pipelines and appurtenances to be laid in the public way and shall be responsible for fees levied by any of these agencies which are applicable to the work covered by this specification. Based on jurisdiction, the District may have to obtain street opening permits and bill the Contractor accordingly based on project ownership.
- 4.5 Establish line and grade for the pipeline and right-of-way boundaries where the pipeline is to be laid in the right-of-way outside of a public way.
- 4.6 Purchase all materials in accordance with the District's specifications.
- 4.7 Furnish all labor, materials and equipment in order to construct water mains, services, hydrants and appurtenances as may be required to complete the work in accordance with said plans and specifications.
- 4.8 Record a minimum of two (2) lateral measurement "swing ties", as close to 90 degrees opposed as practical, prior to backfilling pipeline from permanent fixtures such as house corners, telephone poles, fire hydrants, catch basins, manholes etc. to all valves, fittings, couplings, tees, corporations etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. These ties must be legibly recorded in sketch form or recorded within the as-built drawings and submitted to the District prior to final project acceptance.
- 4.9 Furnish all borrow material (sand, gravel, etc.) to bed pipe and completely backfill trench in accordance with Section 8. All water mains containing water must be provided with five and one-half (5 ½) feet of cover to the top of pipe prior to November 15.
- 4.10 Shall guarantee the workmanship of the pipeline and appurtenances for one (1) year from the date of acceptance by the District and any charges incurred during that year shall be billed to the Contractor.

5 - MATERIALS:

- 5.1 See "Materials and Installation Specifications", Section III, for materials generally associated with water main installation. Additional materials that may be required will be evaluated on a case by case basis as the need arises.

5.2 Materials which do not meet the District's specifications will not be accepted.

6 - EXCAVATION:

6.1 PERMITS

The Contractor shall make application and pay for all necessary street or highway opening permits necessary for the pursuit of the work. No opening shall be made by the Contractor until the appropriate permit has been obtained, and when such opening shall be made it shall be done in strict accordance with the terms of the permit. The Contractor shall pre-mark the area of excavation and contact Dig-Safe prior to the scheduled excavation. The Contractor shall also contact all utilities that **are not** members of Dig-Safe with the same minimum 3 business day notice. Street opening permits may have to be obtained and paid for by the District based on the authority having jurisdiction. In these cases, the District may bill the Contractor directly for the cost of the permit and any required inspection fees based on project ownership.

6.2 CUTTING OF PAVEMENT

Pavement shall be cut by a method approved by the authority having jurisdiction.

6.3 RIGHT-OF-WAY

For water mains to be owned and maintained by the District, a minimum 40 foot right-of-way, centered over the water main(s) and sewer main(s) shall be included in the easement transferring ownership of said water main(s) and sewer main(s) to the District and obtained by the Developer-Contractor prior to installation of said water main.

6.4 TRENCHING

The trench shall be dug so that the pipe can be laid to the alignment and depth required and shall be excavated in advance only to the extent necessary for the proper pursuit of the work. The trench shall be kept dewatered, such that no drainage water shall enter the open end of the pipe and said open end of the pipe shall be temporarily plugged off at night and over the weekends, or whenever the work is suspended, or in cases where unstable material could cause a cave-in to enter into the exposed end of the pipe. The trench width shall be in accordance with the District's "Typical Trench Detail". The bottom of the trench shall be smooth and even and should be as nearly undisturbed as possible. The pipe shall be blocked approximately 18 inches behind the bell such that the pipe barrel is 4 to 6 inches off the trench bottom to permit bedding material to be worked in and compacted under the pipe invert. For pipe installation in ledge or boulder areas, the blocking shall be arranged to provide a minimum 6 inches of clearance between the barrel invert and any ledge or boulders. All bedding material placed under and around the pipe shall be compacted by mechanical means, as approved by the District, so as to give it a solid base, precluding future settlement. When the bottom of the trench at subgrade is found to be unstable or to include cinders, refuse, vegetable, organic or any such undesirable material, such materials shall be removed and replaced with suitable material (bank run gravel – 4 inch minus, screened gravel – 4 inch minus, crushed gravel or crushed stone) prior to the pipe being placed. Such replacement material shall be placed in maximum 12 inch lifts and compacted by approved mechanical means.

6.5 BLASTING

Blasting for excavation shall be done at the sole discretion of the Contractor. Damage caused to existing water mains and services by blasting shall be repaired by the District and paid for by the Contractor.

6.6 METHOD OF EXCAVATING

Excavating may be done by any acceptable and method of excavation, by machine or otherwise as may be desired by the Contractor. Excavation adjacent to nearby water mains or service laterals shall be done by hand to protect these from damage.

6.7 INTERRUPTION OF SERVICE

When, as the result of the Contractors scheduled work, the District must shut down part of its system affecting its customers or fire protection, the Contractor shall provide the District with a minimum 48 hours notice prior to conducting such work. No valve, hydrant or other facility of the District shall be operated by the Contractor or its agents. The District will, upon 24 hours advance notice, furnish personnel and equipment for such activity as necessary, at the Contractor's cost.

7 - PIPE LAYING:

7.1 ALIGNMENT AND GRADE

Pipelines, fittings, valves and other accessories shall be laid to the alignment, grade and location as shown on the plans as approved by the District. All valve stems shall be plumb with the vertical plane and all fittings, likewise shall be oriented such that their center lines shall be at the proper grade and alignment. The main shall be provided with a minimum 5 1/2 feet of cover from finish grade as measured to the top of pipe. Any deviation from line and/or grade caused by the encountering of obstructions such as other utilities shall be done so only after the approval of the District. See "Specification - Ductile Iron Pipe" and "Specification - Ductile Iron Fittings, Including Bends, Reducers, Off-sets, Tees and Sleeves" for general installation instructions regarding these items.

7.2 HANDLING OF MATERIAL INTO TRENCH

Proper implements, tools and facilities, satisfactory to the District, shall be provided and used by the Contractor for the safe and convenient handling of all materials. Pipe fittings and accessories shall be carefully lowered into the trench, piece by piece, by means of crane, slings and other suitable tools and equipment, in a manner such as to prevent damage to the materials or to its protective coatings and linings. No chain or slings shall be passed through any pipe, valve, or fittings. Under no circumstances shall piping materials be dropped or dumped into the trench.

8 - BACKFILLING:

8.1 BACKFILL - GENERAL

All backfill material to be placed in maximum 12 inch lifts and compacted to 95% standard proctor under and around pipe. Compaction densities from the top of pipe to the top of the trench shall also be 95% standard proctor unless otherwise specified by authorities having jurisdiction. Do not place frozen materials in backfill or place backfill (and pipes) upon frozen material. Remove all frozen material or allow to thaw and then compact prior to placing new backfill material. Excavated material shall be re-used for backfill between the top of the pipe bedding material and the aggregate sub-base whenever possible to minimize the effects of frost heaving from differential materials. Refer to the City of Augusta Excavation & Street Opening ordinance or other municipal or State specifications for additional requirements.

8.2 BACKFILLING PIPE TRENCH

Start backfilling and proceed until complete as soon as practicable after the pipes have been laid, and structures such as thrust blocks have been set or had sufficient time to cure.

The Contractor shall be required to backfill the entire trench as part of the scope of work. Upon testing of pipe, if such deficiencies as leaking joints exist, the Contractor shall excavate, expose and repair leaking joints and then backfill the trench to the original specifications - at his own expense.

- a) **Material Placement:** Do not place stone or rock fragment larger than 2 inches in backfilling under and around the pipe (bedding) nor drop large masses of backfill material into the trench in such a manner as to endanger the pipe. Wet material by sprinkling with water when necessary to ensure proper compaction by tamping or rolling, etc. However, no compaction shall be done when material is too wet as determined by the District. At such times, suspend the work until previously placed materials have dried out.
- b) **Tamping and Rolling:** Before compaction, deposit and spread material in uniform parallel layers not exceeding 12 inches in thickness prior to compaction or within tolerances of compaction equipment. Before the next layer is placed, uniformly tamp by mechanical means to obtain a thoroughly compacted mass of the specified density. Additional care shall be taken to ensure all material under the pipe and close to the trench sidewalls is thoroughly compacted. When the trench width and depth to which backfill has been placed make it feasible, and it can be done effectively without damage to the pipe, backfill may be compacted by use of vibratory rollers or other approved methods.

8.3 BACKFILL MATERIAL

Backfill material used from bottom of trench to 1 foot above top of pipe shall be a well graded gravel or sand material with maximum stone or rock fragment size of 2 inches. This material shall be similar to an MDOT Type A aggregate. Backfill material used from 1 foot above the top of pipe to the top of trench (bottom of sub-base aggregate) shall be the original trench excavated material unless the excavated material is deemed unsuitable for use by the District. In such cases, a material with similar properties and characteristics shall be used. A last resort option is a material similar to an MDOT Type D aggregate with maximum stone or rock fragment size of 6 inches or common borrow with a maximum rock fragment size of 12 inches out of paved areas, unless otherwise specified by authorities having jurisdiction. In no case shall materials containing organic or vegetable matter, refuse, cinders or similar friable materials be used as backfill. Exclude pieces of bituminous pavement from backfill unless use is expressly permitted.

9 - FILLING AND TESTING:

9.1 The District will operate all valves and facilities necessary to fill and flush the water main(s) and appurtenances. The Contractor will be billed on a direct time and materials basis for such work. The District requires a minimum 48 hours advance notice be given prior to such work.

10 - PRESSURE AND LEAKAGE TESTING

10.1 The District will conduct all pressure and leakage testing in accordance with AWWA standards for water mains and in accordance with NFPA 24 standards for private fire protection services and bill the Contractor on a direct time and materials basis for such work. The District reserves the right to require the Contractor to conduct all pressure and leakage testing by certified third-party individuals in accordance with the District's standards and specifications and the following information is included for such purposes. The Contractor shall provide all necessary tools, equipment, and materials to conduct all required testing.

10.2 The pressure and leakage test shall be conducted as follows:

- 10.2.1 Decrease pressure in the main to be tested approximately 20 psi. Observe test gauge to ensure the pressure doesn't rise due to an existing valve or tapping valve leaking by. This is done to ensure that no undisinfected water from the installed main enters the existing main while performing the actual test.
- 10.2.2 A pressure test pump shall be connected to the new main at the testing point. The pressure will be slowly increased to 150 psig for AWWA C651 testing and 200 psig for NFPA 24 testing and allowed to stabilize (+/- 2.5 psig) for a minimum of 15 minutes.
- 10.2.3 A reservoir of potable water shall be connected to the test pump and the initial level of water recorded.
- 10.2.4 The pump pressure shall be maintained at 150 psig or 200 psig for a minimum of 1 hour with all makeup water withdrawn from the reservoir.
- 10.2.5 After one hour, the water level in the reservoir will be measured and the volume of water drawn down from the reservoir calculated and compared with the following allowable leakage:

$\text{Allowable Leakage (ounces per hour)} = \frac{\text{Pipe Length (feet)} \times \text{Nominal Diameter (inches)} \times 128}{10,900}$
--

- 10.2.6 **All pressure tests shall be performed for two – 1 hour cycles with the total measured volume of water drawn down equal to or less than two-times the above formula.**
- 10.2.7 If any test discloses leakage greater than that specified above, the Contractor, at his own expense, shall locate the leak and make repairs as necessary until the leakage is within the specified allowance. Written certification of leakage and pressure testing shall be submitted to the District upon completion.

11 - DISINFECTION:

- 11.1 **The District will conduct all disinfecting procedures of water mains and appurtenances in accordance with AWWA standards and bill the Contractor on a direct time and materials basis.** The District reserves the right to require the Contractor to conduct all disinfecting procedures by certified third-party individuals in accordance with District's standards and specifications and the following information is included for such purposes. The Contractor shall provide all necessary tools, equipment, and materials to conduct all required testing.

Upon satisfactory completion of the pressure and leakage test, all new water mains, hydrants, services and branches larger than 2 inch diameter shall be flushed and disinfected prior to being placed in service in accordance with AWWA continuous feed method.

- 11.2 The Contractor shall hire certified individuals to chlorinate the new main and appurtenances in accordance with the continuous feed method specified in Section 5.2 of AWWA Standard C651 (latest revision), using a 5% to 15% sodium hypochlorite solution or properly mixed concentration of calcium hypochlorite (65%) solution.
 - 11.2.1 The chlorinated solution shall be injected into the new main within 10 feet on the connection to the existing main with potable water at a minimum concentration of

50 parts per million (ppm) and a maximum of 100 ppm of free chlorine. District personnel will operate all valves required to set disinfection flow rates, etc. The Contractor will be charged on a direct time and materials basis for such work. The District requires a minimum 48 hours advance notice for this purpose. All discharge and flushing locations shall be monitored to ensure a minimum concentration of 25 ppm free chlorine throughout the new main including all hydrants, branches and services.

- 11.2.2 After a 24 hour detention period, the new main, hydrants, branches and large services shall be flushed until all heavy chlorinated water has been removed. The District will operate all valves for flushing. The Contractor shall furnish all necessary materials to perform the flushing and/or dechlorination. The discharge of water to the environment with chlorine concentrations greater than the ambient distribution system chlorine residual is prohibited. The highly chlorinated water must be dechlorinated before being discharged to the environment. The method of dechlorination is at the discretion of the Contractor as long as the procedure does not cause harm to the environment.

Written certification of disinfection must be submitted to the District for our records once completed.

12 - BACTERIOLOGICAL SAMPLING AND TESTING:

- 12.1 After the final flushing, and with a minimum 24 hours advance notice, the District will take one set of bacteriological tests on the completed new mains and appurtenances; and any additional tests required as the result of improper disinfection. All tests will be paid for by the Contractor on a direct time and materials basis.
- 12.2 The new main(s) shall not be activated and placed into service until successful bacteriological testing and completion of the "Certificate of Title and Project Acceptance."

Section III: Water Main Materials & Installation Specifications

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Review Date: April 2017
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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
BRASS COMPRESSION UNIONS,
COUPLINGS, M.I.P. & F.I.P. ADAPTERS

1.0 SPECIFICATIONS:

- 1.1 This specification covers all brass compression unions in sizes ranging from ¼ inch to 2 inch diameter, inclusive.
- 1.2 All compression unions with iron pipe thread end connections shall have such thread for the full depth of the threaded ends in accordance with AWWA C-800.
- 1.3 Outlet connections shall be copper pipe compression unless otherwise specified. The District requires compression connections in which the brass compression nut "shoulders" tight against the body when fully made up. Compression connections utilizing set screws or split clamps **are not** permitted.
- 1.4 All brass compression unions, couplings and adapters that come in contact with potable water shall be of heavy brass construction and meet the certifications of NSF / ANSI 61 Annex G and NSF / ANSI 372, latest revision.
- 1.5 Rated working pressure shall be 150 psig minimum.
- 1.6 Acceptable brass compression union manufacturers are Mueller Company (Series 110 compression connection), Ford Meter Box Company (Quick Joint), A.Y. McDonald Mfg. Co. (McQuik, "Q" series) and Cambridge Brass (CB Compression series). All other submittals must be pre-approved by the District in writing.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Brass compression unions shall be firmly supported on wooden blocking unless the trench bottom is firm.
- 2.2 All compression nuts shall be made up in accordance with the manufacturers specifications unless otherwise specified by the District.
- 2.3 Fittings shall be installed in accordance with standard practice. Soft set pipe thread compound shall be used on all threaded connections to ensure a drip tight seal. Pipe thread compound shall be compatible with potable water.
- 2.4 Prior to backfilling, the brass compression unions shall be placed under a static head pressure test unless otherwise waived by the District.
- 2.5 A minimum of 2 lateral measurement "swing ties" shall be taken to all buried compression unions prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
BRASS FITTINGS WITH IRON PIPE THREAD

1.0 SPECIFICATIONS:

- 1.1 All brass service fittings with iron pipe threads shall meet the certifications of NSF / ANSI 61 Annex G and NSF / ANSI 372, latest revision.
- 1.2 Threaded bar stock fittings with iron pipe threads made from free cutting brass rod, bar, or shapes shall be constructed in accordance with ASTM B16 specifications.
- 1.3 All fittings shall be rated for 150 psig meeting or exceeding ANSI B16.15. Each fitting shall be air or water pressure tested to the pressure class rating prior to shipment to ensure consistent high quality.
- 1.4 Acceptable cast threaded fitting manufacturers are Lee Brass Company of Anniston, Alabama, Siam Fittings Co., Bangkok, Thailand or a pre-approved equivalent. Fittings manufactured in the country of China are prohibited.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Fittings shall be installed in accordance with standard practice. Soft set pipe thread compound shall be used on all threaded connections to ensure a drip tight seal. Pipe thread compound shall be compatible with potable water.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
M.I.P. BRASS NIPPLES

1.0 SPECIFICATIONS:

- 1.1 All brass nipples shall be manufactured in accordance with ASTM B584 or ASTM B62 specifications as applicable. The minimum working pressure rating shall be 150 psig in accordance with ANSI B16.15.
- 1.2 All brass nipples shall meet the certifications of NSF / ANSI 61 Annex G and NSF / ANSI 372, latest revision.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.2 Brass nipples shall be installed in accordance with standard industry practice. Soft set pipe thread compound shall be used on all threaded connections to ensure a drip-tight seal. Pipe thread compound shall be compatible with potable water.
- 2.3 Never place a pipe wrench on the threaded ends when tightening a brass nipple.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION CORPORATION STOPS

1.0 SPECIFICATIONS:

- 1.1 All corporation valves shall be of the 1/4 turn ball valve design and meet or exceed the latest revision of ANSI/AWWA Standard C-800.
- 1.2 Corporation stops shall have "CC or AWWA taper" threads on the inlet unless otherwise specified.
- 1.3 Outlet connections shall be copper pipe compression unless otherwise specified. The District requires compression connections in which the brass compression nut "shoulders" tight against the corporation valve body when fully made up. Compression connections utilizing set screws or split clamps **are not** permitted.
- 1.4 The corporation body and components shall be of heavy brass construction and meet the certifications of NSF / ANSI 61 Annex G and NSF / ANSI 372, latest revision. The ball mechanism shall be constructed of Teflon coated brass and provide a full port opening.
- 1.5 The valve stem shall be provided with double Buna-N rubber O-rings to insure a permanent watertight seal. The ball seats shall also be molded Buna-N rubber.
- 1.6 Rated working pressure shall be 250 psig minimum.
- 1.7 Acceptable corporations are the Mueller 300 B-25008, the Ford FB 1000-Q, McDonald 74701BQ and the Cambridge Brass 301 series in CB Compression. All other submittals must be pre-approved by the District in writing.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 The District only permits 1 inch diameter direct tapped corporations into cast iron and ductile iron mains. The use of larger taps will require the installation of service saddles and will be evaluated on a case by case basis.
- 2.2 Corporation taps shall be located within 0 and 10 degrees up from horizontal on the main.
- 2.3 Corporations shall be "screwed" into cast iron or ductile iron pipe water mains such that no more than 4 threads are exposed.
- 2.4 A minimum of 2 lateral measurement "swing ties" shall be taken to all buried corporation stops prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
CURB STOPS

1.0 SPECIFICATIONS:

- 1.1 All curb stop valves shall be of the 1/4 turn ball valve design and meet or exceed the latest revision of ANSI/AWWA Standard C-800.
- 1.2 Curb stop bodies for iron pipe ball valve sizes 1 1/4" to 2" shall have full depth F.I.P. thread ends on both ends. This is an optional item occasionally used by the District.
- 1.3 Outlet connections for sizes 3/4" to 2" shall be copper pipe compression unless otherwise specified. The District requires compression connections in which the brass compression nut "shoulders" tight against the ball valve body when fully made up. Compression connections utilizing set screws or split clamps **are not** permitted.
- 1.4 The curb stop valve body and components shall be of heavy brass construction and meet the certifications of NSF / ANSI 61 Annex G and NSF / ANSI 372, latest revision. The ball mechanism shall be constructed of Teflon coated brass and provide a full port opening.
- 1.5 The valve stem shall be provided with double Buna-N rubber O-rings to insure a permanent watertight seal. The ball seats shall also be molded Buna-N rubber.
- 1.6 The curb stop valve shall not have a drain (waste hole).
- 1.7 Rated working pressure shall be 250 psig minimum.
- 1.8 Acceptable curb stop valves are the Mueller 300 B-25209, the Ford B44-Q, McDonald 76100Q and the Cambridge Brass 202 series in CB Compression. All other submittals must be pre-approved by the District in writing.
- 1.9 All curb stop valves shall be **"open left"**

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Curb stop ball valves shall be firmly supported on wooden blocking, set plumb and positioned such that the operator key is vertical prior to backfilling.
- 2.2 All curb stop ball valves shall be provided with S.S. rods and service boxes (see Service Box Specification) unless otherwise specified by the District.
- 2.3 Prior to backfilling, the curb stop ball valve shall be placed under a static head pressure test unless otherwise waived by the District.
- 2.4 A minimum of 2 lateral measurement "swing ties" shall be taken to all curb stops prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
SERVICE BOXES

1.0 SPECIFICATIONS:

1.1 Reference "TYPICAL SERVICE BOX DETAIL" sheet in the Typical Standard Details section of this specification package.

1.2 Service Box Specifications

- Shall be 1 inch inside diameter black A-36 steel pipe with top having N.P.I. threads for a 1 inch screw on cover.
- Shall be Arch Pattern Style with 5 ½ - 6 ½ foot slide type adjustable riser.
- All boxes shall be heavily coated with asphalt-base coal tar type corrosion resistor.

1.3 Service Box Cover Specifications

- Cast iron construction with N.P.I. female threads to accept a service box (1.2 above).
- Shall be tapped with a 1 inch rope thread with a solid brass plug with a pentagon operating head.
- Shall have the word "WATER" integrally cast into the cover.

1.4 Service Box Foot-Piece Specifications

- The standard foot-piece shall be heavy duty (Ford style or equal) cast iron design.
- The large heavy foot-piece shall have an arch that will fit over 2 inch ball-valve curb stops and used on all curb stops sizes 1 ¼ inch – 2 inch.

1.5 Service Rod Specifications

- Shall be 36 inches long, ½ inch diameter # 304 stainless steel and provided with yoke as integral part of the rod.
- Shall be provided with a brass cotter pin to secure the S.S. rod to the curb stop ball valve.
- The rod "wrench flat" shall have a minimum thickness of ¼ inch tapered to 1/16 inch and width of ½ inch.

1.6 Service Box Extension Specifications

- Shall be 1 inch inside diameter black A-36 steel pipe with N.P.I. threads on each end to be coupled to the top of the service box and accept the screw on cover.
- Shall be provided in lengths from 3 inches to 24 inches.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Service box bases shall be placed on the same blocking that supports the curb stop ball valve and set plumb with the vertical plane in all directions.
- 2.2 The 1 inch rope thread solid brass plug of the cover shall be "broken" free of the asphaltic coating prior to installation.
- 2.3 The service box cover must be magnetized for locating purposes prior to installation making sure polarity is a positive reading.
- 2.4 Service box tops shall be set 3 inches below finish grade and painted florescent blue (standard water works color) prior to burial.
- 2.5 A minimum of 2 lateral measurement "swing ties" shall be taken to all service boxes, in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
COPPER SERVICE LINE TUBING

1.0 SPECIFICATIONS:

- 1.1 Type K copper tubing for service lines shall meet or exceed the latest revision of AWWA Standard C-800.
- 1.2 Underground service line malleable tubing shall be seamless Type K copper exclusively and conform to ASTM Standard B-88.
- 1.3 $\frac{3}{4}$ inch, 1 inch and $1\frac{1}{4}$ inch diameter Type K copper tubing shall be available in 100 foot long coils. $1\frac{1}{2}$ inch diameter Type K copper tubing shall be available in 60 foot long coils and 2 inch diameter Type K copper shall be available in 40 foot long coils.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Extreme care shall be taken during installation to ensure that copper tubing is not crimped, gouged or otherwise detrimentally damaged.
- 2.2 The Contractor shall minimize the use of couplings by using the longest continuous coils available as specified above in 1.3 for the specific job unless otherwise approved by the District.
- 2.3 The use of soldered or stab-type fittings on underground copper tubing joints is **not** permitted. All unions of underground copper tubing shall be done so using brass compression type couplings (see specification for "Brass Compression Unions, Couplings, M.I.P. & F.I.P. Adapters"). Flared couplings are not permitted.
- 2.4 Copper tubing ends shall be de-burred and re-rounded prior to installing fittings to ensure strong, water-tight connections.
- 2.5 Bedding material for copper service line tubing shall be fine sand only, free from fines, clays, loam or rocks. Bedding material shall extend to 12 inches above service line tubing.
- 2.6 The District will specify the size of all service lines during the plan review process.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
POLYETHYLENE SERVICE LINE TUBING

1.0 SPECIFICATIONS:

- 1.1 All polyethylene plastic service line tubing (Copper Tube Size - CTS) shall meet or exceed the latest revision of AWWA Standard C-900. The use of polyethylene pipe (Iron Pipe Size - IPS) will be evaluated on a case by case basis and usage must receive prior written approval from the District.
- 1.2 Polyethylene plastic tubing shall be pressure rated for a minimum of 200 psig at 73.4 degrees Fahrenheit.
- 1.3 High quality stainless steel insert stiffeners shall be used at all compression connections for the installation of valves, couplings and similar type fittings. All compression type fittings shall be brass as specified in the appropriate section. The use of plastic compression fittings, plastic or brass friction insert fittings with stainless steel clamps, Sharkbite or PEX fittings are prohibited prior to the water meter.
- 1.4 An exception to 1.3 above would be the use of fusion welded joints, valves, and fittings. The use of fusion welded joints must be pre-approved in writing by the District.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 The contractor shall take extreme caution in the field to minimize the exposure of polyethylene plastic tubing to the harmful effects of degrading ultra violet light prior to burial.
- 2.2 All polyethylene plastic service lines shall be buried with an 8 gauge coated wire attached to the service line to aid in future location. The wire shall rise up to finish grade alongside the service box and attached or tied to the service box cover.
- 2.3 The District shall size all service lines during the plan review process.
- 2.4 All polyethylene lines shall be installed in a loose "snake" pattern to allow for movement due to thermal expansion and settlement.
- 2.5 Bedding material for polyethylene service line tubing shall be fine sand, free from fines, clays, loam or rocks. Bedding material shall extend a minimum 2 inches below to 12 inches above service line tubing.

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**GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON FITTINGS: BENDS, REDUCERS, PLUGS, CAPS, OFFSETS, TEES**

1.0 SPECIFICATIONS:

- 1.1 Mechanical joint compact fittings shall be ductile iron class 350 (350 psig rated working pressure) in accordance with ANSI/AWWA C-153/A-21.53-00 (or latest revision) for fittings 4 inch through 24 inch and ANSI/AWWA C-104/A-21.40-95 (latest revision) double cement lining.
- 1.2 Flanged joint fittings shall be ductile iron class 250 (250 psig rated working pressure) in accordance with ANSI/AWWA C110/A21.10-98 (latest revision) for fittings 4 inch thru 24 inch and ANSI/AWWA C-104/A-21.40-95 (latest revision) double cement lining.
- 1.3 The District **does not** permit the use of push-on type fittings with or without retaining type gaskets.
- 1.4 Interior seal coated with a minimum of 2 mils dry film thickness in accordance with AWWA C104.
- 1.5 Exterior petroleum asphaltic coated with a minimum of 2 mils dry film thickness. The finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to the sun, and strongly adherent to the fitting.
- 1.6 Mechanical joint and flanged joint nuts and bolts shall be high strength, low alloy steel per AWWA C-111, 11-7.5 and ANSI 21.11 unless otherwise specified.
- 1.7 All fittings shall be of standard grade 70-50-05 ductile iron construction with the following minimum characteristics: 70,000 psi minimum tensile strength; 50,000 psi minimum yield strength; 5 % minimum elongation. Test results shall be made available upon request. Cast iron fittings are **not** permitted.
- 1.8 All fittings shall be supplied with appropriate number of standard MJ glands, gaskets and T-bolts as "standard accessories" unless otherwise specifically declined by the District at the time of order. Such "standard accessories" shall be shipped as a packaged unit and not as individual or loose items.
- 1.9 Acceptable ductile iron fitting manufacturers include: Griffin, Star, Tyler, Union and U.S. Pipe. Due to past experience, the District prohibits the use of all fittings manufactured by Sigma, Nappco and their affiliates. Non-domestic fittings from accepted manufacturers will be evaluated for quality and may be rejected.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 All fittings shall be inspected prior to installation to ensure the gasket seats are free of excess coating. Excess coating, if present, shall be manually removed so as to ensure proper seal of the gasket, however, all bare metallic surfaces created as the result of removing the excess coating shall be re-coated with similar material to prohibit corrosion.
- 2.2 The District accepts only the use of "compact" fittings as specified in 1.1 above for all fittings 4 inch to 24 inch. The contractor must seek prior written from the District approval for the use of "standard" size fittings in the 4 inch to 24 inch range.

SPECIFICATION – DUCTILE IRON FITTINGS: Cont.

- 2.3 Fittings shall be placed, supported and installed in strict accordance with the manufacturers instructions and as directed by the District. All bolted joints shall be torqued as follows:
- Mechanical Joint 4 inch-24 inch Diameter Pipe
 - ◆ 3/4" bolts; Torque = 75 to 90 ft.-lbs.
 - Flanged Joint 4 inch-24 inch Diameter Pipe.
 - ◆ 5/8" bolts; Torque = 40 to 60 ft.-lbs.
 - ◆ 3/4" bolts; Torque = 60 to 90 ft.-lbs.
 - ◆ 7/8" bolts; Torque = 70 to 100 ft.-lbs.
 - ◆ 1" bolts; Torque = 70 to 100 ft.-lbs.
 - ◆ 1 1/4" bolts; Torque = 90 to 100 ft.-lbs.
- 2.4 After bolts are inserted and made finger tight, tighten diametrically opposite nuts progressively and uniformly around joint with properly calibrated torque wrench to the values as specified above. **A properly sized and calibrated torque wrench is an explicit requirement of the District.**
- 2.5 Coat all bolt threads for flanged connections with never-seize or an approved equal product.
- 2.6 All ductile iron fittings shall be restrained by means of wedge action retaining glands (see "Ductile Iron Retainer Glands" and "Thrust Restraint Requirements") with a full continuous length of ductile-iron pipe entering and exiting the fitting whenever possible unless entering or exiting another fitting or valve. The use of threaded rods will be evaluated on a case by case basis and must receive prior written approval from the District. The size, number and location of the rods will be determined by the District or its' Inspector prior to installation.
- 2.7 A minimum of 2 lateral measurement "swing ties" shall be taken to all ductile iron fittings prior to backfilling in accordance with Section II, 4, 4.8.

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**GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
 THRUST RESTRAINT REQUIREMENTS**

Thrust restraint shall be provided on all bends, tees, valves, and dead ends for pipe diameter sizes 3 inch and greater. Thrust restraint shall be accomplished utilizing a combination of wedge-action retainer glands and concrete bearing thrust blocks wherever thrust forces are an encountered. Each component (wedge action retainer glands and concrete thrust blocks) shall be designed to independently restrain the entire thrust force of the specific item to be restrained. Each component shall be designed to withstand a test pressure of **150 pounds per square inch (psi)**. Wedge action retainer glands shall be as specified in the “DUCTILE IRON RETAINER GLANDS” section of the materials specifications. Wedge action retainer glands depend on soil friction on the skin of the pipe to restrain, therefore, it is imperative that a full length of pipe (greater than 16 feet) enter and exit all fittings and appropriate backfill material is thoroughly compacted around the pipe. Some larger diameter fittings and valves may require a longer restrained length than can be obtained from a single full length of pipe, therefore, subsequent push-on joints will need to be restrained as directed by the District or its Inspector. Concrete bearing thrust blocks shall be designed as to the amount of bearing area required to restrain the resultant thrust force of the fitting. Soil bearing strength for design purposes shall be 1500 lbs/sq.ft. unless otherwise specified by a soils engineer. Pounds of thrust on fittings can be found in the table below. Concrete bearing thrust blocks must be cast against undisturbed soil. If casting against undisturbed soil is not possible, than backfill material behind thrust block shall be crushed stone or a well graded gravel compacted to a minimum 95% standard proctor density. Cast-in-place concrete thrust blocks shall be formed with plywood to obtain the appropriate bearing area prior to placing concrete. **Under no circumstances shall concrete be cast around (encase) mechanical joint glands or bolts.** The use of an approved pre-cast concrete thrust block of appropriate design shall be an acceptable alternative to cast-in-place. The use of gravity concrete thrust blocks will be evaluated on a case by case basis and must be pre-approved by the District after reviewing design of such.

**Resultant Thrust At Fittings
 At 150 psi Water Pressure**

Nom. Pipe Dia. (in.)	Total Pounds				
	Dead End	90 Deg. Bend	45 Deg. Bend	22 ½ Deg. Bend	11 ¼ Deg. Bend
3"	1,848	2,613	1,414	721	361
4"	2,715	3,838	2,077	1,059	532
6"	5,608	7,932	4,293	2,188	1,100
8"	9,649	13,645	7,384	3,765	1,891
10"	14,515	20,527	11,109	5,664	2,845
12"	20,527	29,029	15,711	8,010	4,024
16"	35,668	50,442	27,298	13,917	6,991
20"	54,966	77,733	42,069	21,447	10,775
24"	78,418	110,901	60,019	30,597	15,373

Note:

Thrust forces on a valve and along the branch line of a tee is the same as thrust on a “Dead End”.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON RETAINER GLANDS

1.0 SPECIFICATIONS:

- 1.1 Mechanical joint valves and fittings shall be restrained with wedge action type retainer glands only. Acceptable wedge action retainer glands are the "Mega-Lug" retainer gland as manufactured by EBBA Iron Sales, Inc. of Eastland, Texas, the Uni-Flange "Series 1400" as manufactured by Uni-Flange, a subsidiary of The Ford Meter Box Co., Inc. of Wabash, Indiana and the RomaGrip pipe restrainer as manufactured by Romac Industries of Bothell, Washington.
- 1.2 Flanged joint valves and fittings shall be restrained with flange adapters in lieu of threaded or welded flanges on plain end ductile iron pipe when so specified.
 - Flange adapters shall be cast from 60-42-10 ductile iron per ASTM 536-77 and shall have bolt holes to meet ANSI B16.1. Flange adapters shall be 125 pound faced. These flange adapters shall contain set screws made from ductile iron. The screws shall have a Rockwell hardness of C40-45 converted from Brinnell. Safety factor shall be minimum of 2:1.
- 1.3 All restrained joint devices shall include a gasket, t-bolts and set screws/foot pads as "standard accessories." Such "standard accessories" shall be shipped as a packaged unit and not as individual or loose items.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 All restrained joint devices shall be installed in strict adherence to the manufacturer's instructions. Torque wrenches must be used in the tightening of t-bolts, set screws/ foot pads and flange bolts in all cases.
- 2.2 The contractor shall thoroughly inspect all restrained joint devices for stress cracks and similar physical defects or mechanical damage prior to their installation.
- 2.3 All set screw / foot pads around the retainer gland shall be tightened until the foot pad rests against the pipe prior to fully tightening the foot pad onto the pipe to the correct torque.

Review Date: April 2017
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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
RETAINER GLANDS FOR PVC PIPE

1.0 SPECIFICATIONS:

- 1.1 Mechanical joint ductile iron valves and fittings on PVC C900 & C905 pipe shall be restrained with wedge action type retainer glands manufactured specifically for PVC pipe only. Acceptable wedge action retainer glands are the "Mega-Lug Series 2000PV" retainer gland as manufactured by EBBA Iron Sales, Inc. of Eastland, Texas, the Uni-Flange "Series 1500 C" as manufactured by Uni-Flange, a subsidiary of The Ford Meter Box Co., Inc. of Wabash, Indiana or the "PVC RomaGrip" retainer gland as manufactured by Romac Industries of Bothell, Washington.
- 1.2 All restrained joint devices shall include a gasket, t-bolts and set screws/foot pads as "standard accessories." Such "standard accessories" shall be shipped as a packaged unit and not as individual or loose items.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 All restrained joint devices shall be installed in strict adherence to the manufacturers instructions. Torque wrenches must be used in the tightening of t-bolts, set screws/ foot pads and flange bolts in all cases.
- 2.2 The contractor shall thoroughly inspect all restrained joint devices for stress cracks and similar physical defects or mechanical damage prior to their installation.
- 2.3 All set screw / foot pads around the retainer gland shall be tightened until the foot pad rests against the pipe prior to fully tightening the foot pad onto the pipe to the correct torque.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON PIPE

1.0 SPECIFICATION:

- 1.1 Ductile iron pipe shall meet the requirements of AWWA Standard C-151/A21.51-96 (or latest revision) and be double cement lined and sealed coated to meet AWWA Standard C-104 (latest revision). Joints shall meet the requirements of AWWA C-111 (latest revision).
- 1.2 Interior seal coat shall be at least 2 mils thick and meet the specification 1.1 as stated above.
- 1.3 Exterior of pipe shall be petroleum asphaltic coated with a minimum of 2 mils dry film thickness. The finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to the sun, and strongly adherent to the pipe.
- 1.4 Class 52 wall thickness, 4 inch diameter through 10 inch diameter inclusive.
- 1.5 Class 51 wall thickness, 12 inch & 16 inch diameter.
- 1.6 Class 50 wall thickness, 20 inch diameter and larger.
- 1.7 Nominal laying length shall average no less than 18 feet per pipe. The District prefers the nominal laying length of 20 feet per pipe.
- 1.8 Approximately 20 percent of the pipe shall be specified as "gauge full length" and **clearly** marked indicating such.
- 1.9 Mechanical joint pipe shall be furnished with standard gland, gasket and Cor-Ten bolts and nuts as "standard accessories."
- 1.10 Push-on joint pipe shall be furnished with gasket and gasket lubricants as "standard accessories."
- 1.11 Special order pipe shall be specified as to the standard accessories required.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Push-on joint pipe shall be assembled in strict accordance with the manufacturers instructions as described below.
 - a) Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.
 - b) After cleaning dirt or foreign material from the plain end, apply lubricant in accordance with the pipe manufacturers recommendations. The lubricant is supplied in sterile cans and every effort shall be made to keep it sterile.
 - c) Be sure that the plain end is beveled; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file, grinder or pipe saw to remove all sharp edges. Push the plain end into the bell of the pipe. Keep the joint straight while pushing. Make deflection after the joint is assembled.

SPECIFICATION – DUCTILE IRON PIPE – Cont.

- d) Small pipe can be pushed into the bell socket with a long bar. Large pipe (generally 12 inch diameter or greater) require additional power, such as a pipe jack, lever puller or backhoe. The pipe supplier may provide a pipe jack or lever puller on a rental basis. A timber header should be used between the pipe and jack or backhoe bucket to avoid damage to the pipe.
 - e) Brass wedges are required on all sizes of ductile iron pipe 8 inches and greater and shall be placed at the 9 and 3 o'clock positions.
- 2.2 Mechanical joint pipe shall be assembled in strict accordance with manufactures instructions as described below:
- a) Wipe clean the socket and the plain end. The plain end, socket, and gasket shall be washed with a soap solution to improve gasket seating. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end.
 - b) Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly. Make deflection after joint assembly but before tightening bolts.
 - c) Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand-tighten nuts.
 - d) Tighten the bolts to the normal range of bolt torque (75-90 ft.- lbs. for 4 inch to 24 inch diameter pipe) while at all times maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This can be accomplished by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, finally the remaining bolts. Repeat the process until all bolts are within the appropriate range of torque. Generally 3 to 4 repetitions are required..
- 2.3 Pipe cleanliness. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, other material, or people shall be placed in the pipe at any time.
- 2.4 Pipe placement. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be held in place via blocking behind the bell prior to backfilling.
- 2.5 Direction of bells. It is common practice to lay pipe with the bells facing the direction in which work is progressing.
- 2.6 Temporary pipe plugs. At times when work is not in progress, the open end of the pipe shall be closed by means of a watertight plug or other means acceptable to the District. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe floatation should the trench fill with water.
- 2.7 Pipe deflection. When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the amount of deflection shall not exceed 75% of the maximum allowable deflection as specified by the manufacturer. For example, for 12 inch DIPCL push-on pipe, the manufacturers maximum allowable deflection is 5 degrees or 21 inches for a 20 foot length of pipe. Therefore, the District will permit 75% of 21 inches or 15 inches maximum deflection per joint. Please keep in mind that deflections are cumulative in the horizontal and vertical plane.
- 2.8 Polyethylene encasement. Polyethylene encasement of DIPCL water mains shall only be done when specifically specified by the District.

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**GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE C900 & C905**

1.0 SPECIFICATION:

- 1.1 Polyvinyl Chloride (PVC) pressure pipe shall meet all the requirements of AWWA Standard C900-07 and C905-97 (or latest revisions) and have a Dimension Ratio (DR) of 18 and a Pressure Rating (PR) of 235 psi for diameters 4 inch through 24 inch and be provided with an outside diameter equivalent of cast iron pipe. The use of Polyvinyl Chloride (PVC) will be reviewed on a case by case basis and must receive prior written approval from the District.
- 1.2 Each piece of pipe shall be provided with a factory installed elastomeric gasket meeting the Standards of ASTM F477 (latest revision). Gaskets shall not be removed from the pipe joint.
- 1.3 Dimensions and tolerances for each nominal pipe size shall be in accordance with the latest revision of the applicable AWWA Standard.
- 1.4 Pipe shall be furnished in standard laying lengths of 20 feet unless otherwise noted. Each pipe shall have an integral bell formed on the pipe end and be designed to be at least as strong as the pipe wall.
- 1.5 Each length of pipe furnished shall bear identification markings that will remain legible after normal handling, storage and installation. Markings shall be applied in a manner that will not weaken or damage the pipe. Markings shall be applied at intervals of not more than 5 feet on the pipe. Marking requirements shall be in conformance with the latest revision of the applicable AWWA Standard for each class of PVC pipe.
- 1.6 Pipe shall be bundled in pallets for ease of handling and storage. Pipe bundles shall be packaged to provide structural support to insure that the weight of upper units shall not cause deformation to pipe in lower units. No pipe bundles shall be accepted which show evidence of degradation from ultraviolet radiation on exposed pipe as may be caused from extended unprotected storage conditions.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 PVC Pressure Pipe shall be assembled in strict accordance with the manufacturers instructions and per the latest revision of the applicable AWWA Standard and as briefly described below.
 - a) Proper care shall be used to prevent damage in handling, moving and placing the pipe. Pipe shall be hoisted with mechanical equipment using a cloth belt sling or continuous fiber rope which avoids scratching the pipe. A chain is not permitted. Pipe shall not be dropped or dumped into the trench.
 - b) Thoroughly inspect the bell end of the pipe to insure the gasket is properly seated in the bell groove and not damaged. Clean entire joint to insure there is no debris, sand or silt in which to cause the gasket to not properly seal.
 - c) Inspect and clean spigot end of pipe. Wipe with a clean dry cloth around entire circumference from the end to at least one inch beyond the reference mark.
 - d) Lubricate the spigot end of the pipe using only lubricant supplied and approved by the pipe manufacturer. Do not allow the lubricated spigot end of the pipe to come in contact with anything before assembly. Do not lubricate the gasket or ring groove as this may result in displacement during assembly.

SPECIFICATION – POLYVINYL CHLORIDE (PVC) PRESSURE PIPE – Cont.

- e) Assemble the joint only to the reference mark provided on the spigot end.
 - f) Insert the beveled spigot end into the bell so that it is in contact with the elastomeric gasket. Pipe must be aligned properly with previous pipe before assembling joint. Bell end of pipe must be protected with wood blocking while pushing lengths together. Care must be taken while pushing joints together that previously completed joints in the line will not be closed up or over-assembled. Previous lengths of pipe should either be braced or sufficiently backfilled to prevent any over-assembling. Apply a steady and constant force to the pipe until the reference mark is even with the bell end.
 - g) Once the joint is assembled, the District will allow a maximum of 1 degree of angular deflection to be taken in the joint for C905 class PVC pipe, 14 inch – 24 inch diameter. This will produce an offset in a 20 foot long section of approximately 4 1/4 inches. Joint deflection is achieved only after the joint is assembled in straight alignment and to the reference mark. It is important to note that horizontal and vertical angular deflections are cumulative.
 - g.1) Joint deflection is not allowed in 4 inch – 12 inch C900 PVC pipe. Curvature of the pipe shall be accomplished through longitudinal bending of the pipe barrel in accordance with 75% of the manufacturer's allowable bending radius.
 - h) Prior to backfilling, check to see that the reference mark is even with the end of the bell.
- 2.11 Pipe cleanliness. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, other material, or people shall be placed in the pipe at any time.
- 2.12 Pipe placement. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be firmly supported along its entire length by the prepared bedding material prior to backfilling.
- 2.13 Direction of bells. It is common practice to lay pipe with the bells facing the direction in which work is progressing.
- 2.14 Temporary pipe plugs. At times when work is not in progress, the open end of the pipe shall be closed by means of a watertight plug or other means acceptable to the District. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe floatation should the trench fill with water.
- 2.15 Mechanical Joint Ductile Iron Fittings. Only MJ DI fittings meeting the District's specifications may be used with C905 PVC pipe. Proper layout of the fittings must be accomplished in a sufficient manner as to insure that nearly a full section of pipe (minimum 18 feet for PVC) enter and exit all fittings and valves to provide the necessary skin friction on the pipe walls required by the wedge-action retainer glands. Only wedge-action retainer glands designed specifically for C905 PVC shall be used. See "RETAINER GLANDS FOR PVC PIPE" for details.
- 2.16 Taps. All taps 1 inch – 2 inch in diameter performed on PVC pipe shall utilize a double stainless steel strap ductile iron service saddle of appropriate size to properly fit the pipe. Service saddles shall be provided with AWWA (CC) threads to accept an appropriately sized corporation. All taps 3 inches and larger on PVC pipe shall utilize mechanical joint ductile iron tapping sleeves. See "DUCTILE IRON TAPPING SLEEVES" for details.
- 2.17 Copper Tracer Wire. All PVC pipe must be provided with a minimum No. 6 AWG insulated copper wire laid along the top of the pipe and secured by means acceptable to the District. Tracer wire must be continuous as to not break conductivity. If wire must be cut and/or reconnected, splice wires with a minimum 6 inch overlap and use 2 u-bolt cable connectors that will not degrade conductivity. Tracer wire must be brought up and secured inside all valve gate boxes to within 3 inches of ground surface for connection to an electronic pipe locator.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
RESILIENT SEAT WEDGE GATE VALVES

1.0 SPECIFICATION:

- 1.1 The District currently utilizes the American Flow Control Model 2500; the U. S. Metroseal Model 250 resilient seat wedge gate valve and the Clow Model 2638 C515 valve for 4 inch through 16 inch diameter sizes inclusive. **Valves constructed of cast iron are not permitted.** Valve configurations include both mechanical joint and flanged type connections. The use of any valves others than those mentioned above will require prior written approval from the District.
- 1.2 All bolts shall be type 18-8 high strength stainless steel.
- 1.3 The valve stem shall be "open-right."
- 1.4 The valve shall be furnished with standard 2 inch AWWA operating nut color-coded ("red") as to valve opening.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Prior to installation, the valve shall be physically operated to confirm operation of valve per section 1.3 above and that all bonnet bolts are tight.
- 2.2 During installation, the valve body shall be set on wooden blocking, the supporting material of which has been thoroughly compacted. Valve body shall be set plumb and positioned such that the operating nut is vertical prior to backfilling.
- 2.3 All joint bolts shall be torqued using a calibrated torque wrench in accordance with the manufacturer's specifications.
- 2.4 Great care shall be taken to ensure that the fusion-bonded epoxy coated interior or exterior is not damaged. Any damaged areas shall be repaired by the Contractor in accordance with the manufacturers recommendation at the sole expense of the Contractor.
- 2.5 All valves shall be restrained by means of wedge action retaining glands (see "Ductile Iron Retainer Glands" and "Thrust Restraint Requirements") with a minimum 16-foot continuous length of ductile-iron pipe entering and exiting the valve whenever possible unless entering or exiting another fitting. The use of threaded rods will be evaluated on a case by case basis and must receive prior written approval from the District. The size and location of the rods will be determined by the District or its' Inspector prior to installation.
- 2.6 All resilient seat wedge gate valves shall be provided with valve boxes (see Valve Boxes, Extensions and Covers specification) to the surface unless specifically requested not to by the District.
- 2.7 A minimum of 2 lateral measurement "swing ties" shall be taken to all valves prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
BUTTERFLY VALVES

1.0 SPECIFICATION:

- 1.1 This specification includes mechanical joint and flanged butterfly valves from 16 inch through 24 inch diameter inclusive. All butterfly valves shall be of the rubber seated tight closing type. They shall meet or exceed the latest revision of the AWWA Standard C504.
- 1.2 All valves must use full AWWA C504 Class 150B valve shaft diameter, and full Class 150 underground service operator torque rating throughout entire travel, to provide capability for operation in emergency service.
- 1.3 All butterfly valves shall be **"open right"**.
- 1.4 All butterfly valve manufacturers shall have a minimum of five (5) years experience in the manufacture of butterfly valves for the size and type of service as specified herein.
- 1.5 The valve body shall be ASTM - A48, Class 40 or A126, Class B high tensile cast iron. The body shall have integral hubs for housing shaft bearings and seals.
 - Mechanical joint ends shall conform to AWWA C-111.
 - Flanged ends with short body laying length per AWWA C-504, and with flanges designed for installation between ANSI B16.1 Class 125 cast iron flanges.
- 1.6 The butterfly valve disc shall be of the "off-set" design to provide a full 360 degree seating surface uninterrupted by shaft holes. The disc shall be constructed of ASTM A56, grade 65-45-12 ductile iron. There shall be no external ribs to the flow. Non-metallic discs are not acceptable.
- 1.7 The resilient seat shall be Buna-N or natural rubber designed to provide tight shutoff at the specified pressures. The rubber seat can be on the disc edge or in the valve body but in either case, must be retained by positive mechanical means with corrosion-resistant hardware. Seats must be capable of mechanical adjustment in either direction without the use of special tools. The should be capable of complete replacement in the field without chipping, grinding, or burning out the old seat or its retaining mechanism. The rubber mating surface in all cases must be 300 series stainless steel (minimum).
- 1.8 All valve shafts shall be of single piece "through" type construction. The shafts shall be composed of round stock, 18-8 stainless steel, type 304 material. Valve shafts shall be securely attached to the disc by means of dowel pins composed of 18-8 stainless steel. Shaft bearings shall be contained in the valve body integral hubs. The bearings shall be of the self-lubricated sleeve type.
- 1.9 The valve assembly shall be furnished with a single two-way thrust bearing designed to center the disc in the body at all times and adsorb thrust forces. The drive end shaft shall be of the cartridge type with O-rings to provide positive sealing.
- 1.10 All valves shall be tested per AWWA C-504, including hydrostatic, performance, and leakage tests.

SPECIFICATION – BUTTERFLY VALVES – Cont.

- 1.11 Valves shall have all internal and external surfaces shop coated with a high performance, one-part, heat-curable thermosetting epoxy coating which provides superior corrosion resistance protection for metal parts (Federal Specification TT-V-51C) except for furnished bearing surfaces. The coating material shall be a suitable, non-toxic epoxy resin consisting of 100% solids. It is impervious to and imparts no taste to potable water. The coating is formulated from materials deemed acceptable in the Food and Drug Administration Document Title 21 of the Federal Regulations on food additives, Section 175.300 entitled "Resinous and Polymeric Coatings." The coating thickness shall be a minimum of 9 mils in thickness.
- 1.12 The valve actuator shall be integrally mounted on the valve mounting flange and shall be of the self-locking traveling nut type in complete accordance with AWWA C-504 requirements. The housing, housing cover, and shaft shall be sealed or gasketed to prevent water entry to a 25 ft. head pressure.
- Buried service valve actuators (mechanical joint) shall be furnished with standard 2 inch AWWA operating nuts. Operator design must permit repositioning of the actuator in 90 degree increments, and must permit adjustment of the valve disc seating.
 - Flanged valves shall be supplied with all the necessary gaskets, nuts and bolts required to install the valves. Flanged valves shall be supplied with either the standard 2 inch AWWA operating nut or a handwheel with integrally cast 2 inch nut which is pinned to the input shaft. The size of the handwheel shall meet AWWA C-504 rim pull limitations.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 All butterfly valves shall be installed in accordance with the manufacturers specifications and instructions and as directed by the District.
- 2.2 Valves delivered to the job site shall be stored undercover and on pallets unless otherwise approved in writing by the District.
- 2.3 Restraint for mechanical joint valves shall be in accordance with the "Thrust Restraint Requirements" section of these specifications.
- 2.4 A minimum of 2 lateral measurement "swing ties" shall be taken to all new butterfly valve installations in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
HORIZONTAL SWING CHECK VALVES

1.0 SPECIFICATION:

- 1.1 Horizontal swing check valves shall meet or exceed the requirements of AWWA Standard C-508. Construction shall consist of a cast iron body, bronze mounted, single gate for non-shock working pressure of 150 psig and tested at double the working pressure.
- 1.2 Check valve ends shall be flanged (generally) or mechanical joint as specified.
- 1.3 All check valves shall be supplied with the appropriate ring gaskets, nuts, and bolts as "standard accessories" required for installation. The gaskets, nuts, and bolts shall comply with the specifications for "Ductile Iron Fittings."
- 1.4 When there is no flow through the main, the swing gate shall hang lightly against the seat.
- 1.5 The valve shall be constructed such that all components may be adjusted/ removed by lifting off the top access cover without removing the valve from the line.
- 1.6 Check valves shall be supplied with the same internal and external epoxy coatings as specified for "Butterfly Valves."
- 1.7 Check valves shall be suitable for mounting horizontally or vertically, depending on the direction of water flow.
- 1.8 Check valves shall have stainless steel hinge pins. The hinge pins shall operate in babbitt style support bearings.
- 1.9 Check valves shall be outside weight and lever unless otherwise specified.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Check valve applications will generally be for interior use via flanged end connections. The District will specify maximum laying length limits when applicable.
- 2.2 Check valve gross weights shall be provided as part of the standard submittal package (i.e. manufacturers specification sheets, etc.).
- 2.3 The Contractor shall provide, at no additional cost to the District, temporary supports under large check valves until such permanent supports such as cast-in-place concrete cradles can be placed and made ready for service.
- 2.4 A minimum of 2 lateral measurement "swing ties" shall be taken to all buried check valves prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION FIRE HYDRANTS

1.0 SPECIFICATION:

- 1.1 The District, in an effort to minimize the quantity and diversity of repair parts, maintenance tools, etc. has standardized around the Waterous WB-67-250 and the Clow Eddy F2641. The hydrant shall be supplied with a 1 5/8 inch pentagon style top nut, 5 ¼ inch main valve **open right**, 6 inch MJ shoe, 6 foot-6 inch bury, two 2 ½ inch NST and one 4 ½ inch NST connection ports. The shoe and lower valve shall be coated inside and out with fusion bonded epoxy paint. The shoe shall be attached to the lower barrel with stainless steel nuts and bolts. All drain ports shall be plugged at the factory.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 All hydrants shall be installed in accordance with the "Hydrant Installation Detail" unless otherwise specified. Hydrants shall be installed plumb and true in the vertical plane in all directions. Finish grade around hydrant shall be 2 inches below breakaway flange of hydrant. Appropriately sized hydrant extensions shall be provided and installed to bring hydrant to proper grade if required.
- 2.2 Color code painting of the hydrant shall be done by the District once the installation is complete.
- 2.3 The distances between the hydrant, the hydrant valve and the distribution main shall be recorded and submitted to the District. If the hydrant branch is other than perpendicular to the distribution main, then a legible sketch shall be recorded accurately showing all distances and angles from the distribution main to the hydrant.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON COUPLINGS (SLEEVES)

1.0 SPECIFICATION:

- 1.1 Mechanical joint style straight and transition type couplings shall be constructed entirely of ductile iron (center body ring and end rings).
- 1.2 Center rings shall be grade 65-45-12 ductile iron meeting or exceeding ASTM Standard A536-80. All areas of the center ring shall receive a heavy shop coat of primer and epoxy paint at the factory.
- 1.3 End rings shall be grade 68-45-12 ductile iron meeting or exceeding ASTM Standard A536-80. End rings shall be color coded as to the outside diameter range of pipe: Red, steel size PVC; Black, cast iron, ductile iron & CL150 asbestos cement; Yellow, CL 200 asbestos cement.
- 1.4 Gaskets shall be virgin SBR compounded for water service. Gasket material shall meet or exceed ASTM Standard D2000 3 BA715.
- 1.5 Bolts and nuts shall be high strength, low alloy steel trackhead type bolts. National coarse rolled thread and heavy hex nuts with black finish. The steel shall meet AWWA C111-80 composition specifications.
- 1.6 Acceptable products are the Romac 501 style coupling as manufactured by Romac Industries, Inc. and the Ford style FC1 and FC2A as manufactured by the Ford Meter Box Co. Inc. All other submittals must pre-approved by the District in writing.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Couplings shall be installed in strict accordance with the manufacturer's instructions. All nuts shall be tightened in an alternating star pattern with a properly calibrated torque wrench as specified by the manufacturer.
- 2.2 Off-set marks shall be made on coupled pipe to allow for the coupling to be centered over the joint between the two sections of main being coupled.
- 2.3 A minimum of 2 lateral measurement "swing ties" shall be taken to all buried couplings prior to backfilling in accordance with Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
DUCTILE IRON TAPPING SLEEVES

1.0 SPECIFICATION:

- 1.1 Tapping sleeve shall be a mechanical joint, split sleeve with outlet flange conforming to AWWA C-110 Section 10-14 with drilling recessed for tapping valve.
- 1.2 The sleeve must be of ductile iron construction and include a 3/4 inch F.I.P. threaded test plug so that sleeve and valve can be pressure tested before the tap is made.
- 1.3 Sleeves up to 12 inch x 12 inch shall be rated for a minimum working pressure of 200 psig.
- 1.4 The side rubber gaskets shall be rectangular in cross-section and fit into grooved channels in the casting. These gaskets shall extend the entire length of the sleeve and shall not require cutting or trimming to match mechanical joint end gaskets.
- 1.5 Sleeves shall be furnished with standard accessories including: glands, gaskets for both ductile and oversized pit-cast pipe, and Cor-Ten T-bolts and nuts or equivalent. All flange bolts shall be 316 stainless steel.
- 1.6 Interior and exterior to be bituminous coated with a minimum 2 mils dry film thickness.
- 1.7 For resilient seat tapping wedge valves, in order to avoid damage to the valve sealing surface, use recommended cutters with the following maximum dimensions:

Valve Size:	4"	6"	8"	10"	12"
Cutter Size:	3.75"	5.75"	7.75"	9.75"	11.75"

- 1.8 Fabricated stainless steel tapping sleeves (non-mechanical joint) may be permissible in certain applications and will require prior written permission from the District. These sleeves may also require the use of particular valves.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Mechanical joint tapping sleeves shall be installed in strict accordance with the manufacturers instructions.
- 2.2 Once installed, the tapping sleeve shall be pressure tested prior to making the tap.
- 2.3 The tapping sleeve shall be installed such that the flanged face of the sleeve is plumb with the vertical plane. The Contractor shall use a level to check for plumb and make adjustments as necessary.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
MECHANICAL JOINT TAPPING SLEEVE VALVES

1.0 SPECIFICATION:

- 1.1 Mechanical joint tapping sleeve valves shall be resilient seat wedge gate type valves conforming to Resilient Seat Wedge Valve specifications. As is the case with tapping sleeve valves, one valve end will be flanged and the other end mechanical joint.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 The tapping sleeve valve shall be installed in full compliance with the manufacturers specifications. The valve face must be plumb with the vertical plane.
- 2.2 All Mechanical Joint Tapping Sleeve Valves shall be provided with valve boxes (see Valve Boxes, Extensions & Covers specification) to the ground surface unless specifically requested not to by the District.
- 2.3 A minimum of 2 lateral measurement "swing ties" shall be taken to all Mechanical Joint Tapping Sleeve Valves prior to backfilling in accordance to Section II, 4, 4.8.

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GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
REPAIR CLAMPS

1.0 SPECIFICATION:

- 1.1 Repair clamps shall have a carbon steel body adhering to ASTM A 285 Grade A or ASTM A 283 Grade C. The body finish for the carbon steel body shall be fusion bonded epoxy with an average 12 mil thickness. The gasket shall be Nitrile (Buna-N), 100% circumferential waffle-type gasket with stainless steel bridging plates that afford a permanent seal.
- 1.2 Acceptable products in sizes 4 inch to 12 inch are the Smith-Blair 267 Full-Circle Repair Clamp as manufactured by Smith-Blair, of Texarkana, Arkansas and the Viking EasiClamp as manufactured by Viking Johnson.
- 1.3 All repair clamps shall be delivered to the District complete within a sealed box. Repair clamps delivered unboxed shall be rejected and returned to the Supplier at their cost.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Prepare pipe surface, ensuring that the damaged pipe is free from loose surface deposits, mud, scale, rust, etc.
- 2.2 Place a reference mark on the pipe to check for proper positioning of the clamp over the damaged area during installation.
- 2.3 Install half housings around the pipe, ensuring that the leading edges of the gaskets are fed into the mating side of the opposite half housing. Note: For 10 inch & 12 inch sizes, install top half housing first and then offer up the bottom housing ensuring that both gasket sections are mated within it.
- 2.4 Push half housings together by hand locating captive clamp bolts in the bolt holes. Fit the washers and loosely tighten the nuts. Note: For 10 inch & 12 inch sizes, do not disassemble nuts & washers. Simply loosen off the nuts to allow the bolt heads to be swung over and located in the top housing slot holes.
- 2.5 Position clamp over the damaged area and seat firmly in place. Rotate the clamp as necessary to allow access to the nuts for tightening.
- 2.6 Commence bolt up. Tighten bolts per manufacturer's recommendations starting at the center of the clamp and working to the outside. Torque bolts to manufacturer's specifications per the size of the clamp used.

Review Date: April 2017
Approved By: MAM

GREATER AUGUSTA UTILITY DISTRICT SPECIFICATION
VALVE BOXES, EXTENSION & COVERS

1.0 SPECIFICATION:

- 1.1 Valve boxes shall be heavy cast iron, two piece, sliding type with a top flange and a minimum inside shaft diameter of 5 inches.
- 1.2 The bottom section shall be a minimum 36 inches long and provided with a belled (buffalo) base in accordance with the "Typical Valve Box Detail". Longer bottom sections may be required in lengths of 48 inches or 57 inches, based on depth of valve.
- 1.3 The top section shall be a of minimum 26 inches long and designed to slide over the base section. See "Typical Valve Box Detail". Longer top sections may be required in lengths of 36 inches or 54 inches, based on depth of valve.
- 1.4 The cover shall be a heavy drop type, non-tilting cast iron unit that is recessed in the box top to prevent plow breakage. The cover shall be provided with two pick holes for easy removal and have the word "WATER" clearly cast into the cover. The rim of the cover shall be solid, not fluted. Acceptable covers are the Bingham & Taylor Standard Round Drop-in Lid 4905-L1.5 or pre-approved equal.
- 1.5 Valve box extensions shall be slide type top extensions designed to be installed inside of a standard valve box top as detailed in 1.3 above. Valve box extensions shall be able to accept a standard valve box cover as detailed in 1.4 above.
- 1.6 All valve box components shall be generously coated with a corrosion resistant bituminous coating.
- 1.7 The District only accepts valves boxes, extensions and covers manufactured within North America.

2.0 GENERAL INSTALLATION INSTRUCTIONS:

- 2.1 Valve boxes shall be installed concentric to the operating nut and plumb with the vertical plane. The belled base section shall be placed on blocking in such a way that no additional loading is transferred to the valve body. Valve boxes shall have a minimum overlap of 8 inches between the bottom and top sections. In no cases shall valve boxes be stacked or contain more than one base section, one top section and one extension.
- 2.2 Longer valve box bottoms and/or tops will be specified as required for water mains at depths that exceed the limitations of the above specified valve box.
- 2.3 Valve boxes located in paved areas shall be left ¼ inch below finish grade; in a manner so they are not an obstruction to traffic or plows; unless otherwise specified.
- 2.4 Valve boxes located in non-paved gravel shoulders shall be left 4 inches below finish grade and covered with gravel unless otherwise specified.
- 2.5 Valve boxes located in other non-paved areas shall be left 2 inches below finish grade and covered with earth unless otherwise specified.
- 2.6 Valve boxes shall be left clean from debris on the inside to allow unobstructed access to the valve operating nut.
- 2.7 All covers shall be magnetized before installation to allow locating. Polarity shall be positive.

Section IV: Water Main Installation Documents

Certificate of Title and Project Acceptance 46

Water Main Extension Agreement47

CERTIFICATE OF TITLE AND PROJECT ACCEPTANCE

KNOW ALL MEN BY THESE PRESENTS: that a corporation doing business as _____ of _____, and State of _____, hereinafter called "DEVELOPER" and a corporation doing business as _____ of _____, County of _____, and State of _____, hereinafter called "CONTRACTOR" in consideration of One Dollar (\$1.00) and other valuable considerations paid by GREATER AUGUSTA UTILITY DISTRICT (the "DISTRICT"), a quasi-municipal corporation with a principal office in Augusta, Maine, the receipt of which consideration is hereby acknowledged, does hereby, GREANT, SELL, TRANSFER, AND DELIVER unto the said DISTRICT, its successors and assigns, the following personal property:

New _____ water main extension in _____ in _____, Maine
_____ new _____ inch water services installed from the new mains.
_____ public fire hydrants.

TO HAVE AND TO HOLD, all of the said personal property to the said GREATER AUGUSTA UTILITY DISTRICT, its successors and assigns to its and their own use and behold forever.

AND, the Developer/Contractor hereby covenants with the said DISTRICT, its successors and assigns, that it is the lawful owner of all the said personal property, that it is free from all encumbrances; that Developer/Contractor has good right to sell the same as aforesaid; and that it will WARRANT AND DEFEND the same unto the DISTRICT, its successors and assigns against the lawful claims and demands of all persons.

AND, the said GREATER AUGUSTA UTILITY DISTRICT, having inspected the installation of the said personal property, and having received certification verifying satisfactory results with regards to testing of said installation, finds that it substantially complies with the terms of the AGREEMENT between the District, the Developer and the Contractor dated as of the _____ day of _____.

This date shall mark the commencement of all warranties and guarantees required by the Contract Documents and such warranties and guarantees shall be fully effective, notwithstanding the fact that the District has inspected such property.

IN WITNESS WHEREOF, the parties hereto have caused this Certificate of Title and Project Acceptance to be executed by their duly authorized officials.

(SEAL)

DEVELOPER

By _____

Its _____

Witness

(SEAL)

CONTRACTOR

By _____

Its _____

Witness

(SEAL)

GREATER AUGUSTA UTILITY DISTRICT

By _____

Its _____

Witness

GREATER AUGUSTA UTILITY DISTRICT

WATER MAIN EXTENSION AGREEMENT

MEMORANDUM OF AGREEMENT made this _____ day of _____, 20____, by and between the Greater Augusta Utility District, a quasi-municipal corporation duly established under the laws of the State of Maine, hereinafter referred to as the "District" and _____, hereinafter referred to as the "Applicant".

WITNESSETH: Whereas the Applicant desires to have the District extend its water facilities on _____ in _____, Maine as follows:

Install _____ DICL water main in _____
Install _____ domestic water services
Install _____ public fire hydrants

NOW THEREFORE, it is agreed between the Applicant and the District as follows:

1. The Applicant shall submit an adjustable deposit of \$ _____ to the District, which is the estimated total cost of the extension and includes materials, labor, equipment, permits, inspection, testing and Subcontractor fees. All construction within the public R.O.W. shall be done by the District, or the Applicant's Contractor, at the Applicants expense and District's full inspection. The full amount of the adjustable deposit shall be paid to the District upon execution of this Agreement. The estimated cost (does) (does not) include an allowance for ledge removal.
2. Within 60 days following determination of the final costs incurred for the extension, including the water main and the District's portion of the service line, the amount advanced (adjustable deposit) shall be adjusted to the actual cost of construction, by the District's return to the Applicant of any excess amount, or by additional payment of the Applicant to the District to cover any deficiency.
3. Should the water main extension cross property other than that owned by the Applicant, including the public R.O.W., prior to reaching the Applicant's property, and customers located on property other than the Applicant's property are connected to the watermain extension within ten (10) years following connection of the Applicant (normally the first connection), then those customers shall be required to make a contribution to the Applicant. The customer contribution shall be calculated in accordance with the requirements of Maine Public Utilities Commission (MPUC) Rule, Chapter 650, Section 4, Paragraph D.
4. The documents which comprise the entire agreement between the District and the Applicant consist of the following attachments:
 - This Water Main Extension Agreement
 - Chapter 650 of the MPUC Rules and Regulations
5. This agreement is subject to the Rules and Regulations of the MPUC governing water main extensions (Chapter 650). In the event of a conflict between this agreement and the rules and regulations of the MPUC, then the rules and regulations of the MPUC shall govern. The parties understand that the provisions of this agreement are subject to alteration by a decision or rule of the MPUC.

6. Disputes arising under this agreement or under the rules and regulations of the MPUC governing water main extensions may be referred pursuant to said rules and regulations to the MPUC for resolution.
7. The ownership of the water main extension service connections constructed under this agreement shall at all times remain the property of the District and the Applicant does not accrue any equity or value in said water mains and service connections.
8. The Greater Augusta Utility District shall have the right to further extend its water main beyond this extension or to tap and take-off from this extension laterally for any purpose including customer services connections, hydrant installations, etc.
9. This agreement shall be binding on the heirs, executors, administrators, successors or assigns, of the contracting parties.

Executed in duplicate by the parties hereto, upon the day and year above written.

APPLICANT

GREATER AUGUSTA UTILITY DISTRICT

By: _____

 By: General Manager
 Greater Augusta Utility District

Its: _____

Date: _____

Date: _____

Address for giving notice: _____

Personally appeared the above named Applicant, _____,
 and acknowledged the foregoing instrument to be his/her free act and deed.

Before me,

By: _____
 Notary Public

Section V: Work Associated with Sewer Construction

1. DESCRIPTION OF THE WORK

All the work shall conform to these specifications and to the accompanying plans drawn by a Professional Engineer registered in the State of Maine, based on plans and other information submitted by the Developer on file with the District.

The Contractor shall furnish all labor, materials and equipment in order to construct gravity sewers, pressure mains, storm sewers, manholes, connections, catch basins and such other structures or features as may be required to complete the work in accordance with said plan and specifications.

Construction work shall start on a date and place mutually agreed upon between the District and the Contractor and only after the District has received approval of the extension from DEP. Work shall be continued with regularity until its completion. Sufficient labor and equipment shall be supplied to maintain a rate of progress satisfactory to the District. The District will assess the Project a Permit Fee, Service Availability Fee and Inspection Fee. The actual costs for these fees will be determined at the time the final plans are submitted.

Whenever the words “as directed”, “as permitted”, “as required” or words of like effect are used it shall be understood that the direction, permission or requirements of the District is intended and similarly the words “approved”, “acceptable”, “satisfactory”, or words of like import shall mean approved by or acceptable or satisfactory to the District.

Whenever the words “or equal” or words of like import are used it shall be understood that this means “equal” in the opinion of the District.

The Contractor shall employ at his own expense a competent surveyor or engineer, who shall stake out the lines and grades for all pipes, structures, and other portions of the work and establish all necessary controls. All reference marks shall be verified by an instrument at frequent intervals and the Contractor shall be responsible for the accuracy of all lines and grades relative to the project.

All gravity sewers and storm sewers shall be laid with laser beam unless other means are approved by the District.

Whenever the Developer or Contractor is not present on any part of the work, a competent assistant shall be placed in charge with full authority to act for the Developer or Contractor.

2. CONSTRUCTION PROCEDURES REQUIRED FOR SEWER

- a. Plans must be approved by the District.
- b. Sanitary plans may need to be approved by DEP. If so, the District will deliver the plans to DEP after its' approval.
- c. All required easements and land title transfers to the District must be completed prior to final acceptance by the District.
- d. Developer shall pay up front, before construction begins, the sewer availability fee, construction inspection fee and permit fee, as well as any other additional fees, as applicable. All sewer and storm drain related work shall be inspected by a representative of the District.
- e. All new sewer and storm drain related work shall be tested as specified in these specifications.
- f. Prior to acceptance, as-built drawings will be required at the completion of the project or each phase of project per Section I, 1, h.
- g. The Contractor and/or Developer shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION. The Contractor and/or Developer warrants and guarantees for a period of one (1) year from date of SUBSTANTIAL COMPLETION of the system that the completed system is free from all defects due to faulty materials or workmanship and the Contractor and/or Developer shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The District will give notice of observed defects with reasonable promptness. In the repairs, adjustments, or other work that may be made necessary by such defects, the District may do so and charge the Contractor and/or Developer the cost thereby incurred. The performance bond shall remain in full force and effect through the guarantee period.
- h. All construction work shall be in full compliance with the regulations of OSHA.
- i. Contractor shall notify DIG SAFE and all non-member utilities three business days prior to starting construction work on any project.

3. INSURANCE REQUIREMENTS

Before work is started under the contract the Contractor will be required to file with the District a Certificate of Insurance, executed by an insurance company or companies satisfactory to the District and licensed by the State of Maine Department of Business Regulation, Bureau of Insurance to do business in the State of Maine, stating that the Contractor carries insurance in accordance with the following requirements and stipulations:

- a. Workers' Compensation Insurance. With respect to all the operations the Contractor performs and all those performed for him by subcontractors, the Contractor or the Subcontractor shall carry Workers' Compensation Insurance or shall qualify as a self-insurer with the State of Maine Workers' Compensation Commission, all in accordance with the requirements of the laws of the State of Maine.

- b. Contractor's Public Liability and Property Damage Insurance. With respect to the operations he performs and also those performed for him by subcontractors, the Contractor shall carry regular Contractor's Public Liability Insurance and Contractor's Protective Public Liability Insurance, each covering bodily injury liability of not less than 1,000,000 dollars for damage arising out of bodily injuries to or death of one person and subject to that limit for each person, a total of 1,000,000 dollars damage arising out of bodily injuries to or death of 2 or more persons in any one accident or occurrence and covering property damage liability of not less than 1,000,000 dollars for all damages arising out of injury or destruction of property in one accident.
- c. Automobile Liability Insurance. The Contractor shall carry Automobile Liability Insurance covering the operation of all motor vehicles, including those hired or borrowed, used in connection with the contract, covering bodily injury liability of not less than 300,000 dollars for all damages arising out of bodily injuries to or death of one person and subject to that limit for each person, a total of 300,000 dollars for all damages arising out of bodily injuries to or death of two or more persons in any one accident or occurrence and covering property liability for a limit of not less than 300,000 dollars for all damages arising out of injury to or destruction of property in one accident or occurrence.
- d. Contractual Liability Insurance. The Contractor shall carry Contractual Liability Insurance covering the liability he has assumed under the contract to indemnify and save harmless the District, its officers and employees with respect to bodily injuries to or death of any persons or injury to or destruction of property. The limits for such insurance shall be not less than those specified for Contractor's Public Liability Insurance in paragraph (b) above.
- e. Blasting. All blasting must be in complete compliance with the Municipality having jurisdiction. When explosives are to be used in the progression of the work, the insurance required under paragraphs (b), (c) and (d) above shall also contain provisions for protection, in the amounts stated, against damage claims due to such use of explosives.
- f. Each policy shall be signed by the President and Secretary of the insurance company and shall be countersigned by a licensed resident agent in the State of Maine as an authorized representative of the company.
- g. Termination or Change of Insurance. Each insurance policy shall be endorsed to provide that the insurance company shall notify the District at least 30 days in advance of cancellation of or any change in the policy. No change shall be made without prior written approval of the District.

The Contractor shall keep all the required insurances in continuous effect until 31 days after the date of final acceptance of the project or until such earlier time as may be established by the District.

- h. Claims. Each insurance policy shall state that the insurance company shall agree to investigate and defend the insured against all claims for damages, even if groundless.
- i. Compliance with the requirements of the section may be met by procurement of insurance covering all work under contract with the District or may be met by procurement of separate insurance for each individual contract. In either case a Certificate of Insurance must be filed for each contract to show evidence that all required insurance has been obtained.

4. CLEARING, EXCAVATION, BACKFILL AND MISCELLANEOUS FOR SEWERS AND STORM DRAINS

a. General

The work covered by this section comprises the furnishing of all materials, labor, and equipment required to perform all operations in connection with the clearing, grubbing, topsoil removal, pavement removal, excavating, trenching, site grading, removal of unsuitable materials, and backfilling for all piping, manholes, catch basins, and other such structures, as may be required.

The trench grade referred to in the specifications is defined as being six inches (6") below the bottom of the barrel of the sewer coupling unless otherwise specified.

b. Trees

All trees adjacent to the project, including tree roots, shall be carefully protected from damage.

c. General Excavation

All excavations shall be made to such depth and width as will provide suitable room for building the structures they are to contain for sheeting, shoring, pumping and draining, and for removing peat, silt, or other materials which the District may deem unsuitable for foundation. The width of the excavation shall be kept as small as practicable to carry on the work.

d. Trench Excavation

Trench excavation shall be made by open cut sufficient to accommodate the pipe or structure at the depths indicated on the plans. Excavations shall be made to such a point as to allow a minimum of six (6) inches of bedding material to be placed beneath the bottom of all barrels, bells or couplings of all pipes installed. The banks of the excavation shall be properly braced and sheeted. The maximum clear width of trench at the top of the pipe shall not be more than the outside diameter of the pipe plus two feet. The bottom of the trench shall be accurately graded to provide a uniform layer of bedding material for each section of pipe. Trench excavation shall include the satisfactory removal and disposal of all surplus material.

e. Rock Excavation

Rock excavation shall be to the minimum depths previously specified for bedding material. In all excavations for sewers, ledge or boulders shall be removed from insides of trenches to a plane eight (8) inches outside the inside wall of the pipe, unless permission to do otherwise is expressly given by the District.

Where rock is encountered in excavation it shall be removed by blasting methods, unless directed otherwise by the District. The Contractor is to check with all existing utilities adjacent to blasting area for acceptable time period for blasting prior to each blast.

Blasting operations shall be in complete compliance with all OSHA requirements. The proper signing procedures warning oncoming traffic of blasting shall be strictly enforced.

All rock blasts shall be covered with suitable cover and proper precautions shall be taken to avoid damage.

Where sewers, water, steam, telephone, electrical or other utility ducts or lines, manholes or other structures have been exposed during excavation, such structures shall be adequately protected from damage before proceeding with the blasting. The Contractor at the Contractor's expense shall promptly repair any structures damaged by blasting.

Selected fill material shall be furnished to replace the excavated ledge.

f. Experimental Excavation

The Contractor, at the direction of the District, shall make excavations and backfill at such locations as directed, without furnishing or laying pipe in same. These excavations are, in general, to be used as test holes to locate existing pipelines, structures, other underground utilities, etc., for properly carrying out the work.

g. Trenching Machinery

Excavating machinery shall be of such kind and used in such a way and only in such locations as not to injure road surfaces, fences, poles, trees, shrubs, buildings, walks, conduits, posts, pipes, etc.

The only machinery allowed on any paved areas shall be rubber tired except for the backhoe digging the main sewer trench.

h. Water in Trenches

The excavations are to be kept free from water, and pumps, well points or other suitable methods are to be used when necessary, and shifted frequently to avoid drainage from too long a distance. All water pumped or bailed from the excavation is to be conveyed to a suitable point of discharge, in a manner satisfactory to the District. Pump wells in proper locations and sufficiently removed from the line of work and at sufficient depth shall be constructed and maintained as required. Wells are to be securely refilled upon the completion of the work. Disposal of excavation water shall not enter any District Storm Drain without the permission of the District. No excavation water will be allowed into the Sanitary sewer under any conditions.

No pipe or masonry is to be laid in water and water is not to be allowed to rise onto or flow over any pipe or masonry until such time as approved by the District.

i. Backfilling Around Structures

The Contractor shall not place backfill against any structures without obtaining the express permission of the District. Unsuitable material (such as excessive moisture content, large rocks, and ledge.) will not be acceptable for backfill. Approved backfill material shall be deposited in twelve (12) inch horizontal layers, thoroughly compacted by adequate mechanical means to the satisfaction of the District.

j. Backfilling Trenches

The Contractor shall first place and consolidate a six (6) inch layer of approved screened stone on all trench bottoms. After the pipe has been laid, additional screened stone shall be placed and consolidated to the top of the pipe. The trench shall then be carefully backfilled with cover sand deposited in six (6) inch layers, thoroughly consolidated by mechanical tampers, until the pipe has at least twelve (12) inches of cover sand over the top of the pipe. The use of all screened stone to six (6) inches over the pipe is also acceptable. A layer of non-woven geotextile fabric will then be placed over the sand or stone pipe bedding for the full width of the trench between the pipe bedding and backfill material.

The remainder of the trench shall be backfilled as follows:

In Roads, Walks, Drives, Etc.

The area between a line twelve (12) inches over the top of the pipe and the bottom of the sub-base aggregate shall be carefully backfilled in not over twelve (12) inch layers using suitable excavated material taken from the excavation to minimize frost heaving from differential materials unless such materials are unsuitable for re-use. In such cases, a material with similar properties and characteristics shall be used. A last resort option is a material similar to an MDOT Type D aggregate with maximum stone or rock fragment size of six (6) inches or common borrow with a maximum rock fragment size of twelve (12) inches out of paved areas, unless otherwise specified by authorities having jurisdiction.

Cross Country Areas

The area between a line 12 inches over the top of the pipe and a line below the topsoil shall be carefully backfilled in not over twelve (12) inch layers using suitable material taken from the excavation or approved bank run gravel or sand hauled for the purpose.

No mud, frozen earth, or stone larger than ten (10) inches in diameter is to be used for backfilling.

All trench backfill above the top of the pipe shall be consolidated by a vibratory compaction system, proposed by the Contractor subject to approval of the District. The approval by the District of the proposed method of compaction for the backfill shall in no way be construed as relieving the Contractor of responsibility for settlement of trenches, and any settlement which may occur shall be repaired by the Contractor at his own expense. Regardless of the method of compaction the backfill from the top of the pipe must be consolidated to a minimum density of 95 percent of the maximum density determined by ASTM Method D1557 (Modified Proctor). The remaining twenty-four (24) inches to the top of the trench shall be filled with twenty-one (21) inches of road gravel and three (3) inches of surface gravel or as directed by the authority having jurisdiction. The gravel shall be placed, graded and tamped in six (6) inch layers to the finished surface.

After the completion of all backfilling operations, the Contractor shall grade the site to the lines, grades and elevations shown on the plans, taking into account any subsequent topsoil and paving requirements.

k. Material below Trench Grade

The Contractor shall furnish and place selected fill material or screened rock below trench grade, as directed and to such depths as determined by the District. These materials shall be used only when existing material below trench grade is unsuitable for properly placing bedding material and laying pipe.

I. Selected Material

Any selected material required for filling above trench grade, in addition to surplus earth from trench excavation, shall be placed by the Contractor. Selected material shall be clean granular material free from loam, sod, roots, or other organic material and from stones larger than 6-inches in diameter and shall conform to the following table:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieve</u>
6 inch	100
No. 40	0-70
No. 200	0-10

m. Screened Stone

All screened stone shall be clean granular material free from loam, sod, roots, or other organic material and shall conform to the following table:

<u>Screen Size Square Openings</u>	<u>Percentage by Weight Passing Square Mesh Sieve</u>
1 inch	100
¾ inch	90-100
½ inch	20-55
No.4	0-5

n. Road Gravel

All road gravel shall be clean granular material free from vegetable matter, roots, or other organic material and shall conform to the following table:

<u>Screen Size Square Openings</u>	<u>Percentage by Weight Passing Square Mesh Sieve</u>
3 inch	100
½ inch	35-75
¼ inch	25-60
No. 40	5-25
No. 200	0-5

Surface Gravel

All surface gravel shall be clean granular material free from vegetable matter, roots, or other organic material and shall conform to the following table:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieve</u>
1 inch	95-100
¾ inch	90-100
No. 4	40-65
No. 10	10-45
No. 200	0-5

p. Cover Sand

The fine granular material required for cover above the screened rock to a point twelve (12) inches over the top of the sewer pipe shall contain no stones over ¾-inch diameter and shall be of such gradation to be free draining and readily compactible.

q. Sheeting and Bracing and Shoring

The Contractor shall furnish, install complete, and maintain timber or steel sheeting and bracing where such sheeting and bracing is required to prevent disturbance, damage or settlement of adjacent pipelines, structures and all other existing facilities. Sheeting and bracing to be of adequate size and strength for the conditions encountered and shall be driven to true alignment in a workmanlike manner. Timber sheeting shall be straight and sound and shall be tongued and grooved where semi-fluid material is encountered. Minimum thickness of wood sheeting shall be a nominal three (3) inches. All sheeting and bracing shall be removed unless ordered by the District to be left in place. All sheeting and bracing ordered to be left in place shall be cut off at least 2 feet below the ground surface unless otherwise ordered by the District.

r. Clean Up

All surplus material shall be removed and disposed of as specified after refilling of trenches. The removal of surplus material, cleaning up of trench surfaces along streets and premises shall closely follow the pipe laying. If cleaning operations are not carried out the District will suspend pipe laying until the clean-up is satisfactory. Where hardened surfaces or roadways, driveways, or walls are dug up or interfered with, special attention is to be given to the refill and the consolidation before its resurfacing and it shall be done and redone as may be required to make the premises safe at all times and to give the required result.

The Contractor shall continually provide street sweeping on roadways used by his vehicles in order to reduce dust, siltation and nuisance problems.

5. GRAVITY SEWERS (Sanitary & Storm)

a. General

Sewers shall be furnished and installed at locations shown on the plans, and to the line and grade indicated on the plans. All piping shall be complete, including fittings, connections to existing structures, and other miscellaneous items of work. Gravity sanitary sewers with more than twelve (12) feet of cover shall be ductile iron.

b. Pipe

1. PVC-SDR-35

Pipe shall conform to ASTM D 3034 for sizes 4 to 15 inches and ASTM F679 for sizes 18 to 27 inches. PVC resin compound shall conform to ASTM D 1784 and rubber gaskets shall conform to ASTM D 3212 and F 477. Standard laying lengths shall be 13 feet. The pipe shall be colored green to identify it for sewer applications.

2. Ductile Iron Pipe

Pipe shall be manufactured in accordance with the requirements of ANSI / AWWA C151 / A21.51 Ductile Iron Pipe, Centrifugally Cast, for Water and Other Liquids. Pipe shall be manufactured in accordance with the requirements of ANSI / AWWA C111 / A21.11 Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings. Pipe thickness shall be designed in accordance with the requirements of ANSI / AWWA C150 / A21.50 Thickness Design of Ductile Iron Pipe and shall be based on laying conditions and internal pressure as specified in the project plans. Ductile iron pipe shall have cement mortar lining in accordance with the requirements of ANSI / AWWA C104 / A21.4 Cement Mortar Lining for Ductile Iron Pipe.

2.1 Ductile iron pipe and fittings for wastewater shall also be lined with a ceramic-filled amine-cured epoxy, Protecto 401 by Induron Coatings, Inc. The lining thickness shall be a minimum of 40 mils. Application shall be performed by an applicator approved by the coating manufacturer, in accordance with manufacturer's instruction and under controlled conditions at the applicator's shop or the pipe manufacturer's plant. Applicator shall submit a certified affidavit of compliance with coating manufacturer's instruction and requirements specified herein.

3. Concrete Pipe

Concrete pipe shall be Class IV reinforced concrete pipe meeting ASTM Designation C-76.

4. Corrugated Polyethylene Storm Sewer Pipe

Pipe shall have a smooth interior and annular exterior corrugations. Sizes 4 to 10 inches shall meet AASHTO M252, Type S. Sizes 12 to 60 inches shall meet AASHTO M294, Type S or ASTM F2306. Manning's "n" value for use in design shall be 0.012. Virgin material for pipe and fitting production shall be high density polyethylene conforming with the minimum requirements of cell classification 424420C for 4 to 10 inch diameters, and cell classification 435400C for 12 to 60 inch diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12 to 60 inch virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Section 9.5 and 5.1 of AASHTO M294 and ASTM F2306, respectively.

c. Service Fittings

Contractor shall furnish and install wyes or teewyes as required in the pipe lines. These will be used for service connections. Wyes and teewyes, shall be made of the same material as the main line pipe.

d. Flexible Couplings

Flexible couplings (Fernco) shall only be used to connect new PVC sanitary main or service piping to other forms of existing sanitary piping such as vitrified clay, asbestos cement, cast iron etc. PVC to PVC connections shall be accomplished using solid PVC couplings. When flexible couplings are used, solid pieces of blocking shall be installed under the connecting pipes on either side of the coupling to prevent settlement.

e. Chimneys

Chimneys shall be located where directed by the District on a pre-approved basis, and constructed in accordance with the details shown on the plans. Concrete

encasement shall be 3,000 pounds class. Ends of chimneys shall be capped with solid caps matching material of pipe.

f. Pipe Installation

Excavations shall be made to a point at least 6 inches below the pipe to accommodate the bedding material as previously specified.

All excavations are to be kept dry while pipe is being laid and until each joint and pipe has been observed by the District, and approval given to commence backfilling

operations. Pipe shall be laid in strict accordance with the pipe manufacturer's published recommendations. Any pipe which is not laid to grade and alignment shall be relaid to the satisfaction of the District at the Contractor's expense.

All Gravity sewers and storm sewers shall be laid with laser beam unless other means are approved by the District.

No pipe installation will be allowed to begin at any point other than a manhole or other appurtenance without the expressed consent of the District.

If a new sewer extension is tying into an existing system, a plug shall be kept installed in the new line until all new construction is accepted and or approved by the District and all piping and manholes have been cleaned and tested.

g. Pipe Testing

1. General

All gravity sewers shall be tested for water tightness. Testing shall be by internal tests. Where groundwater is high the District may elect to accept infiltration measurements in lieu of exfiltration tests.

The Contractor shall furnish at his own expense, the necessary facilities for making the test including the furnishing and placing of bulkheads, furnishing and placing of water and other necessary materials, labor and equipment.

A section under these specifications shall mean a length of sewer between any two manholes.

2. Low Pressure Air Test For Gravity Sewers

The Contractor shall test the gravity sewers with a low-pressure air test. It shall be conducted in compliance with the following:

After completing backfill of a section of wastewater line, the Contractor shall, at his own expense, conduct a Line Acceptance Test using low pressure air. The test shall be performed using the below stated equipment, according to stated procedures and under the supervision of the District.

3. Equipment

The equipment to be used for the line acceptance test will be Cherne Air-Loc Equipment, as manufactured by Cherne Industrial, Inc. of Edina, Minnesota or approved equal. Equipment used shall meet the following minimum requirements:

- a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.
 - b. Pneumatic plugs shall resist internal pressures without requiring external bracing or blocking.
 - c. All air used shall pass through a single control panel.
 - d. Three individual hoses shall be used for the following connections:
 - 1. From control panel to pneumatic plugs for inflation.
 - 2. From control panel to sealed line for introducing the low pressure air.
 - 3. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
4. Procedures

All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (4.0 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 4.0 to 3.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

<u>Pipe Dia. In Inches</u>	<u>Minutes</u>
4.....	4.0
6.....	4.0
8.....	5.0
10.....	8.0
12.....	11.5
15.....	17.0
18.....	25.0
21.....	35.0
24.....	45.0
30.....	60.0

The Contractor shall furnish all labor, materials and equipment for making infiltration and leakage tests.

THE ATTENTION OF THE CONTRACTOR IS DIRECTED TO THE STRICT REQUIREMENTS RELATIVE TO MAXIMUM RATES OF THE INFILTRATION AND TO THE IMPORTANCE OF THESE SPECIFICATIONS RELATIVE TO TIGHT JOINTS REQUIRED. SEWERS NOT MEETING THE ABOVE REQUIREMENTS SHALL BE REPAIRED AS NECESSARY AT THE CONTRACTOR'S EXPENSE.

6. FORCE MAINS

a. General

The work of this section includes furnishing all labor, materials and equipment required to furnish and install the pipe specified herein for a force main from the Pumping Stations to the gravity sewers.

b. Pipe

1. PVC Pipe

PVC Ring-Tite shall be minimum of 200 PSI SDR-21 pressure pipe meeting the requirements of ASTM Designation D 2241, D 1784, and D 869.

Provisions must be made for contraction and expansion at each joint with a rubber ring and integral bell as part of each joint. Pipe and fittings must be assembled with a nontoxic lubricant, manufactured by the pipe manufacturer.

2. Ductile Iron Pipe

Pipe shall be manufactured in accordance with the requirements of ANSI / AWWA C151 / A21.51 Ductile Iron Pipe, Centrifugally Cast, for Water and Other Liquids. Pipe shall be manufactured in accordance with the requirements of ANSI / AWWA C111 / A21.11 Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings. Pipe thickness shall be designed in accordance with the requirements of ANSI / AWWA C150 / A21.50 Thickness Design of Ductile Iron Pipe and shall be based on laying conditions and internal pressure as specified in the project plans. Ductile iron pipe shall have cement mortar lining in accordance with the requirements of ANSI / AWWA C104 / A21.4 Cement Mortar Lining for Ductile Iron Pipe.

2.1 Ductile iron pipe and fittings for wastewater shall also be lined with a ceramic-filled amine-cured epoxy, Protecto 401 by Induron Coatings, Inc. The lining thickness shall be a minimum of 40 mils. Application shall be performed by an applicator approved by the coating manufacturer, in accordance with manufacturer's instruction and under controlled conditions at the applicator's shop or the pipe manufacturer's plant. Applicator shall submit a certified affidavit of compliance with coating manufacturer's instruction and requirements specified herein.

3. HDPE Pipe

Polyethylene pipe shall be made from high density, extra high molecular weight compound equaling a PE 3408 or 4710 designation and shall conform to ASTM-D 1248 and ASTM-D 3350; with a cell classification of 34543C. Minimum SDR of 9.0 or the minimum equivalent of 200 psi.

4. Tracer Wire

All non-conductive pipe materials used for force sewer mains shall be provided with a minimum No. 6 AWG insulated copper or approved equal tracer wire laid along the top of the pipe and secured by means acceptable to the District. Tracer wire must be continuous as to not break conductivity. If wire must be cut and/or reconnected, splice wires with a minimum six (6) inch overlap and use 2 u-bolt cable connectors that will not degrade conductivity. Tracer wire must be brought up to within three (3) inches of ground surface and secured at all manholes or other access points for connection to an electronic pipe locator.

c. Bracing and Blocking

Thrust restraint shall be in accordance with the Thrust Restraint Requirements under Section III of the Water Main Specifications.

d. Pipe Testing

1. General

All force mains throughout the entire length of lines shall be tested for water tightness. Testing shall be by internal pressure tests.

The Contractor shall furnish, at his own expense, the necessary facilities for making the test including the furnishing and placing of bulkheads, furnishing and placing of water and other necessary materials, labor and equipment.

2. Internal Pressure Test for Force Mains

All force mains shall be tested per the testing requirements of Section II, 10, "Pressure and Leakage Testing".

7. MANHOLES

a. General

The Contractor shall furnish, construct and install all manholes, complete, including the excavation, precast reinforced concrete base, barrel sections, eccentric flat top section at the top of the structure, manhole steps, frame and cover, backfill and all accessories to complete the manholes as shown on the plans and as specified.

b. Materials

Brick – Shall be Grade H (hard) brick conforming to the Federal Specifications for Building Brick (common) Designations SS-B-656 and amendments thereto, new and of first quality, solid, sound, hard burned throughout of uniform color, and equal in quality to samples which shall have been approved by the District.

Precast Concrete Chimney – The precast concrete sections shall conform to ASTM C478, Standard Specifications for "Precast Reinforced Concrete Manhole Sections".

Manhole Steps – Manhole steps shall be aluminum and shall conform to ASTM B221, Alloy 6061-T6 or steel reinforced polypropylene.

Precast Concrete Grade Rings – Grade Rings shall be precast reinforced concrete with a minimum 4,000 psi after 28 days.

Frame and Cover

1. Manhole covers and frames shall be East Jordan or General Foundry. Covers shall be solid and clearly marked as either "Sewer" or "Drain" based on utility.
2. Set to final grade as shown on the plans and as specified. Provide adequate temporary covers to prevent accidental entry until final placement of frame and cover is made.
3. Set manhole frames and covers to final grade only after pavement base course has been applied, or after final grading of gravel roads.
4. There shall be no overhang of the bottom flange of the frame, bricks or grade rings beyond the vertical plane of the manhole structure. Frame shall be parged from 2" above the bottom flange of the frame to the top of structure. The parge shall be a minimum of 3/8" thick and shall create a smooth surface along the entire outside of the adjustment components to prevent infiltration and the possibility of frost grabbing hold of the structure.

Mortar – Mortar, except as otherwise specified, shall consist of one part Portland Cement Type II, and one part Mortar Cement, and four parts Mortar Sand. Sand shall be approved by the District.

c. Installation

a. Manhole Concrete Barrel Sections & Bases

Manholes of precast reinforced concrete sections and bases shall be furnished with steps 12 inches on center; with a minimum 5-inch wall thickness for all barrel sections.

All joints shall be sealed with a double strip of self-sealing butyl rubber based flexible joint sealant in rope form. Lifting holes in all sections shall be filled solid with an approved non-shrink grout, both inside and out. Exterior surface of all concrete manholes shall be painted with two coats of PPS 922 Superseal or an approved equal.

The top six feet of the exterior surface of the manhole structure shall be wrapped with a minimum of 4 layers of U.V. resistant, 6 mil high grade polyethylene and secured in place as to not move during backfill operations.

The top uppermost reinforced concrete section shall be set as close to finish grade as possible allowing adequate room for the frame and cover installation. All adjustments to set the frame and cover to grade shall be accomplished using precast concrete grade rings. The corners of the frame shall not extend out beyond the edge of the structure or grade ring. Any corners that do shall be trimmed accordingly by mechanical means.

The Contractor shall furnish and faithfully use suitable slings, hooks, cable, or such other means as necessary, for proper handling of reinforced barrel sections and bases. No cracked, damaged or defective sections will be allowed in the work. Each section must be inspected and approved by the District immediately prior to final placement. Any sections not approved for use in this work shall be removed from the site and satisfactorily disposed.

d. Tables and Inverts

Tables and inverts shall be as shown on plans and shall be constructed of brick, concrete or fiberglass. Inverts shall have the exact shape of the sewers which are connected, and any change in size or direction shall be gradual and even.

e. Protection of the Work

Adequate precautions shall be taken during freezing weather to protect the masonry from damage by frost. No water shall be allowed to rise in excavations for manholes until all mortar and cement has set sufficiently. Upon completion, all debris shall be removed from each manhole.

f. Watertight Work Required

The entire work of constructing manholes must be carried on in a manner to insure watertight work. Any leak in manholes shall be caulked and completely repaired from the exterior of the manhole or the entire work shall be removed and rebuilt. All pipe openings shall have an approved neoprene boot meeting ASTM C-443 to insure a watertight seal between the pipe and manhole.

g. Manhole Testing

All manholes shall be tested as to water tightness as follows:

VACUUM TESTING OF MANHOLES

1. Each manhole shall be tested immediately after assembly and prior to backfilling.
2. All lift holes shall be plugged with an approved non-shrink grout.
3. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole.
4. The test head shall be placed at the inside of the top section and the seal inflated in accordance with the manufacturers recommendations.
5. A vacuum of 10 inches of Hg (Mercury) shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall be considered to have passed the test if the time for the loss of 1 inch of Hg vacuum is as follows:

<u>Depth of Manhole (feet)</u>	<u>Time (min.)</u>
0 – 10	3.0
10 – 15	3.5
15 – 20	4.0
20 – 25	4.5
>25	5.0

6. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

8. CATCH BASINS

a. General

Work included: The work included under this section is the excavation for and backfilling of the widened trench at catch basin locations, together with the furnishing and installing of all materials for catch basins as shown on the plans. The District requires the precast top to be an eccentric flat top.

The work includes furnishing the precast reinforced concrete flat top section, the precast concrete barrel section(s), the precast catch basin base, and all accessories to complete the catch basins shown on the plans and as specified.

b. Materials

The precast reinforced concrete sections shall conform to ASTM C478. All pipe connections to either catch basins or drain manholes shall have an approved neoprene boot meeting ASTM C-443.

Mortar, except as otherwise specified, shall consist of one part Portland Cement Type II and one part mortar cement and four parts mortar sand. Mortar sand shall be approved by the District.

Cast Iron catch basin frames and grates shall be East Jordan or General Foundry. The District reserves the right to specify the type of frame & grate to be used based on area of drainage and slope of surface.

Brick shall be Grade H (hard) brick conforming to the Federal Specifications for Building Brick (common) Designations SS-B-656 and amendments thereto, new and of first quality, solid, sound, hard burned throughout of uniform color, and equal in quality to samples which shall have been approved by the District.

Precast Concrete Grade Rings – Grade Rings shall be precast reinforced concrete with a minimum 4,000 psi after 28 days.

All concrete shall meet the requirements of Section V, 12 – Concrete.

c. Installation

The precast base and barrel section(s) shall be installed together with precast eccentric flat top.

All joints shall be sealed with a minimum of two strips of self-sealing butyl rubber based flexible joint sealant in rope form. Lifting holes in all sections shall be filled solid with an approved non-shrink grout, both inside and out. .

The top six feet of the exterior surface of the catch basin structure shall be wrapped with a minimum of 4 layers of U.V. resistant, 6 mil high grade polyethylene and secured in place as to not move during backfill operations.

The top uppermost reinforced concrete section shall be set as close to finish grade as possible allowing adequate room for the frame and cover installation. All adjustments to set the frame and cover to grade shall be accomplished using precast concrete grade rings. The corners of the frame shall not extend out beyond the edge of the structure or grade ring. Any corners that do shall be trimmed accordingly by mechanical means. See 7, b, IV for parging requirements.

9. SERVICE CONNECTIONS

a. General

Service connection pipe shall be furnished and installed as required. Connections shall be complete including excavation and backfill, pipe, fittings, connections and other miscellaneous items of work. All fittings and service leads shall be installed at the same time the main sewer line is installed unless specified otherwise.

b. Materials

Pipe shall be 6 inches in diameter and the same material as the main sewer under new installations. All pipe and fittings shall be connected by standard couplings and gaskets furnished by the manufacturer. All elbows used for service connections shall be bends or sweeps with no angle greater than 22 ½ degrees unless otherwise allowed by the District.

c. Installation

All work in regards to joints, laying, etc. shall be as specified under Section V, 5 above. Pipe shall be installed at a slope of at least ¼ inch per foot unless otherwise approved by the District. The end of each service lead shall be properly capped to prevent any objectionable material from entering the pipe. The end of the pipe shall not be covered until its location has been inspected by the District. Contractor shall furnish and install a 4 inch x 4 inch wood post at the end of the connection, extending from the pipe to a point 2 feet above the finish surface of the ground. All sewer service lines shall be buried with a metallic "tracer" tape acceptable to the District to aid in locating. The tracer tape shall be labeled "sewer" and be located approximately 3 feet above the service line and shall extend from the connection of the service to the main, to the property line or the foundation wall, as far as the pipe is installed.

Record a minimum of two (2) lateral measurement "swing ties", as close to 90 degrees opposed as practical, prior to backfilling pipeline from permanent fixtures such as house corners, telephone poles, fire hydrants, catch basins, manholes etc. to all wyes, tees, bends, elbows, couplings, clean-outs etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. These swing ties must be legibly recorded in sketch form or recorded within the as-built drawings and submitted to the District prior to acceptance of the service.

10. RESURFACING

a. General

The work shall consist of furnishing and installing temporary surfacing, complete in place, where existing paved surfaces are removed or damaged during the process of any part of the construction.

Temporary surfacing shall closely follow the completion of laying sewers and shall not be delayed until the completion of the entire Contract.

b. Preparation

All trenches in paved areas shall be backfilled as required under Section V, 4., as shown on the plans, and in accordance with the requirements of the authority having jurisdiction. The edges of all pavements along the line of the trench shall be cut back from exposed edges thereof, a sufficient distance to form a clean, sharp, straight edge essentially parallel to the centerline of the trench. The minimum lateral cut back to be allowed will be 6-inches. Cut back pavement shall be carefully removed to minimize any disturbance to foundation materials. The exposed surface of the foundation material shall then be rolled with a power tandem roller, weighing not less than 240 pounds per inch width of tread/drum, wetting the surface as necessary to obtain a firm, even surface.

Any depressions or uneven areas shall be re-graded and re-rolled until the surface is tight and parallel to the existing surface.

c. Temporary Surfacing

Temporary surfacing shall consist of 1 ½ inch hot bituminous base mix (MDOT 19.0mm) placed over trenches and other areas where directed or as shown on the plans or indicated within project specifications. When hot mix is not available 3 inches of cold patch shall be used. Road Gravel at top of trench shall be removed to allow for placing temporary surfacing.

Contractor shall maintain temporary surfacing in good condition until the final surface is placed. Trenches shall be inspected daily for holes and settlements. Holes and settlements shall be promptly repaired with bituminous mixture. Hot mix shall be used when available; otherwise, cold mix.

d. Final Surfacing

Final surfacing shall be as specified by the authority having jurisdiction.

11 PUMP STATION SPECIFICATIONS

a. General

1. Extent of Work

The work specified and/or referred to under this Section includes all materials, labor, tools and equipment necessary to: furnish and install one submersible pump station with all equipment as indicated on the plans and specified herein. The Contractor shall fully coordinate all related field operations with the Pump Station Manufacturer. Coordination shall include: verifying dimensions of equipment furnished; interfacing with and connection of all exterior piping and utilities in the field; connecting external power to the pump station; and all other miscellaneous components as required for a complete, properly operating pumping facility. The pump station manufacturer shall provide factory trained qualified personnel to assemble the pump station in the field as the Contractor is placing it in the excavation.

2. Manufacturer's Qualifications

One (1) Manufacturer shall furnish the pumping station and all equipment contained within them as a complete packaged system. Alternate systems based on a built-in-place, field erected pumping stations utilizing precast or cast-in-place concrete shall not be accepted. The factory built pumping station shall be a standard product in regular production by the Manufacturer who shall have five years minimum, successful experience in the design and assembly of products similar to that specified herein. The Manufacturer shall have also

satisfactorily furnished a minimum of ten units of the type described herein within the last five years. The Manufacturer shall be reputable and thoroughly qualified in the manufacture, assembly and installation of the products and equipment specified herein.

3. Shop Drawings

Shop drawings for all products and equipment specified and/or referred to herein shall be submitted to the Owner's Engineer and the District for review prior to their manufacture and/or shipment. Submittals shall contain complete detailed shop drawings and literature on all equipment, including descriptions, diagrams, parts and listing of construction material as required indicating full conformance with the specifications. Partial submittals of shop drawings or equipment data will not be reviewed. Shop drawings and equipment data shall be complete with respect to dimensions, materials of construction, design/performance criteria, wiring diagrams, component parts, etc., to enable the Owner's Engineer and the District to conduct a complete review of all equipment specified. Submittals shall be comprehensive and must fully address and contain:

- Structural design calculations and floatation calculations.
- Schematic electrical wiring diagrams, piping layouts, and descriptive literature on each item of equipment to be furnished as specified for a complete installation.
- Certified performance or test data as may be prescribed for the select equipment components specified in the following sections.
- A comprehensive painting/finish schedule shall also be submitted, summarizing paints, damp proofing and waterproofing materials and/or special coatings to be utilized.
- Each submittal set shall be fully indexed and shall be bound in a three-ring vinyl binder, electronic submittals in PDF format are also acceptable.
- At the time of submission the Contractor shall, in writing, call the Owner's Engineer and the District's attention to any deviations from the requirements of these specifications that are contained in the submittal documents. Deviations or omissions in the submittal drawings and related data shall not relieve the Contractor from his responsibility for providing the specified requirements unless the Engineer and the District have given written approval for the deviations or missions identified.

4. Guarantee

All products and / or equipment incorporated into the precast pump station and valve pit shall be guaranteed for a period of one (1) year from startup or 18 months after installation, whichever occurs first.

b. Products

1. Precast Concrete Structure

Precast concrete structure shall be constructed to the general lengths, widths and heights shown on the plans. Special attention shall be given to equipment clearances and/or control dimensions noted on the plans and/or elsewhere herein. The structure shall be designed to adequately and safely support all live and dead loads to which the structure will be subjected, and to withstand all conditions which may be encountered. Design calculations shall verify that the structure has been designed to withstand the burial depth, groundwater hydrostatic pressures, and seismic forces based on the information provided, and also the dead and live loads anticipated for the structure. The structure shall have adequate wall, floor, and roof thickness and steel reinforcement for the depth and conditions of burial shown of the plans. Design computations for uplift forces shall contain a minimum factor of safety of 1.15. Station to be cast with a monolithic extended base slab. Lock joint or Press-Seal Gasket Corp shall form all wall penetrations utilizing resilient rubber pipe connectors. Each precast module shall be provided with formed male and female joints in insure accurate joint surfaces and tolerance for a watertight seal. The pump station structures shall be fabricated and cast at the Manufacturer's facility in full accordance with approved structural designs and shop drawings. The Pump Station Manufacturer shall have a facility of sufficient size to permit assembly of all structural components and interior mechanical equipment, with an environmentally controlled building. All work associated with fabricating, assembling and testing the pumping station shall be performed within the building except as otherwise noted herein, or allowed by the Owner. The building shall keep the structures protected from the elements and be maintained at an ambient temperature of at least 45 degrees Fahrenheit. Concrete used in the manufacture of the various structural components of the precast concrete structures shall meet the following requirements:

- Cement shall be High Early Strength Portland Cement, Type II or Type III, conforming to ASTM C-150.
- Fine aggregate shall consist of natural sand conforming to ASTM C-33.
- Coarse aggregate shall consist of well-graded crushed stone conforming to ASTM C-33.
- Air entrainment shall be 4.5% plus or minus 1%.
- A super plasticizer may be used and if so, used per manufacturers recommendations.
- No concrete shall be placed when the ambient temperature in the building is less than 50 degrees Fahrenheit.
- The concrete used for the structural components shall attain a minimum 28-day compressive strength of 5,000 psi.
- The pump station manufacturer to have on staff a PCI Certified Technician.
- As a minimum, six 4 by 8 inch concrete test cylinders shall be made for each production day from the same concrete batch used in the actual components. Two cylinders shall be tested at time of product stripping, two at seven days cured in environment similar to the actual component, and two at 28 days cured in 100% humidity. Results shall be furnished to the Engineer. Test cylinders shall be cured in the same manner as the actual components are cured.

Reinforcing steel used in the manufacture of the various structural components of the precast concrete components shall meet the following requirements:

- Steel shall be a new billet steel, deformed steel bar conforming to ASTM A-615 (latest revision) Grade 60. Welded steel wire fabric reinforcing shall conform to ASTM A-185 (latest revision)
- Minimum cover of reinforcement shall be one inch.

2. Pump Station Pumps

Furnish and install 2 submersible non-clog wastewater pumps. Each pump shall be equipped with a submersible electric motor, connected for operation on 460 volts, 3 phase, 60 hertz, 4 wire, grounded neutral service, with the required length of submersible cable (SUBCAB) suitable for submersible pump applications as shown on the contract electrical drawings. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be supplied with a mating ductile iron discharge connection. Each pump shall be fitted with adequate length of stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

B. PUMP DESIGN

The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well to remove a pump. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact. **Sealing of the discharge interface with a**

diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

C. PUMP CONSTRUCTION

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

D. COOLING SYSTEM

Each unit shall be provided with an integral motor cooling system. A motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104 degrees Fahrenheit. Operational restrictions at temperatures below 104 degrees Fahrenheit are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

E. MOTOR

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180 degrees Celsius (350 degrees Fahrenheit). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104 degrees Fahrenheit. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The same manufacturer shall produce

the motor and the pump. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15 (1.0 service factor when operated on VFD equipment and inverter duty rated). The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40 degrees Celsius ambient temperature and shall have a NEMA Class B maximum operating temperature rise of 80 degrees Celsius. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

F. BEARINGS

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a single ball type bearing to handle radial loads. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L_{10} bearing life shall be 50,000 hours at any usable portion of the pump curve.

G. MECHANICAL SEALS

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant **tungsten-carbide** ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant **tungsten-carbide** seal ring. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

H. PUMP SHAFT

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be AISI type 431 stainless steel. Shaft sleeves will not be acceptable.

I. IMPELLER

The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyl resin primer.

J. VOLUTE/SUCTION COVER

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may

enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have integral spiral-shaped, sharp-edged grooves that are cast into the suction cover. The spiral grooves shall provide the sharp edges across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

K. PROTECTION

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

The thermal switches and float switch shall be connected to a Mini CAS control and status-monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel.

L. MIX-FLUSH VALVE

At least one pump in each sump shall be equipped with an automatically operating valve that will provide a mixing action within the sump at the start-up of the pumping cycle.

This valve shall be mounted directly on the pump volute and shall direct a portion of the pump age into the sump to flush and re-suspend solids and grease by the turbulent action of its-discharge. The turbulent action caused by the flow shall also provide some sump aeration benefits. The valve shall be mounted on the pump volute so that it can be removed from the sump along with the pump during normal and routine maintenance checks and shall be positioned on the volute to provide for non-clogging operation. The valve shall be equipped with an adjustable, wear-resistant discharge nozzle, which shall be used to direct flow from the valve to optimize mixing action within the sump.

The valve shall not require any external power source or control to operate, neither electric nor pneumatic. The use of the external power source is not acceptable. The valve shall be suitable for use in Class I, Division 1 hazardous locations.

The valve shall open at the beginning of each pumping cycle and shall automatically close during pump operation after a pre-selected time of operation. The valve shall operate automatically by differential pressure across the valve and shall be actuated through a self-contained hydraulic system, which uses an environmentally safe fluid. A method of adjusting the valve operating time shall be provided.

M. ACCESS HATCH

1. Access Hatch

A FDRND 300 PSF Rated Channel Style Hatch, as manufactured for ITT Flygt Corp., Trumbull, Connecticut. (or equal) as noted on the plans shall be supplied for access to the top of the pump station.

Material shall be 6061-T6 aluminum for bars, angles and extrusions. Diamond plate (1/4 inch thick) shall be 5086 aluminum.

Design of access hatch shall conform to O.S.H.A. standard 1910.23.

Unit shall be designed for 300 PSF. Channel frame and bearing must be cast into and supported by concrete. Hatch shall be designed using a maximum design stress of 17,300 psi as per the Aluminum Association, Inc. "Specifications for Aluminum Structures", with a safety factor of 2.2 applied to a minimum allowable tensile strength. Engineering calculations shall be supplied upon request.

Hatch door shall be supplied with a heavy duty, stainless steel pneu-spring, for ease of operation when opening cover. Cover shall be counterbalanced; so one person can easily open the hatch cover. Spring design shall accommodate ease of maintenance.

Hatch door shall be equipped with a grade 316 stainless steel hold open arm. Door shall loc open in the 90-degree position. Each hold open arm shall have red vinyl grip handle. Hold open arm shall be fastened to the frame with ½ inch grade 316 stainless steel bolts.

Channel frame shall be of extruded aluminum, with a continuous 1-1/4 inch anchor flange. Frame shall be a minimum of ¼ inch thick, with a minimum cross section of 7.5 inches.

Each "FDRN-HD" style hatch shall be supplied with a 1-1/2 inch threaded drain coupler on the underside of the channel frame for pipe connection.

Hinges shall be heavy-duty design. Material shall be a brass alloy with a 65,000-psi tensile strength. Each hinge shall have a 3/8 inch grade 316 stainless steel pins. Hinges shall be bolted to the angle frame and diamond plate, with 316 stainless steel bolts and ny-lock nuts.

Each hatch shall be supplied with a grade 316 stainless steel slam lock, with keyway protected by threaded aluminum plug. Plug shall be flush with top of the ¼ inch diamond plate. Slam lock shall be fastened with four grade 316 stainless steel bolts and washers.

Each hatch shall be equipped with an aluminum lift handle. The lift handle shall be flush with the top of the ¼ inch diamond plate.

2. Hatch Safety Grate

The hatch shall be provided with a hinged aluminum "Safe Hatch" designed to combine covering of the hole per OSHA Standard 1910.23 and shall include fall through protection and controlled confined space entry.

Safety grates shall be as manufactured for ITT/Flygt Corp, shall be made of 6061-T6 aluminum with a minimum ultimate strength of 38,000 psi and minimum yield strength of 35,000 psi, as per ASTM B221. Grate design shall use safety factors as defined in the Specifications for Aluminum Structures, by the Aluminum Association Inc., 5th edition, December 1986 for Bridge Type Structures.

Aluminum grating shall be designed to withstand a minimum live load of 300 pounds per square foot. Deflection shall not exceed 1/150th of the span.

Aluminum grate opening shall be 5-inch by 5-inch, which will allow for visual inspection of the pit and level adjustment, once the access hatch is open.

Each grate shall be provided with a permanent hinging system, which will lock the grate in the 90-degree position once opened.

Design of the system must assure fall through protection is in place after the door has been closed, thereby protecting the next operator.

Each grate shall have an opening arm, with a red vinyl grip handle, which will allow opening of the grate, while providing the grate as a barrier between the operator and opening of the grate, while providing the grate as a barrier between the operator and the pit. The opening arm shall also be equipped with a controlled confined space entry-locking device (lock provided by Owner). This locking device will prevent unauthorized entry to the confined space. The grating system will allow anyone to make visual inspection and level adjustments without entering the confined space.

Grate shall be painted with OSHA type safety orange paint.

Welding shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum.

2.03 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. The Manufacturer shall furnish three (3) Operations and Maintenance (O&M) Instruction Manuals
- B. O&M Manuals shall be prepared with clear instructions which will enable the Owner's personnel to operate and maintain the overall pump station and all equipment associated with each individual system installed within the station.
- C. The manuals shall be prepared specifically for this installation. General literature from the equipment manufacturer, which is not specifically applicable to the operation and maintenance of the installed items, shall not be acceptable.
- D. The manuals shall be bound in a three-ring vinyl binder with a heavy gauge clear vinyl overlay on the front cover and spine, which is insertable from the top. A title sheet tabulating project information including name and location of project; manufacturer's and consulting engineers' name and address; shall be placed in these pockets. Manuals shall contain an index, which lists and locates all enclosed literature and drawings.
- E. The manuals shall be comprehensive and as a minimum contain:
 - 1. Descriptions and operating instructions for all system components within the station.
 - 2. Instructions relevant to all modes of equipment operation.
 - 3. Service and troubleshooting instructions as available from select manufacturers of equipment supplied.
 - 4. Procedures for the adjustment of equipment at initial start-up, during routine preventative maintenance, and following replacement or repair.
 - 5. Instructions for testing and calibration of electronic components as may be required to determine proper performance.
 - 6. As-Built Mechanical Drawings and dimensional information showing the actual layout and location of all major equipment components within the structure.

7. As-Built Electrical Schematic Drawings of all wiring as supplied with the station. Motor controls, alarm system circuitry, electrical appliances, interconnections, etc. as well as all electrical components within the station to be fully identified and described.
8. Finish Schedule, listing all paints and / or special coatings utilized on the various components.

STANDARD CONTROL PANEL SPECIFICATION

SCOPE:

A control system shall be supplied by the pump manufacturer containing all of the mechanical and electrical equipment necessary to provide for the operation of the submersible pump or pumps as depicted on the plans.

ENCLOSURE:

The control panel enclosure shall be NEMA 4X 304 stainless steel. The enclosure door shall be gasketed with a rubber composition material around the perimeter and shall be installed with a retainer to assure a positive weatherproof seal. The door shall open a minimum of 180 degrees. A padlock hasp shall be provided.

A polished inner door shall be mounted on a continuous aircraft aluminum hinge and shall contain cutouts for the protrusion of the circuit breakers and provide protection of personnel from internal live voltages. All pump controllers, control switches, pilot indicators, elapsed time meters and other operational devices shall be mounted on the inner door. The inner door shall open a minimum of 150 degrees to allow for access to the equipment for maintenance. A ¾ inch break shall be formed around the perimeter of the inner door to provide rigidity.

A back plate shall be manufactured from 12-gauge sheet steel and shall be finished with a primer coat and two (2) coats of baked on white enamel. All hardware shall be mounted using stainless steel machine thread screws. Sheet metal or self-tapping screws shall not be acceptable. All installed devices will be permanently identified with engraved legends.

POWER DISTRIBUTION:

The panel power distribution shall include all necessary components and be wired with stranded copper conductors rated at 90 degrees Celsius. Conductor terminations shall be as recommended by the device manufacturer.

The power system shall contain incoming power terminals, motor circuit breakers control circuit breaker and convenience outlet breaker. All circuit breakers shall be heavy-duty thermal magnetic or motor circuit protector similar and equal to Square D type FAL. Each breaker shall be sized to adequately meet the operating conditions of the load and have a minimum interrupting capacity of 10,000 amps at 230 volts and 18,000 amps at 460 volts. Breakers shall be indicating type, providing "on/off/tripped" positions on the handle. They shall be quick-make quick-break on manual and automatic operation and have inverse time characteristics. Breakers shall be designed so that tripping of one pole automatically trips all poles.

Motor starters shall be open frame, across the line NEMA rated with individual overload protection on each phase. Motor starter contacts and coil shall be replaceable from the front of the starter without removal of the starter from its mounted position. Overload heaters shall be block type, utilizing melting alloy spindles, sized for the full load amperage of the motor. Adjustable overloads, definite purpose contactors, fractional size starters and horsepower rated contactors or starters shall not be acceptable.

A lightning transit protector shall be provided. The device shall be a solid-state device with a response time of less than 5 nanoseconds with a withstanding surge capacity of 6500 amperes. Units shall be instant recovery, long life and have no holdover currents.

The following shall be supplied as standard equipment:

- a. 12-pin plug in phase/voltage monitor with two (2) sets of double pole double throw contacts.
- b. NEMA 4 rated Hand Off Auto switches.
- c. Pump Run/Failure pilot lights as required.
- d. Elapsed Time meters for each pump.
- e. 50-watt condensation heater and thermostat.
- f. Control Power transformer minimum of 2kVA.
- g. GFCI Duplex convenience outlet on inner door.
- h. Laminated wiring schematic adhered to the inside surface of the outer door.

PUMP PROTECTIVE DEVICES:

Each pump shall be protected by a solid-state relay to monitor motor winding temperature and seal leakage. The relays shall have an 11 pin octal base and shall be flanged for mounting on the inner door. The relay shall be powered by 24VAC, 28VDC or 120VAC supply. LED indicators shall be provided on the relay for power on, overtemp and seal fail conditions. An overtemp-reset pushbutton shall be mounted on the relay. The sensor input circuitry shall contain both hardware and software filters to provide noise immunity, as well as sensor input short circuit protection. The relay shall be MiniCas 120, model 14-407129 by ITT Flygt.

PUMP CONTROLLER:

GENERAL:

The pump controller shall consist of all the components, hardware and software to provide a trouble-free pumping station. The system shall be designed and specifically produced for the surveillance of the pump station. The system shall provide for interface to other RTU's and SCADA systems for remote control and data collection. The RTU shall control the pumps as a stand-alone unit in the event of a communications loss. The controller shall be an FMC as manufactured by ITT Flygt or pre-approved equal.

OPERATION:

Pump controller shall provide continuous monitoring of the wet well level via submersible pressure transducer. The pump controller shall start and stop pump based upon wet well level and operator programmed set points. The controller shall have provision for a float switch backup in event of transducer failure. The pump controller shall alternate pump cycles to ensure equal run times. The pump controller shall monitor pump protection features to provide alarms in event of impending pump failure. It shall also monitor pump performance data to provide operations personnel the ability to evaluate station performance.

HARDWARE:

The pump controller shall be programmed via built-in operator interface. The interface shall consist of pushbuttons in combination with a 2-line LCD backlit display in English. The front panel shall also include LED indicators for controller operation, communication status, alarm status, pump operation status, and individual critical alarms.

The front panel operator interface shall be rated IP65 (applicable to NEMA 4 standard).

The pump controller shall contain a 486CPU, 32 bit 66 MHz processor, with a primary memory of 8 Megabytes D-RAM and a flash memory of 4 Megabytes. The memory shall be protected by a 3.6 VDC NiMH battery and have a watchdog function.

The pump controller shall provide 16 digital inputs, 8 digital outputs (6 relay normally open, 2 solid state normally open), and 4 analog inputs. The inputs/outputs shall meet the following:

- a. All inputs/outputs shall be optically isolated.
- b. Digital inputs shall be 11-30vdc, selectable logic.
- c. Digital outputs shall have a max load of 2A at 250VAC/DC (relay) or have an output capacity of 100mA at 250VAC/DC (solid state).
- d. Analog inputs shall be 4-20mADC with 12bit resolution and an accuracy of 0.1%

In addition to the input/output features listed, the controller shall be expandable up to a total of 600 physical I/O points.

The pump controller shall operate from a supply voltage of 24VDC (-15% to +20%), and have a current consumption of 1A (no load). The controller shall be protected internally with a fuse rated at 2A.

The pump controller shall include 3 communications ports. One port shall be RS-232 and dedicated to service functions (local programming of controller with laptop). The other two ports shall be RS-232/485 capable, and available for use as communication interface to dialup modem, leased line modem, GSM modem, or radio. A PCMCIA slot shall also be provided for installation of internal modem. The District reserves the right to modify the controller based on current technology and needs.

The pump controller shall be UL listed.

The submersible transducer shall be a two wire device operating on 10-30VDC supply with a 4-20mADC level signal. The transducer shall have a temperature range of -20 to 80 degrees Celsius and have an inaccuracy of plus or minus 0.1% of total range. The transducer shall be cable suspended and not dependent upon position. The sensor shall be ceramic, with a 316 stainless steel sensor housing, Vitron o-ring and polyurethane vented cable. The transducer shall be LS 100, manufactured by ITT Flygt or pre-approved equal.

FUNCTIONS:

The pump controller shall operate the pumps in accordance with operator-programmed set points. The controller shall also be capable of remote start-stop functions via network. The following information shall be observed on the front panel display:

- a. Cross-section areas of the wet well
- b. Start-stop pump levels
- c. Alarm levels for low, high and overflow
- d. Nominal capacities of the pumps
- e. Current flow and accumulated flow
- f. Pumped volume for two days
- g. Number of starts for each pump
- h. Run time for each pump
- i. Amp draws for each pump

The pump controller shall provide for local display, acknowledgement and remote notification of alarm conditions. The controller shall log up to 1000 alarm events. Alarm capabilities shall include:

- a. Wet Well High Level

- b. Wet Well Low Level
- c. Wet Well Overflow
- d. Pump Over current
- e. Pump Undercurrent
- f. Pump Fail to Start
- g. Pump Over temperature
- h. Pump Seal Fail
- i. Pump Service Alarm (when pump run time exceeds preset service interval)
- j. Intrusion Alarm
- k. Personnel Alarm (adjustable time-delay alarm if not acknowledged by on-site personnel)
- l. Communications Failure
- m. Test Alarm (periodic test alarm for communications)

The pump controller shall be capable, via network, of blocking up to five upstream stations should local conditions prevent pumping operations.

The pump controller shall provide flow calculations based on the geometry of the wet well. Five cross-sectional areas shall be used for inflow calculation, which shall be updated every pumping cycle. Pump capacity shall be calculated from wet well discharge time and inflow. Pumped volume (total) shall be calculated from current pump capacity.

The controller shall calculate station overflow. A level sensor shall be installed at the overflow point, and the controller shall register overflow time, number of overflows and accumulated volume.

The controller shall provide a sump cleaning function. At preset intervals the pumps shall be allowed lower the wet well level to the bottom of the volute in order to remove built up solid debris in the sump. The controller shall also allow periodic timed pump cycles in low inflow stations to prevent the wet well from becoming septic.

The pump controller shall be capable of receiving an input from a rain gauge or tipping bucket. The controller shall log this data for piping analysis by operations personnel.

The pump controller shall calculate energy consumption from preset voltage level and motor current readings.

The pump controller shall contain a real-time clock and shall time and date stamp all logged data. The controller shall store logged data for a period of up to 30 days.

COMMUNICATIONS:

The pump controller shall be able to communicate via leased phone line, dialed phone line, GSM, radio or LAN.

The pump controller shall be capable of communicating via AquaCom, MODBUS or Comli protocols. The controller shall also be capable of sending SMS messages.

HMI SOFTWARE:

The pump controller shall communicate to HMI software that is Windows based with intuitive menu-type navigation. The software shall include templates to facilitate future system expansion by operations personnel. The software shall also be customizable to portray the system in realistic detail. The software shall provide the ability to observe station operating conditions, remote control of pumps and other station equipment, observe and change set points, monitor

and acknowledge alarms, log system historical data and generate reports and trend charts. The HMI software shall be AquaView by ITT Flygt or pre-approved equal.

Historical data trend charts shall be based on 1-30 minute time periods and shall include the following:

- a. Wet well levels
- b. Motor Currents
- c. Calculated capacity of wet well
- d. Inflow
- e. Pumped Volume
- f. Overflow

In addition to the available historical data, the following daily reports shall be provided:

- a. Pump run times
- b. Number of pump starts
- c. Average value of pump capacity
- d. Pumped volume
- e. Number of overflow events
- f. Overflow duration
- g. Overflow volume
- h. Station blocked events (time and date stamped)
- i. Energy consumption

LOCAL ALARM:

A top mounted flashing red alarm light shall be provided. The alarm light shall be weatherproof and shatterproof with a minimum 4-inch diameter and 40 watt lamp.

An alarm horn shall be provided with an alarm silence button. The alarm horn shall be mounted on the left side of the enclosure with a weatherproof back box. The horn shall provide a signal of not less than 90db at 10 feet.

The alarm light and horn shall be used to signal those alarms indicated on the drawings.

MISCELLANEOUS:

A final as-built drawing encapsulated in Mylar shall be attached to the inside surface of the outer door. A list of all legends shall be included.

The control panel shall be UL508A listed.

12. CONCRETE

Concrete for inverts, thrust blocks, concrete encasement, concrete fill, etc. shall be minimum 3,000 psi @ 28 days.

13. RIPRAP

Description: This work shall consist of constructing a riprap as shown on the plans and in reasonably close conformity to the lines and grades as detailed or directed by the Engineer.

Material: Riprap shall consist of stones weighing from 10 pounds to 200 pounds except that when available, suitable stones weighing more than 200 pounds may be

used. Approximately 50 percent of the stones by volume shall exceed a unit weight of 50 pounds.

Construction Requirements: Riprap shall be placed upon a slope properly graded and compacted as called for. Plain riprap shall be placed full depth in one operation without special handwork, shall be approximately true to the required slope line and grade and shall be uniform in appearance.

14. DUST CONROL

Dust control shall be exercised throughout the entire project by using brooms, water, calcium or any combination thereof to control all dust generated during the process of construction.

15. PIPE CLEANING

At the conclusion of the work, the Contractor shall thoroughly clean the sewers by flushing with water and flushing ball or other means to remove dirt, stones and other material. Prior to acceptance, all pipe lines shall be inspected for cleanliness and to be sure no sandbags, broken pipe or other obstruction exist.

The work area, property adjacent to the project and all grounds occupied by the Contractor in connection with the work shall be cleaned of all rubbish, excess material, temporary structures and equipment and the ground graded and restored to match the surrounding terrain.

16. LOAM, FERTILIZER AND SEED

a. General

The loaming, fertilizing and seeding shall consist of furnishing, placing, grading, seeding and fertilizing in all disturbed areas, except where pavement or gravel is installed, and where indicated on the plans or as directed by the Engineer.

b. Loam

Loam shall be rototilled topsoil free of stones, large clods, roots of trees or shrubs or other foreign matter. Muck, peat or other excessively acid soils will not be used.

c. Grass Seed

Grass seed shall be fresh, clean, new crop seed. Seed shall be delivered to the work site with each container bearing the dealer's guaranteed analysis. Grass seed shall have minimum percentages of germination and of purity as listed below:

Proportion

<u>Kind of Grass</u>	<u>by Weight</u>	<u>Purity</u>	<u>Germination</u>
Annual Ryegrass	10-25%	97%	90%
Kentucky 31 Fescue	15-25%	97%	85%
Perennial Ryegrass	5-25%	97%	90%
Chewings Fescue	10-20%	95%	90%
Creeping Red Fescue	0-10%	95%	85%
Kentucky Bluegrass	8-30%	5%	80%

NOTE: Weeds and inert materials shall not exceed 2%.

d. Construction

The loam is to be spread and raked to a depth of at least three inches. Fertilizer shall be spread and graded at a minimum rate of 30 pounds per 1,000 square feet. Lime shall be spread at a minimum rate of 20 pounds per 1,000 square feet. After spreading the seed at a rate of three (3) pounds per 1,000 square feet, the area shall be lightly raked and rolled.

The Contractor shall be responsible for the protection and maintenance of the seeded area until a satisfactory uniform stand of grass has been established. Where seed fails to germinate, resulting in bare spots, the Contractor shall reseed, at his own expense, until satisfactory to the Engineer.

17. MAINTENANCE OF TRAFFIC

a. General

Work included: Work under this section shall consist of maintaining traffic on the roads, streets or highways on which the work is being carried out. The work shall be carried out in accordance with the following paragraph.

The Contractor will be responsible for conducting the work in accordance with the requirements of the permits and any penalties due to the failure of the Contractor to comply with the permit.

b. Detours and Road Accessibility

The Contractor shall contact the responsible heads of the Fire, Police, and other appropriate governing bodies of the municipality in order to obtain necessary permits and determine the requirements of said departments with respect to traffic control, alternate vehicular access routes, and the like. Wherever detours are permitted the size, construction and location of signs shall conform with local and state requirements and/or standards. Detour routes shall be adequately posted to assist the motorist to return to his route of travel. Where the roadway under construction is the only means of vehicular access to a particular area, the Contractor shall provide continual access to the area for residents and emergency vehicles.

c. Working Procedures

The Contractor shall be responsible for continuous traffic control as directed by the State, City and the District. The methods of traffic control shall conform to State regulations and requirements and to the "Manual on Uniform Traffic Control Devices for Street and Highways". In general, the Contractor shall maintain continuous two-way traffic during working and non-working hours. In the event that two-way traffic cannot be maintained (i.e. highway crossings, etc.) the Contractor shall provide traffic officers to maintain traffic flow. Flagmen shall be provided at all times that work is being conducted within the limits of the highway.

A responsible representative of the Contractor shall be available during all periods of time that the Contractor is not actually working on the project. These periods of time shall include nights, weekends, holidays and other times the work may be suspended.

The representative shall have the authority and the means to repair and maintain the roadway, signs and lighting during the above periods of time, and the telephone number where he can be reached shall be given to the Local Police Department and the District.

The Contractor shall be responsible for barricades and warning signs with flashing lights, as may be required, to be furnished and installed subject to the approval of the District. Work areas signs shall be provided at local work sites. The size, legend and position of the various construction signs are shown in Plates C-MDOT-11, 12 and 13 and shall be in conformance with the Manual of Uniform Traffic Control Devices. All construction signs shall have a black legend with an orange background. The "Sewer Construction Ahead" sign and "End Construction" sign are to be placed 1500 feet from each end of the project and the "Sewer Construction Ahead" sign shall also be placed at each major intersection. All current work areas shall be provided with reflectorized signs overnight to facilitate traffic and maintain safety. A "Blasting Area" within three hundred feet of any traveled way shall be marked by approved signs with information similar to the following: "BLASTING AREA, TURN OFF RADIO TRANSMITTERS" and the reverse side "END OF BLASTING AREA".

d. No interference with Traffic

The Contractor shall conduct his work so as not to interfere with traffic, both vehicular and pedestrian. Traffic originating or having business along the section of the road under construction shall be provided with a passable and adequate road. To accomplish this may necessitate the bridging over or the construction of structures in sections or the providing of short detours around them. The work shall be progressed in such a manner that the access to private or business driveways adjacent to the improvements will be interfered with as little as possible.

Where feasible, bridging over the trenches or completed work of other acceptable methods shall be used for this purpose. The Contractor shall furnish adequate protection to the public by installing and maintaining adequate warning signs, flags, lights, paths, railings, barricades, watchmen and signalmen where necessary or called for by the District.

At least one-way traffic shall be maintained at all times. All traffic controls shall be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, as issued by the Federal Highway Administration.

All equipment and material will be stored off the traveled-way and if on the shoulders, properly delineated at night.

All work in the traveled-way and shoulder shall be completed by sunset of each working day. At the close of each weeks work or before any holiday all open trenches will be completely backfilled and equipment and materials removed from the traveled-way and shoulders for the coming weekend or holiday.

No detours of any sort shall be used during the period of construction without prior permission from the proper authorities.

Failure to meet the requirements of this item will result in immediate suspension of work of the project until the requirements can be met.

18, STREET OPENINGS

The District will need to obtain and pay all Highway / Street Opening Permits and Legal Location Permits for any State, City or Town in the District's service area prior to starting actual construction in any roadway. Depending on the project ownership, any associated fees may be billed to the Developer or Contractor.

Section VI: Standard Installation Details

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RESIDENTIAL SERVICE ENTRANCE DETAIL

5/8", 3/4" & 1" METERS

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

NOTES:

1. The Greater Augusta Utility District, (G.A.U.), recommends the use of 1 inch copper to the hot water tank and 3/4" copper hot and cold feed lines to the bathrooms and kitchen where the static pressure is less than 40 psig.

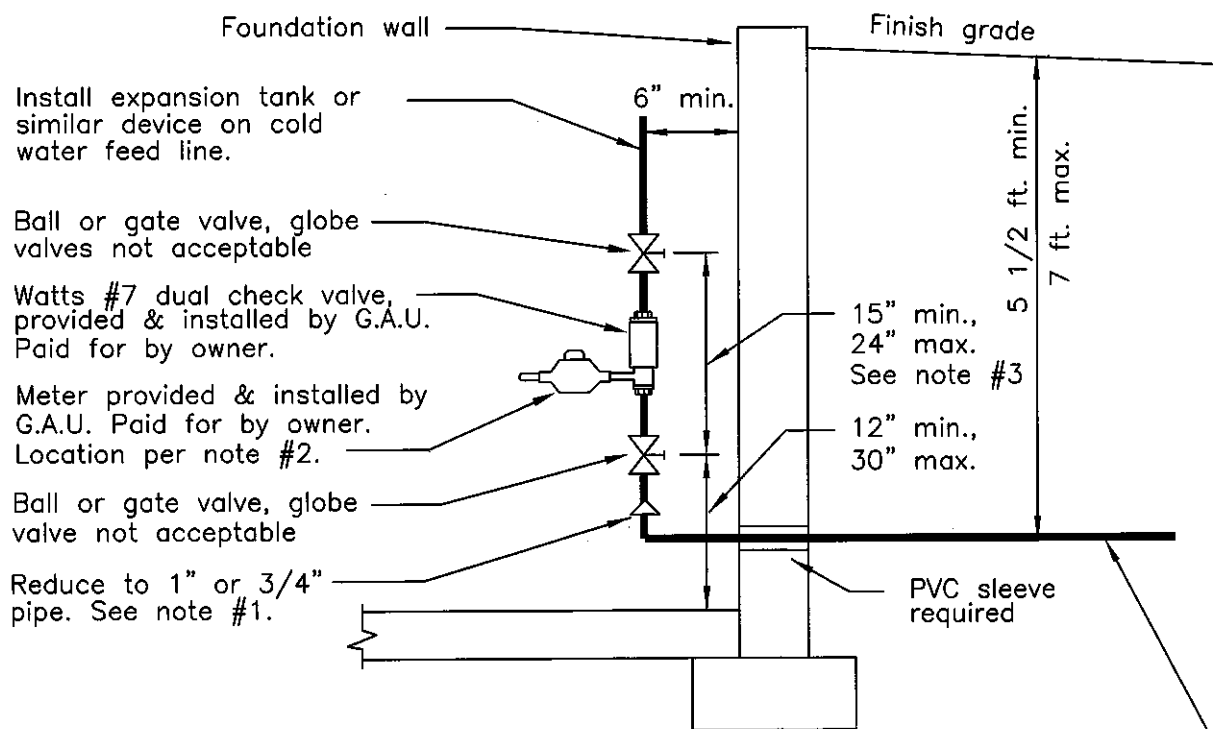
Where the static pressure is between 55 and 40 psig, the above pipe sizes could all be changed to a minimum of 3/4 inch.

Where the static pressure is 55 psig or greater, the line feeding the hot water tank should be a minimum of 3/4 inches while all feed lines after (downstream) of the hot water tank may be reduced to a minimum of 1/2 inches where runs to fixtures are not excessive.

2. The owner must provide a clean, dry, accessible and warm (continually above 45 degrees F) location for the meter installation.

G.A.U. must install a 22 gauge wire from meter to radio read unit on exterior wall. This should be accomplished during construction, before interior insulation/drywall is installed.

3. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.



Service line from street, size & materials to be approved by G.A.U. Only TYPE "K" copper tubing or 200 psig rated CTS polyethylene tubing are acceptable for service lines. Sand to be used for backfill. Attach 8 AWG coated wire to CTS PE from corporation to curb stop and curb stop to house. Bring ends of wire up to top of S. Box and tie to top for access.

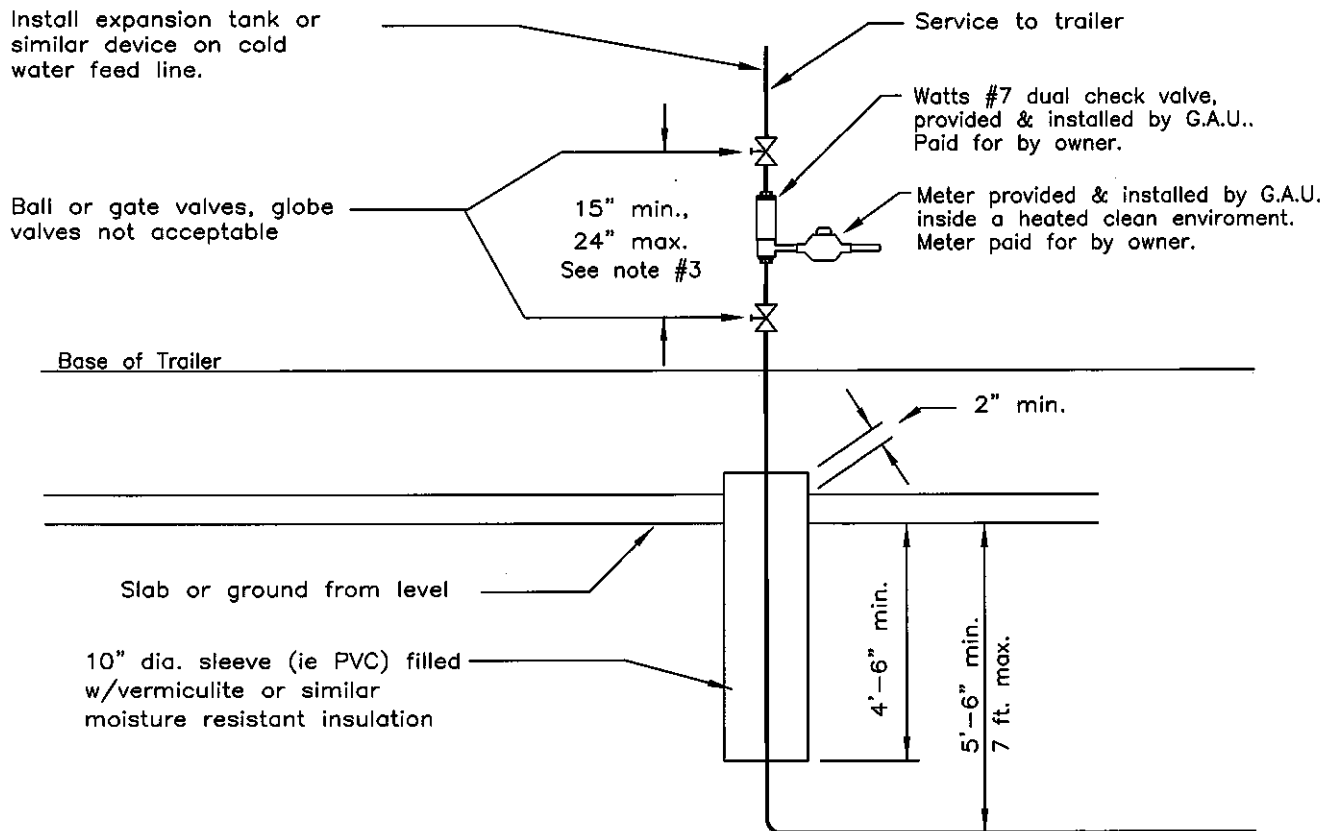
TRAILER OR SLAB SERVICE ENTRANCE DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

NOTES:

1. Heat trace and insulate service from approximately 2'-6" below slab to the top of the sleeve which abuts the base of the trailer.
2. Meter must be located inside the heated living space of the mobile home and must be in a warm, clean, dry & accessible location. Meter cannot be located under any structure that does not have full basement access.
3. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.

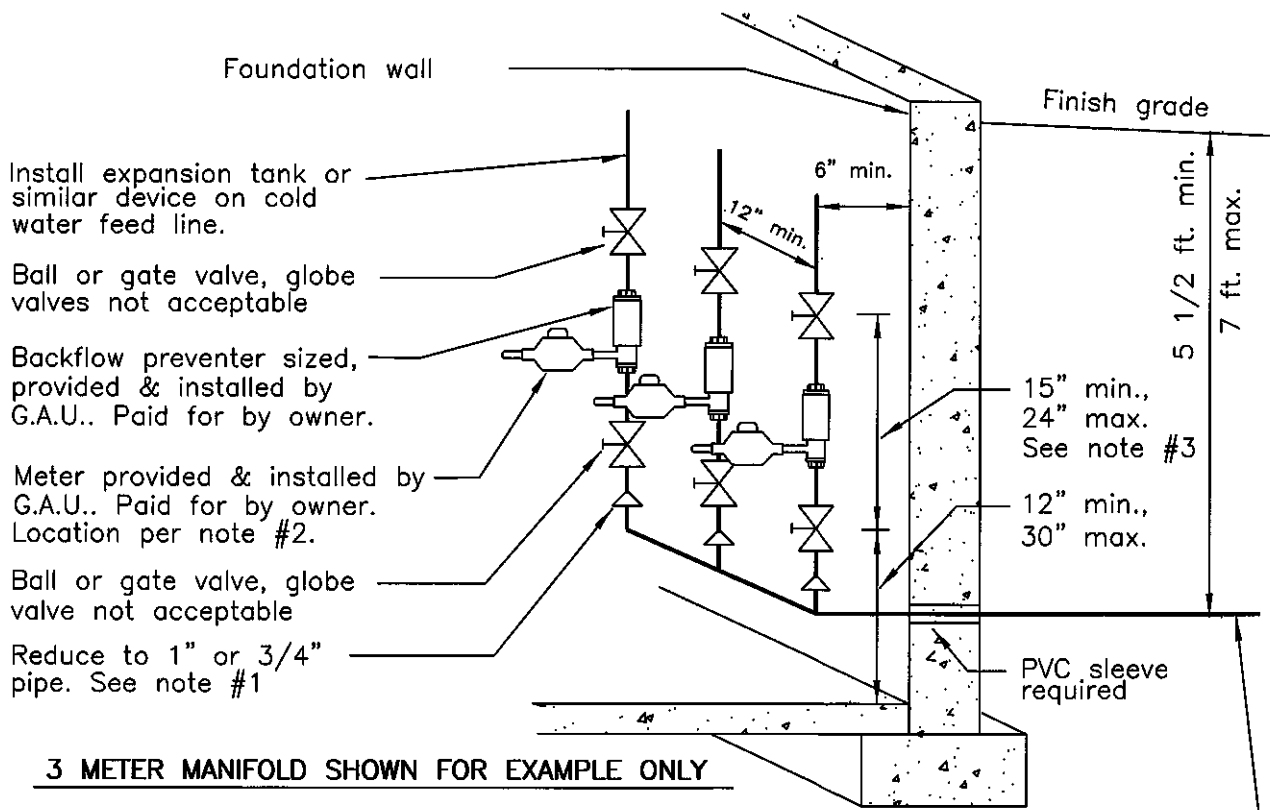


Service line from street, size & materials to be approved by G.A.U. Only TYPE "K" copper tubing or 200 psig rated CTS polyethylene tubing are acceptable for service lines. Sand to be used for backfill. Attach 8 AWG coated wire to CTS PE from corporation to curb stop and curb stop to house. Bring ends of wire up to top of S. Box and tie to top for access.

**RESIDENTIAL SERVICE ENTRANCE DETAIL
MULTI-METER ARRANGEMENT
5/8", 3/4" & 1" METERS
GREATER AUGUSTA UTILITY DISTRICT
REVISED FEB. 2017 NTS**

NOTES:

- The Greater Augusta Utility District, (G.A.U.), recommends the use of 1 inch copper to the hot water tank and 3/4" copper hot and cold feed lines to the bathrooms and kitchen where the static pressure is less than 40 psig.
Where the static pressure is between 55 and 40 psig, the above pipe sizes could all be changed to a minimum of 3/4 inch.
Where the static pressure is 55 psig or greater, the line feeding the hot water tank should be a minimum of 3/4 inches while all feed lines after (downstream) of the hot water tank may be reduced to a minimum of 1/2 inches where runs to fixtures are not excessive.
- The owner must provide a clean, dry, accessible and warm (continually above 45 degrees F) location for the meter installation.
G.A.U. must install a 22 gauge wire from meter to radio read unit on exterior wall. This should be accomplished during construction, before interior insulation/drywall is installed.
- Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.
- This detail for multi-unit residential with 4 units or less. For multi-unit residential with more than 4 units, backflow preventer shall be provided and installed by owner downstream of second valve.



Service line from street, size & materials to be approved by G.A.U. Only TYPE "K" copper tubing or 200 psig rated CTS polyethylene tubing are acceptable for service lines. Sand to be used for backfill. Attach 8 AWG coated wire to CTS PE from corporation to curb stop and curb stop to house. Bring ends of wire up to top of S. Box and tie to top for access.

COMMERCIAL SERVICE ENTRANCE DETAIL

5/8", 3/4" & 1" METERS

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

NOTES:

1. The Greater Augusta Utility District, (G.A.U.), recommends the use of 1 inch copper to the hot water tank and 3/4" copper hot and cold feed lines to the bathrooms and kitchen where the static pressure is less than 40 psig.

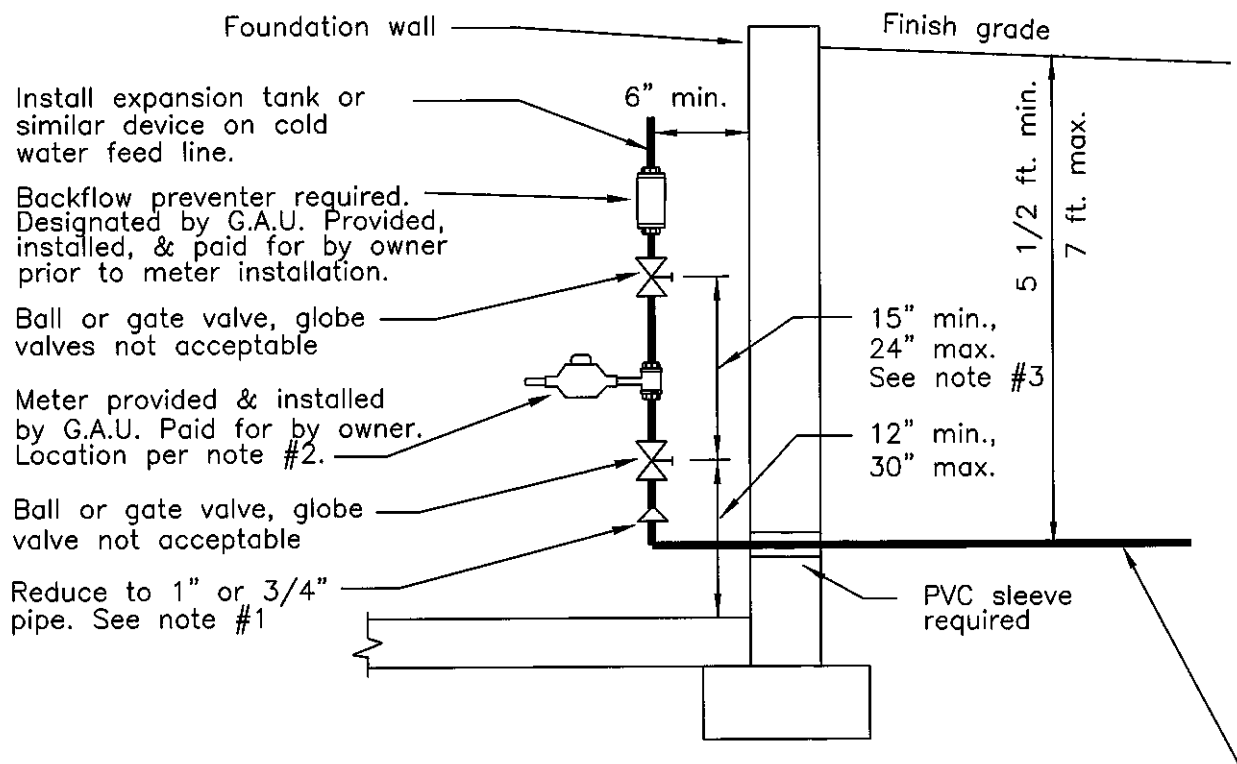
Where the static pressure is between 55 and 40 psig, the above pipe sizes could all be changed to a minimum of 3/4 inch.

Where the static pressure is 55 psig or greater, the line feeding the hot water tank should be a minimum of 3/4 inches while all feed lines after (downstream) of the hot water tank may be reduced to a minimum of 1/2 inches where runs to fixtures are not excessive.

2. The owner must provide a clean, dry, accessible and warm (continually above 45 degrees F) location for the meter installation.

G.A.U. must install a 22 gauge wire from meter to radio read unit on exterior wall. This should be accomplished during construction, before interior insulation/drywall is installed.

3. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.



Service line from street, size & materials to be approved by G.A.U. Only TYPE "K" copper tubing or 200 psig rated CTS polyethylene tubing are acceptable for service lines. Sand to be used for backfill. Attach 8 AWG coated wire to CTS PE from corporation to curb stop and curb stop to house. Bring ends of wire up to top of S. Box and tie to top for access.

COMMERCIAL SERVICE ENTRANCE DETAIL

SLAB ON GRADE

5/8", 3/4" & 1" METERS

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

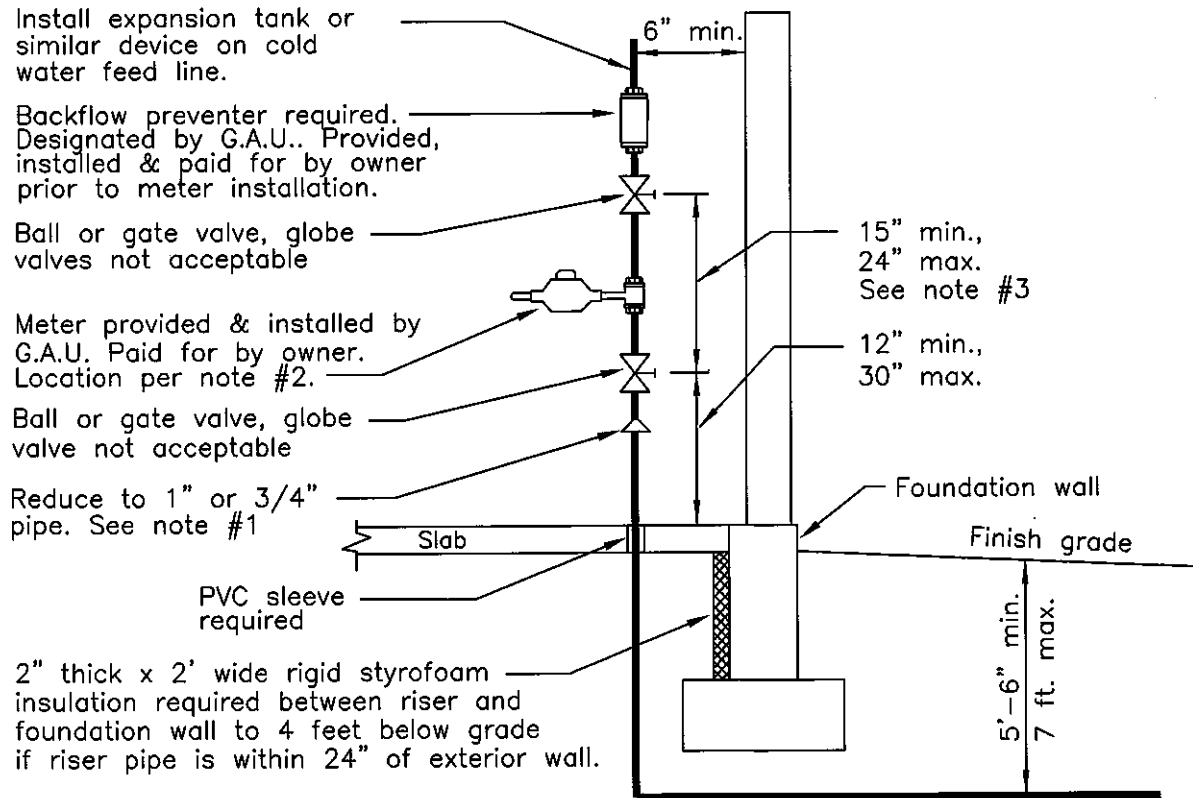
NOTES:

1. The Greater Augusta Utility District, (G.A.U.), recommends the use of 1 inch copper to the hot water tank and 3/4" copper hot and cold feed lines to the bathrooms and kitchen where the static pressure is less than 40 psig.

Where the static pressure is between 55 and 40 psig, the above pipe sizes could all be changed to a minimum of 3/4 inch.

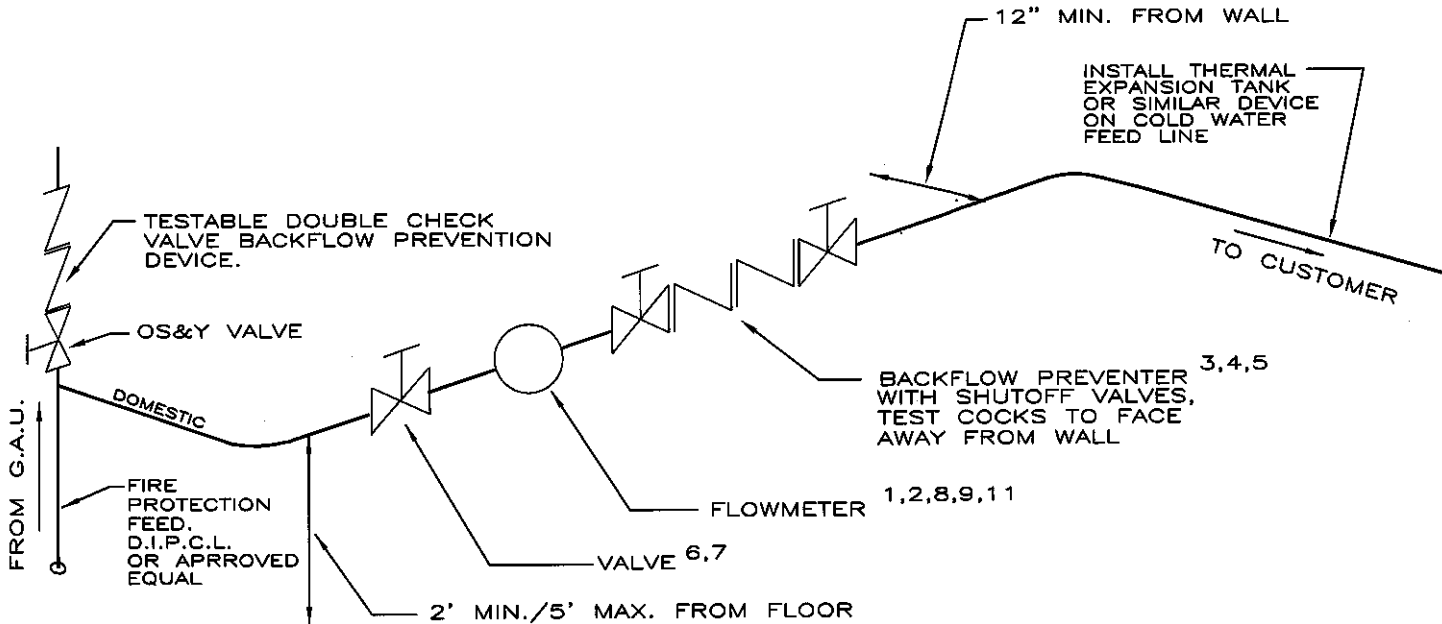
Where the static pressure is 55 psig or greater, the line feeding the hot water tank should be a minimum of 3/4 inches while all feed lines after (downstream) of the hot water tank may be reduced to a minimum of 1/2 inches where runs to fixtures are not excessive.

2. The owner must provide a clean, dry, accessible and warm (continually above 45 degrees F) location for the meter installation.
G.A.U. must install a 22 gauge wire from meter to radio read unit on exterior wall. This should be accomplished during construction, before interior insulation/finished wall is installed.
3. Provide a solid piece of copper between ball or gate valves of the same size as service line entering building or size service line has been reduced to.



Service line from street, size & materials to be approved by G.A.U. Only TYPE "K" copper tubing or 200 psig rated CTS polyethylene tubing are acceptable for service lines. Sand to be used for backfill. Attach 8 AWG coated wire to CTS PE from corporation to curb stop and curb stop to house. Bring ends of wire up to top of S. Box and tie to top for access.

COMMERCIAL FIRE SERVICE ENTRANCE WITH DOMESTIC FEED
GREATER AUGUSTA UTILITY DISTRICT
 REVISED FEB. 2017 NTS



NOTES:

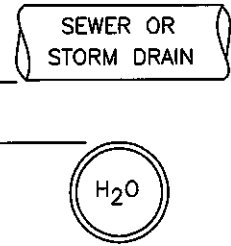
1. FLOWMETER TO BE SIZED, SELECTED, AND PLACED BY G.A.U. METER FLANGES, GASKETS, AND BOLTS, IF REQUIRED, PROVIDED BY G.A.U. & PAID FOR BY OWNER. METER TO BE LOCATED IN A WARM, DRY, ACCESSIBLE LOCATION.
2. FOR 1 1/2" & LARGER METERS: A MINIMUM OF TWO AND ONE-HALF (2 1/2) PIPE DIAMETERS STRAIGHT RUN SHALL BE PROVIDED BEFORE & AFTER THE METER. ALL OTHER DEVICES MUST BE FOUR (4) PIPE DIAMETERS DOWNSTREAM OF METER.
3. BACKFLOW PREVENTER SHALL BE OF THE SIZE AND TYPE RECOMMENDED BY G.A.U. AND SHALL BE IN ACCORDANCE WITH STATE OF MAINE CROSS CONNECTION REGULATIONS. SEE SECTION V, ITEM E, PARAGRAPH 8 OF THE DISTRICT'S CROSS CONNECTION PROGRAM RELATIVE TO THE PROVISION OF A BYPASS TO THE BACKFLOW PREVENTER.
4. BACKFLOW PREVENTERS TO BE INSTALLED IN THE VERTICAL POSITION MUST BE PRE-APPROVED BY THE DISTRICT.
5. RPZ'S MUST BE TESTED SEMI-ANNUALLY, REQUIRING THAT THE WATER BE SHUT OFF FOR UP TO 20 MINUTES. IF LOSS OF WATER FOR THIS TIME FRAME IS UNACCEPTABLE, A SECOND PARALLEL RPZ SHOULD BE INSTALLED TO ALLOW FOR UNINTERRUPTED WATER SERVICE.
6. ALL VALVES SHALL BE GATE OR BALL VALVES. GLOBE VALVES ARE NOT ACCEPTABLE.
7. NO VALVES WILL BE ALLOWED BETWEEN FLOOR AND METER OTHER THAN THE ONE SHOWN.
8. THE DISTRICT REQUIRES ALL NEW AND/OR RENOVATED MULTI-TENANT BUILDINGS BE INDIVIDUALLY METERED. THE INSTALLATION OF THE INDIVIDUAL METERS SHALL BE INSTALLED IN A COMMON LOCATION, WITH KEYED ACCESS FROM THE EXTERIOR OF THE BUILDING. THE UTILITY WILL PERMIT A SINGLE MASTER METER AT THE OWNER'S WRITTEN REQUEST, PROVIDED THE OWNER AGREES TO PAY FOR ALL WATER CHARGES AND CONSUMPTION:
9. G.A.U. MUST INSTALL A 22 GAUGE WIRE FROM THE METER TO A RADIO READ UNIT ON AN EXTERIOR WALL. THIS SHOULD BE ACCOMPLISHED DURING CONSTRUCTION, BEFORE INTERIOR INSULATION/FINISHED WALL IS INSTALLED.
10. G.A.U. WILL ADVISE TO THE LOCATION OF SUCH APPURTENANCES AS PRESSURE REDUCING VALVES, BOOSTER PUMPS, ETC. WHEN THEIR USE IS APPLICABLE.
11. COST OF METER, APPURTENANCES AND INSTALLATION SHALL BE BORNE BY THE OWNER / DEVELOPER.

TYPICAL TRENCH DETAIL

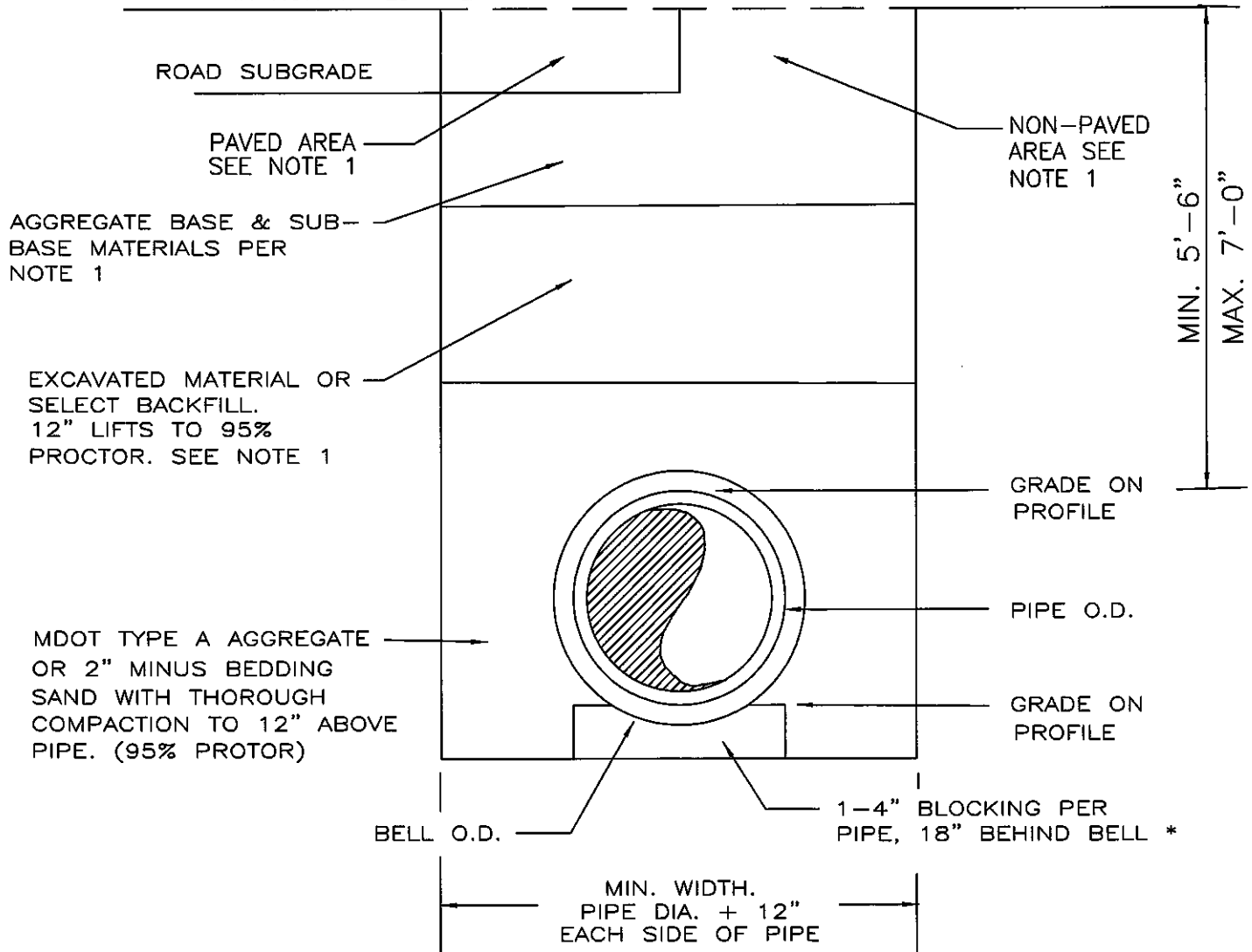
GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

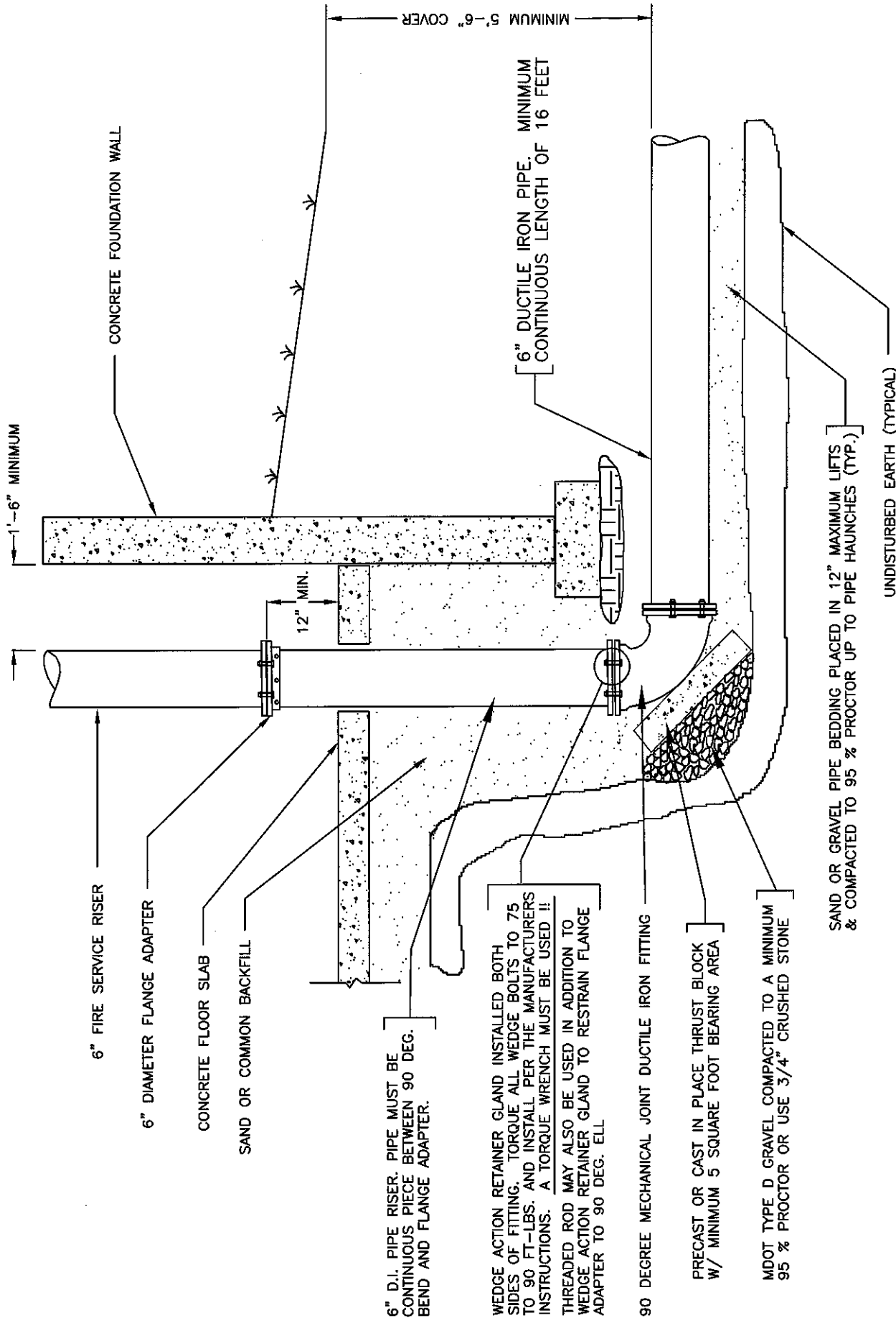
IF LESS THAN 2.0' EITHER ABOVE OR BELOW THEN INSULATE WITH 2" BLUEDOW RIGID STYROFOAM.



NOTE 1: MATERIAL TYPE AND PLACEMENT REQUIREMENTS TO BE IN ACCORDANCE WITH AUTHORITY HAVING JURISDICTION IN PAVED AREAS. GRAVEL, LOAM & OR SEED IN ACCORDANCE WITH AUTHORITY HAVING JURISDICTION IN NON-PAVED AREAS.



* 6" BLOCKING REQUIRED IN LEDGE OR BOULDER EXCAVATION AREA.



6" FIRE SERVICE RISER

6" DIAMETER FLANGE ADAPTER

CONCRETE FLOOR SLAB

SAND OR COMMON BACKFILL

6" D.I. PIPE RISER. PIPE MUST BE CONTINUOUS PIECE BETWEEN 90 DEG. BEND AND FLANGE ADAPTER.

WEDGE ACTION RETAINER GLAND INSTALLED BOTH SIDES OF FITTING. TORQUE ALL WEDGE BOLTS TO 75 TO 90 FT.-LBS. AND INSTALL PER THE MANUFACTURERS INSTRUCTIONS. A TORQUE WRENCH MUST BE USED !!
 THREADED ROD MAY ALSO BE USED IN ADDITION TO WEDGE ACTION RETAINER GLAND TO RESTRAIN FLANGE ADAPTER TO 90 DEG. ELL

90 DEGREE MECHANICAL JOINT DUCTILE IRON FITTING

PRECAST OR CAST IN PLACE THRUST BLOCK W/ MINIMUM 5 SQUARE FOOT BEARING AREA

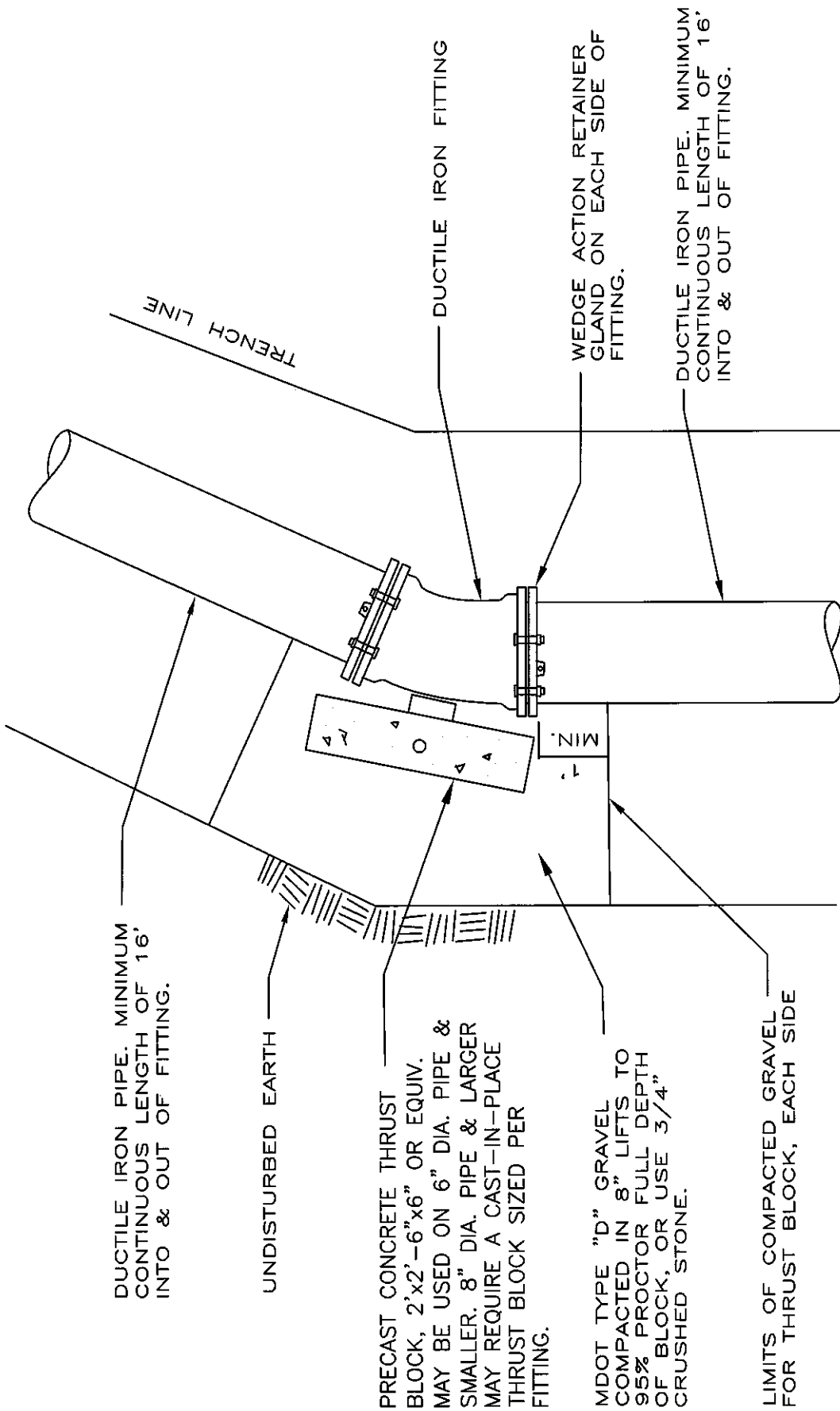
MDOT TYPE D GRAVEL COMPACTED TO A MINIMUM 95 % PROCTOR OR USE 3/4" CRUSHED STONE

SAND OR GRAVEL PIPE BEDDING PLACED IN 12" MAXIMUM LIFTS & COMPACTED TO 95 % PROCTOR UP TO PIPE HAUNCHES (TYP.)

UNDISTURBED EARTH (TYPICAL)

6" FIRE SERVICE THRUST RESTRAINT DETAIL

GREATER AUGUSTA UTILITY DISTRICT
 REVISED FEB. 2017 NTS



NOTE:
 ALL CAST-IN-PLACE CONCRETE THRUST BLOCKS MUST BE SIZED PER THE THRUST RESTRAINT REQUIREMENTS OF SECTION III OF THE DISTRICT'S SPECIFICATION PACKAGE. CAST-IN-PLACE CONCRETE THRUST BLOCKS MUST BE FORMED UP WITH A SUITABLE MATERIAL SUCH AS PLYWOOD, PARTICLE BOARD ETC. AS TO NOT ALLOW CONCRETE TO ENCOMPASS THE FITTING.

FITTING & THRUST BLOCK DETAIL

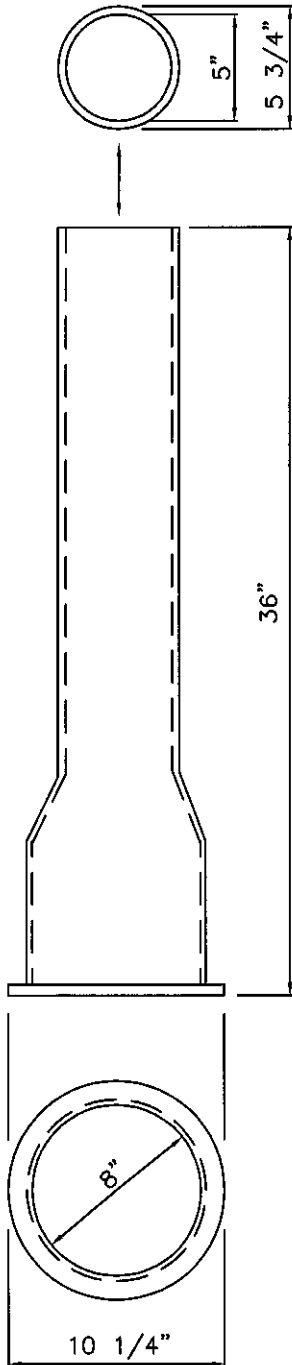
GREATER AUGUSTA UTILITY DISTRICT

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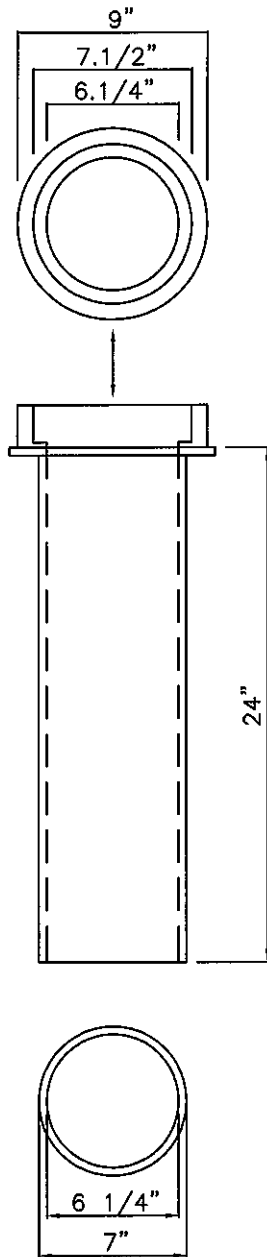
TYPICAL VALVE BOX DETAIL

GREATER AUGUSTA UTILITY DISTRICT

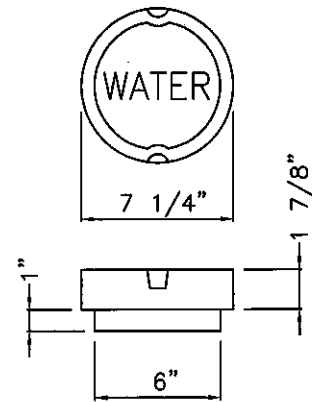
REVISED FEB. 2017 NTS



BASE SECTION *



TOP SECTION *



HEAVY DUTY DROP STYLE
COVER W/ SOLID RIM

NOTE: COVER MUST BE
MARKED "WATER"

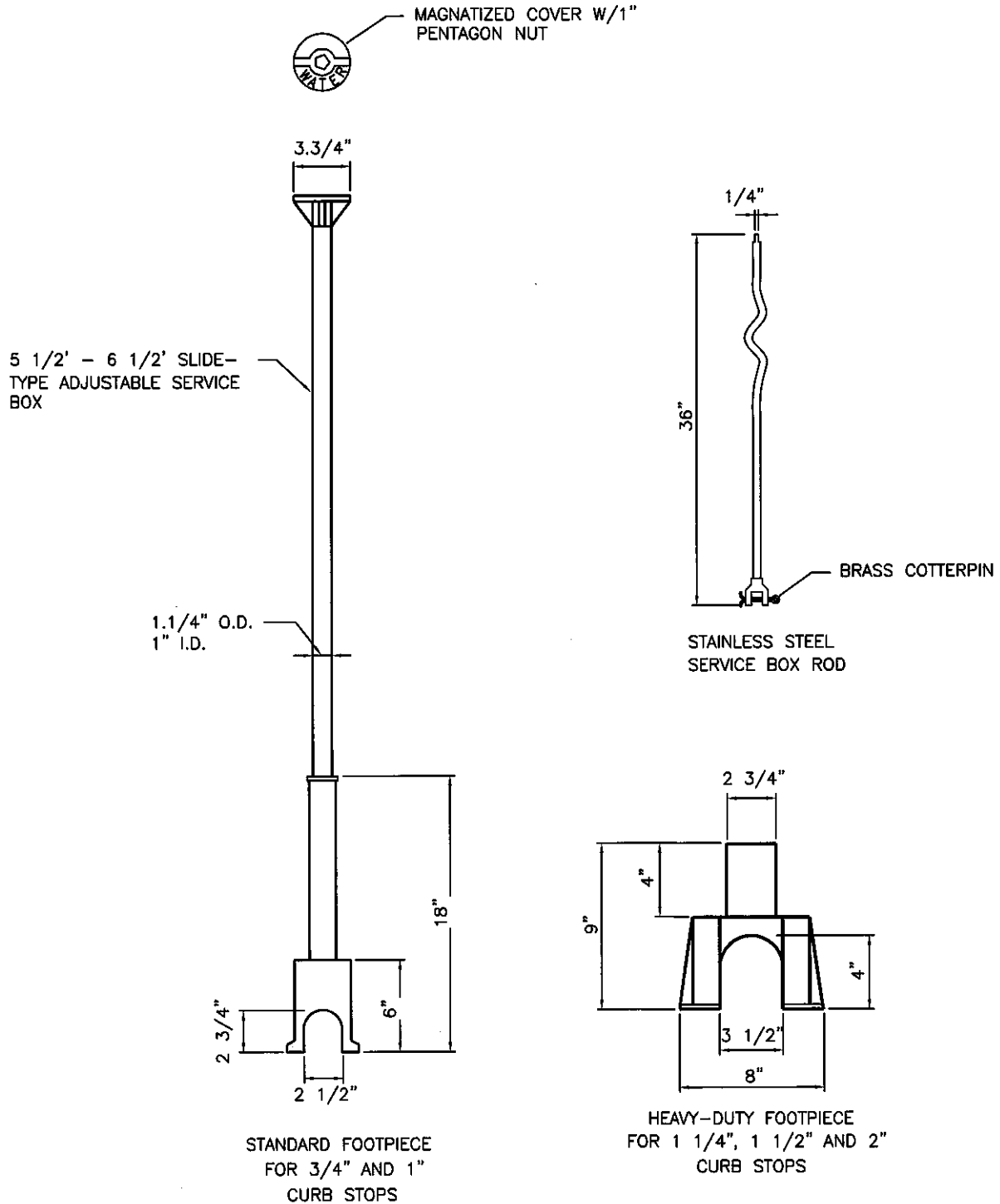
* PARTS FOR STANDARD 5'-0" VALVE BOX COMPLETE, LONGER PARTS
AVAILABLE IF NECESSARY

GAUD REQUIRES A MINIMUM OVERLAP BETWEEN BASE AND TOP SECTION OF 9".

TYPICAL SERVICE BOX DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

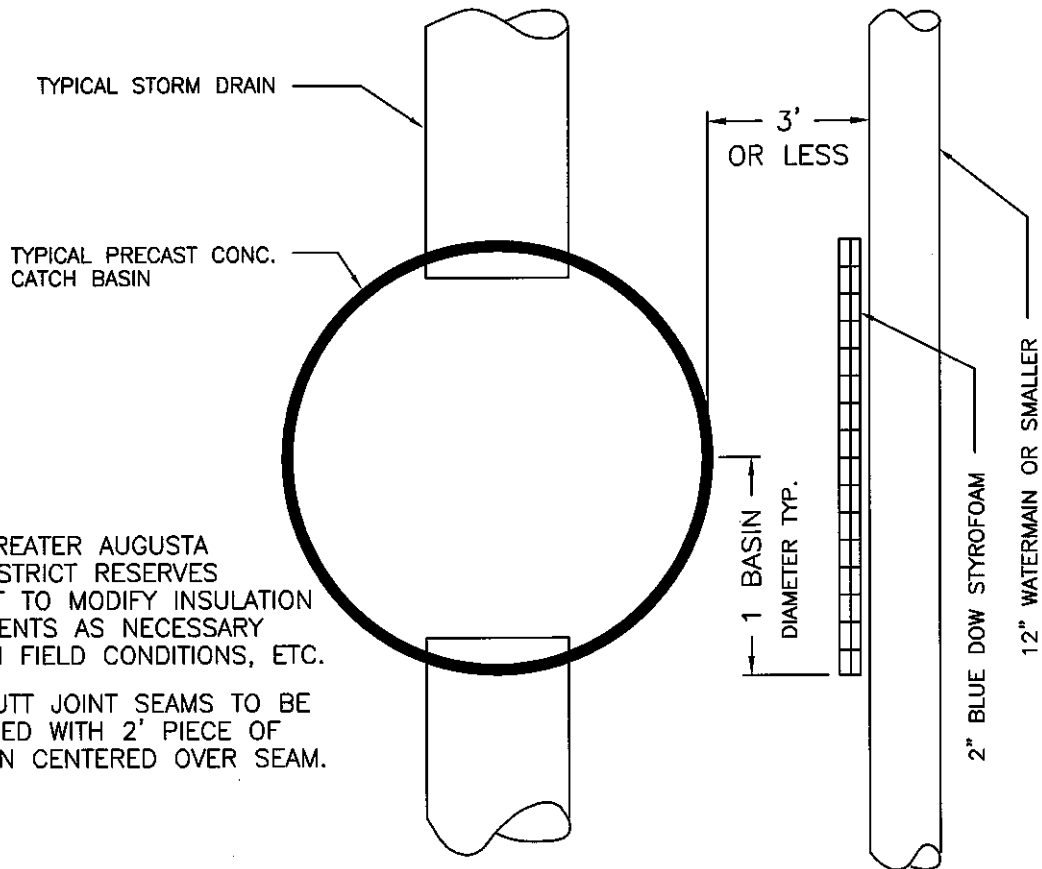


CATCH BASIN INSULATION DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017

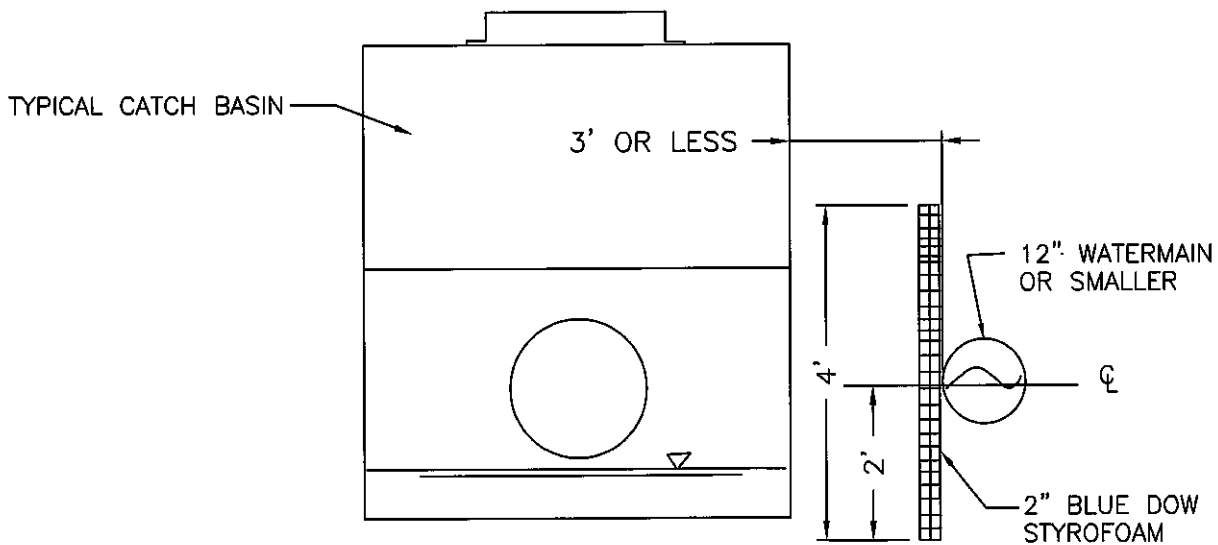
NTS



NOTES

1. THE GREATER AUGUSTA UTILITY DISTRICT RESERVES THE RIGHT TO MODIFY INSULATION REQUIREMENTS AS NECESSARY BASED ON FIELD CONDITIONS, ETC.
2. ALL BUTT JOINT SEAMS TO BE OVERLAPPED WITH 2' PIECE OF INSULATION CENTERED OVER SEAM.

PLAN VIEW

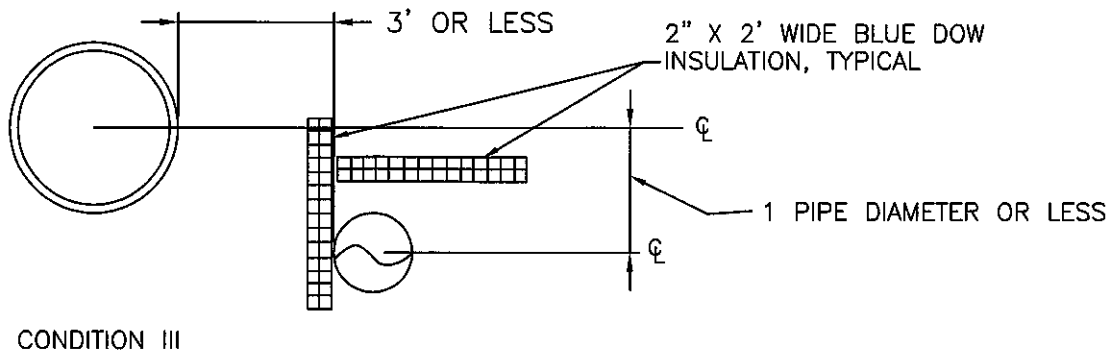
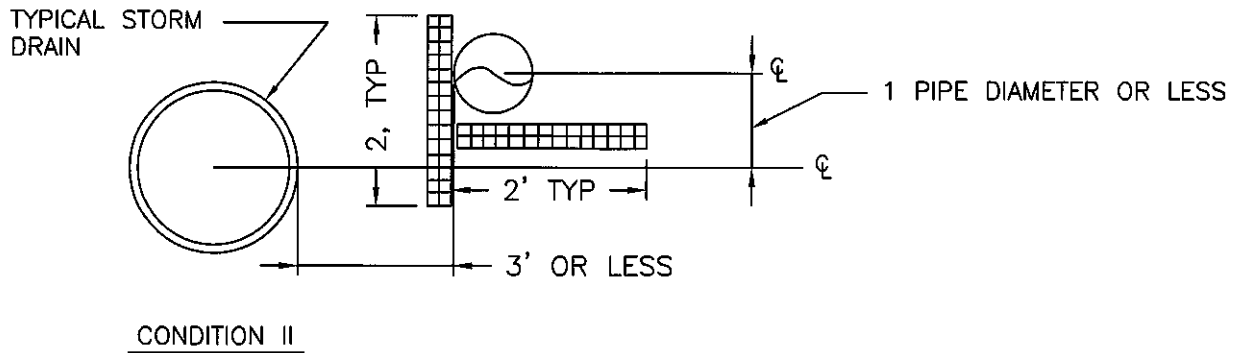
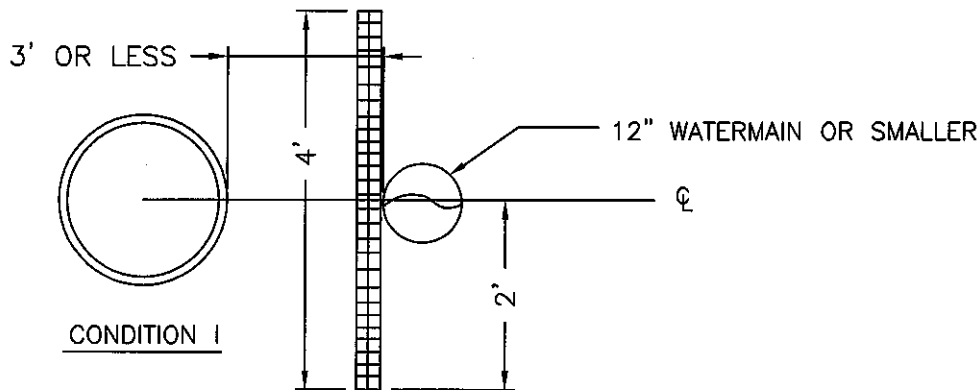


ELEVATION VIEW

STORM DRAIN/WATER MAIN PARALLEL RUNS ELEVATION VIEW

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS



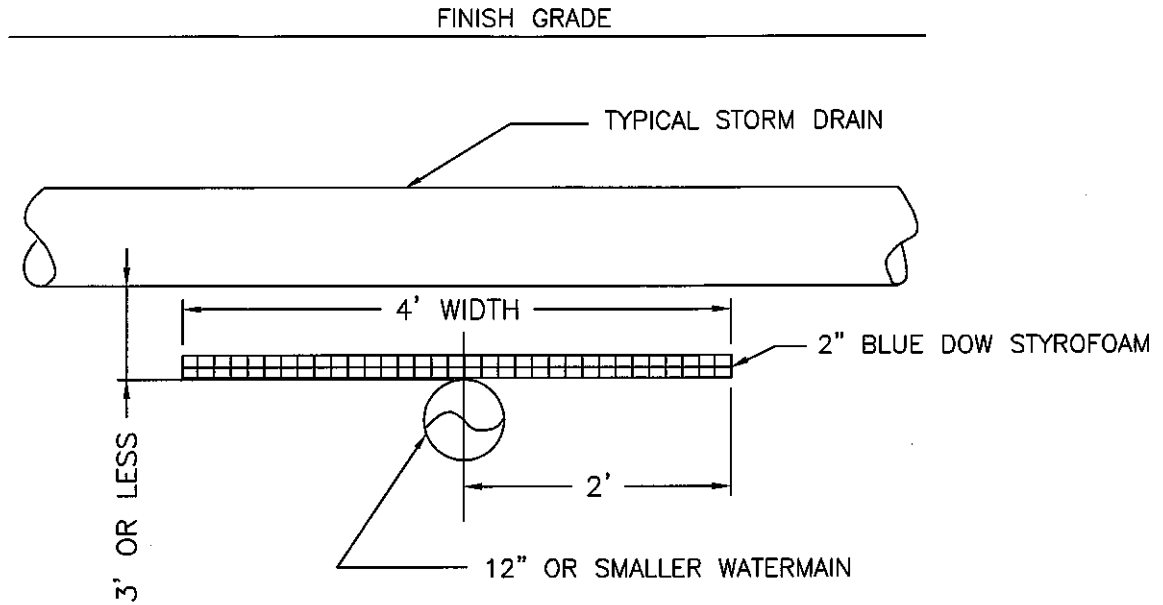
NOTES:

1. THE GREATER AUGUSTA UTILITY DISTRICT RESERVES THE RIGHT TO MODIFY INSULATION REQUIREMENTS AS NECESSARY BASED ON FIELD CONDITIONS, ETC.

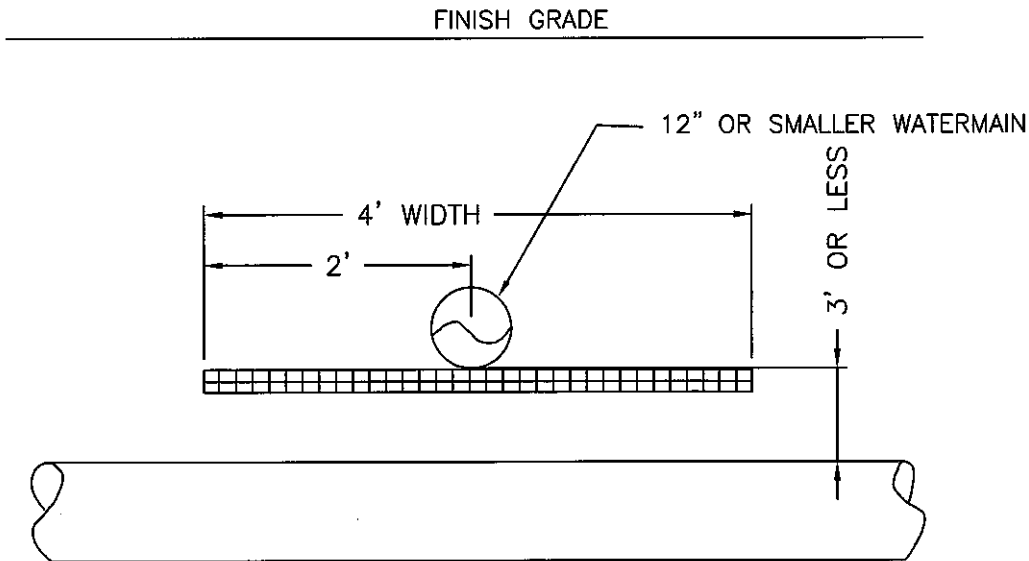
2. INSULATION TO BE RUN HORIZONTALLY AS LONG AS CONDITIONS I, II, OR III ABOVE EXIST. ALL BUTT JOINT SEAMS TO BE OVERLAPPED W/2' PIECE OF INSULATION CENTERED OVER SEAM.

STORM DRAIN/WATER MAIN INTERSECTING RUNS ELEVATION VIEW

GREATER AUGUSTA UTILITY DISTRICT
REVISED FEB. 2017 NTS



CONDITION I



CONDITION II

NOTES:

1. THE GREATER AUGUSTA UTILITY DISTRICT RESERVES THE RIGHT TO MODIFY INSULATION REQUIREMENTS AS NECESSARY BASED ON FIELD CONDITIONS, ETC.
2. THE LENGTH OR WIDTH OF INSULATION SHALL EXTEND 1 STORM DRAIN PIPE DIAMETER BEYOND THE EDGE OF STORM DRAIN PIPE IN EACH DIRECTION OR A MINIMUM OF 2' BEYOND THE CENTERLINE OF STORM DRAIN PIPE, WHICHEVER IS GREATER.
3. ALL BUTT JOINT SEAMS TO BE OVERLAPPED WITH A 2' PIECE OF INSULATION CENTERED OVER SEAM.

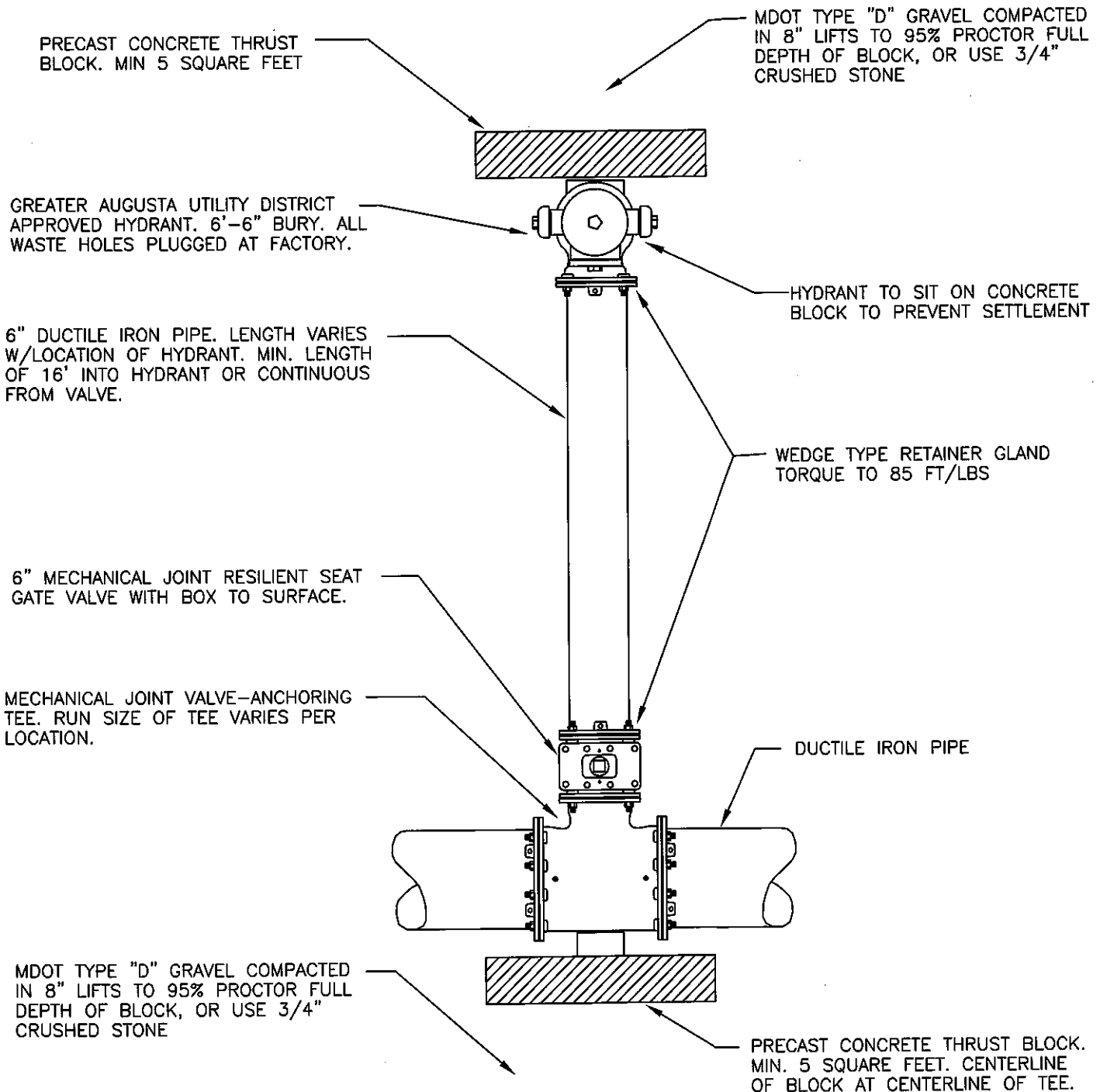
TYPICAL HYDRANT INSTALLATION

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017

NTS

MIN. DEPTH OF 6'-0" AT FLOWLINE

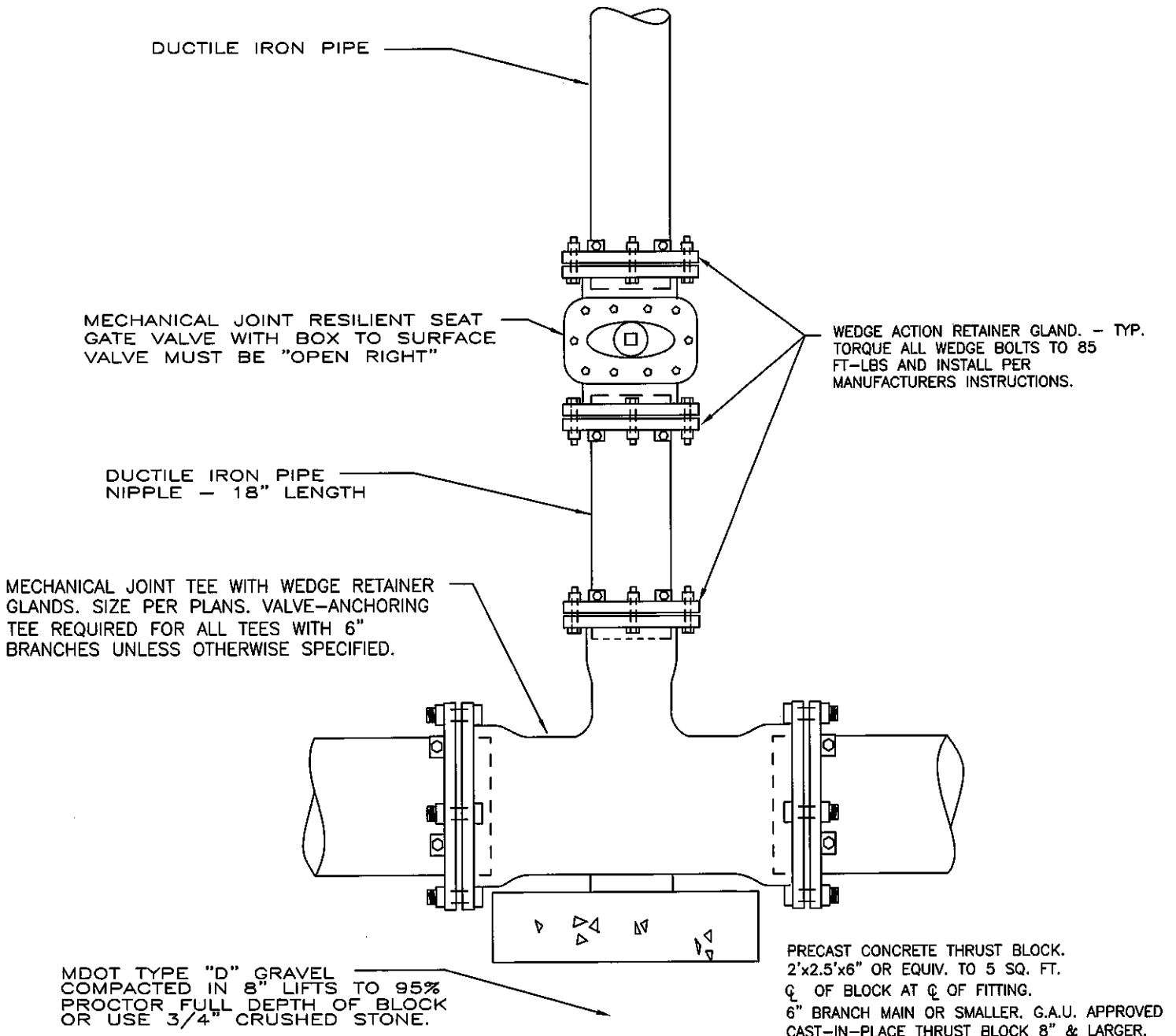


TYPICAL TEE DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

ALL PIPE SHOULD HAVE A MINIMUM DEPTH OF 5.5' TO TOP OF PIPE FROM FINISH GRADE



TYPICAL END OF MAIN DETAIL

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

MDOT TYPE "D" GRAVEL COMPACTED TO 95% PROCTOR TO ORIGINAL GROUND FULL DEPTH OF BLOCK OR USE 3/4" CRUSHED STONE.

CONCRETE THRUST BLOCK. SIZE TO BE DETERMINED BY SIZE OF PIPE. MIN. 5 SQ. FT. FOR 6" & 8", CAST-IN-PLACE THRUST BLOCK FOR 10" & LARGER. DESIGN TO BE PRE-APPROVED BY DISTRICT.

6" DICL PIPE CUT IN HALF TO FORM CHANNEL FOR VALVE & RISER

DUCTILE IRON PIPE. LENGTH TO BE DETERMINED IN THE FIELD

WEDGE ACTION RETAINER GLANDS.

DUCTILE IRON PIPE

2" DIAMETER THREADED IRON PIPE x REQUIRED LENGTH W/2" COUPLING & 2" IP PLUG ON TOP. NEVERSEIZE PLUG PRIOR TO INSTALLATION. TOP OF RISER TO BE 4" BELOW FINISH GRADE AND SET INSIDE GATE BOX TOP.

2" BRASS 90° ELBOW

2"x6" BRASS NIPPLE

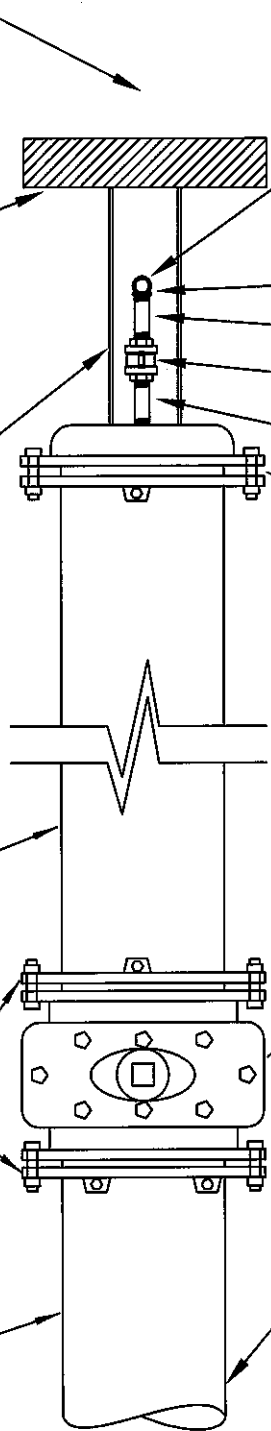
2" FIP BALL VALVE W/SERVICE BOX & ROD SET INSIDE GATE BOX TOP

2"x6" BRASS NIPPLE

MECHANICAL JOINT CAP TAP 2" W/ WEDGE ACTION RETAINER GLAND.

MECHANICAL JOINT RESILIENT SEAT GATE VALVE W/BOX TO SURFACE. LEAVE IN CLOSED POSITION

SUNSEQUENT JOINTS UPSTREAM OF GATE VALVE MAY NEED TO BE RESTRAINED BASED ON SIZE OF PIPE AND RESULTANT THRUST.

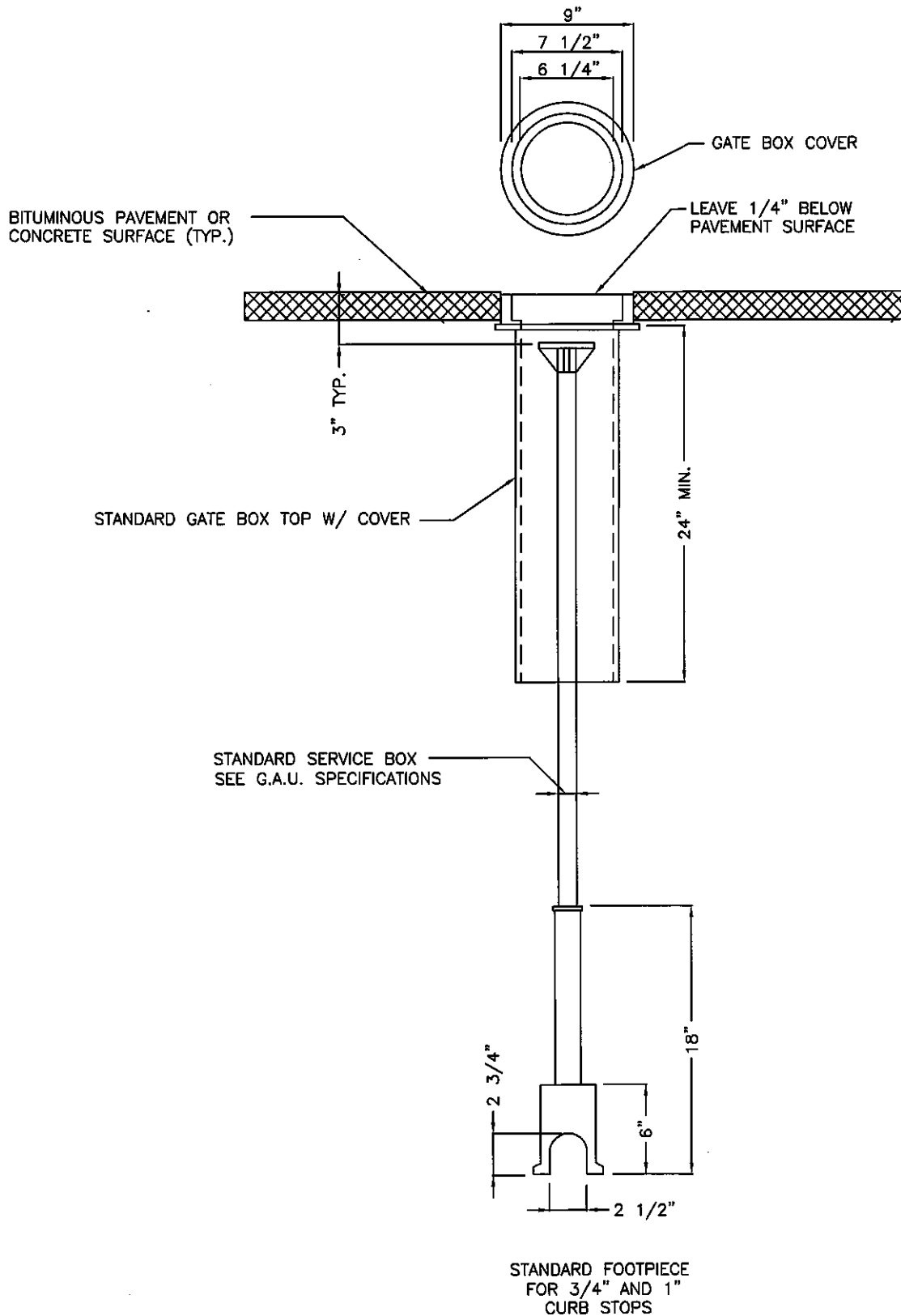


TYPICAL SERVICE BOX DETAIL IN PAVED AREAS

GREATER AUGUSTA UTILITY DISTRICT

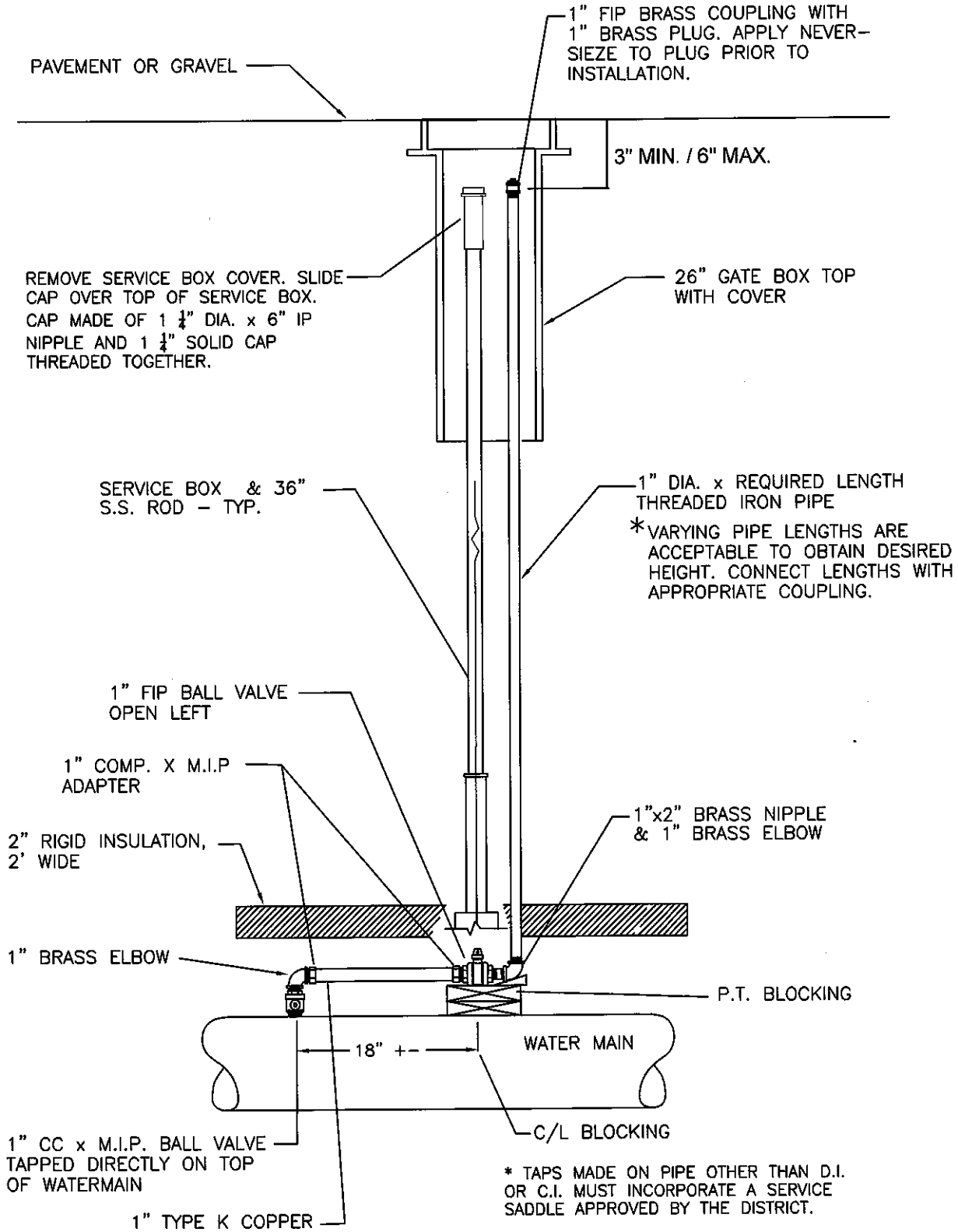
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TYPICAL AIR RELEASE DETAIL

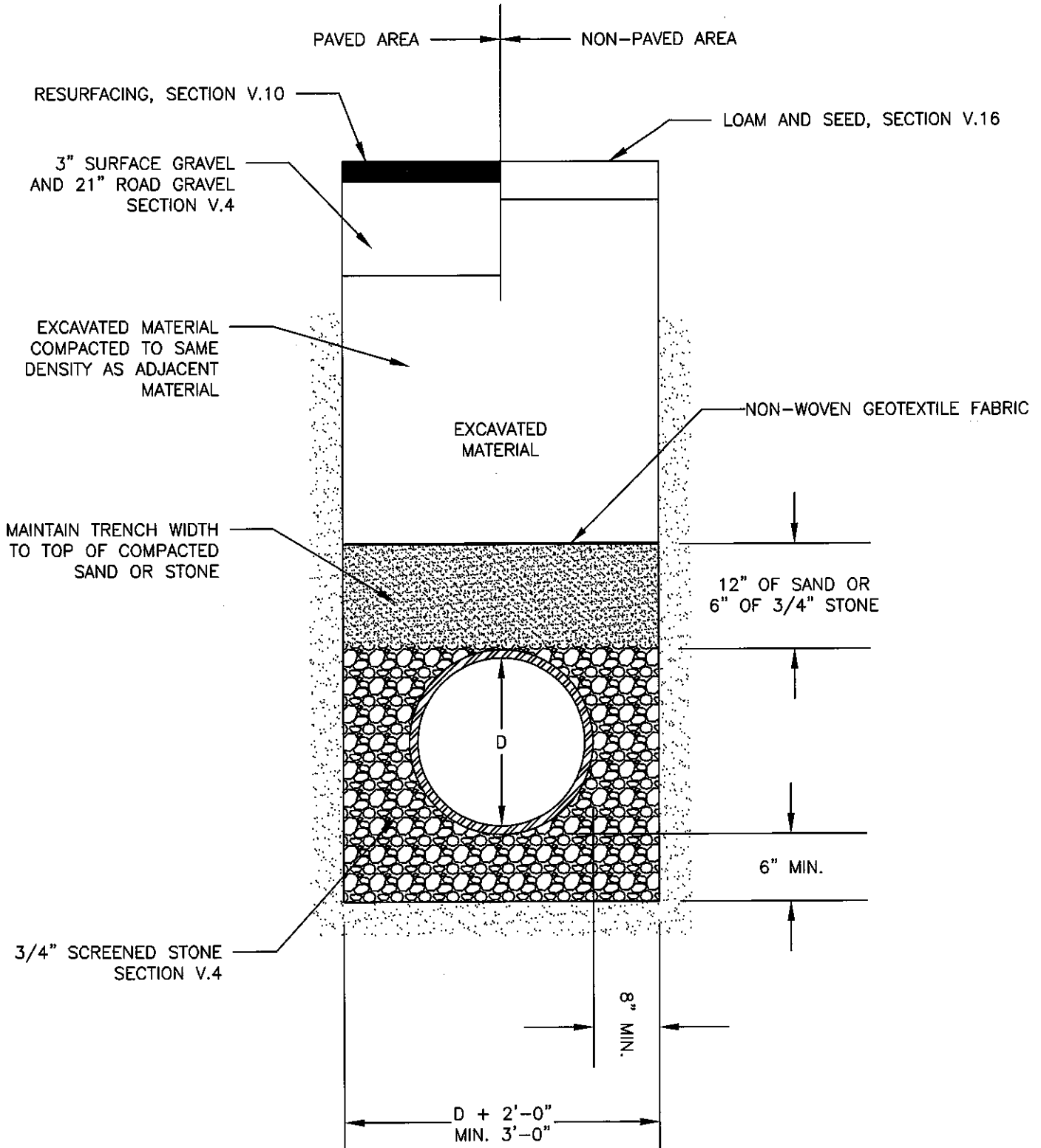
GREATER AUGUSTA UTILITY DISTRICT
REVISED FEB. 2017 NTS



TYPICAL TRENCH DETAIL - SEWER

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

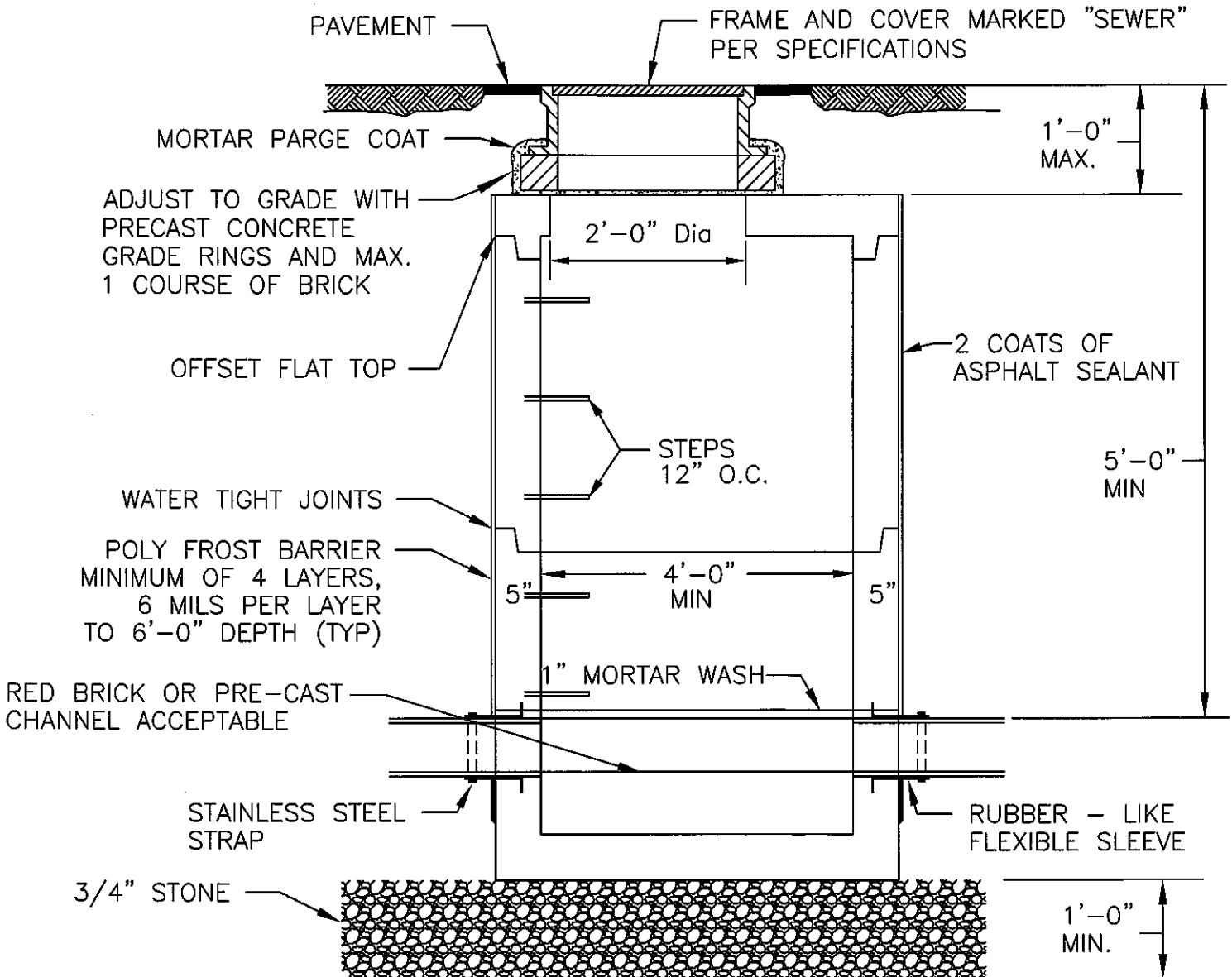


STANDARD PRECAST MANHOLE

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

SECTION V.7

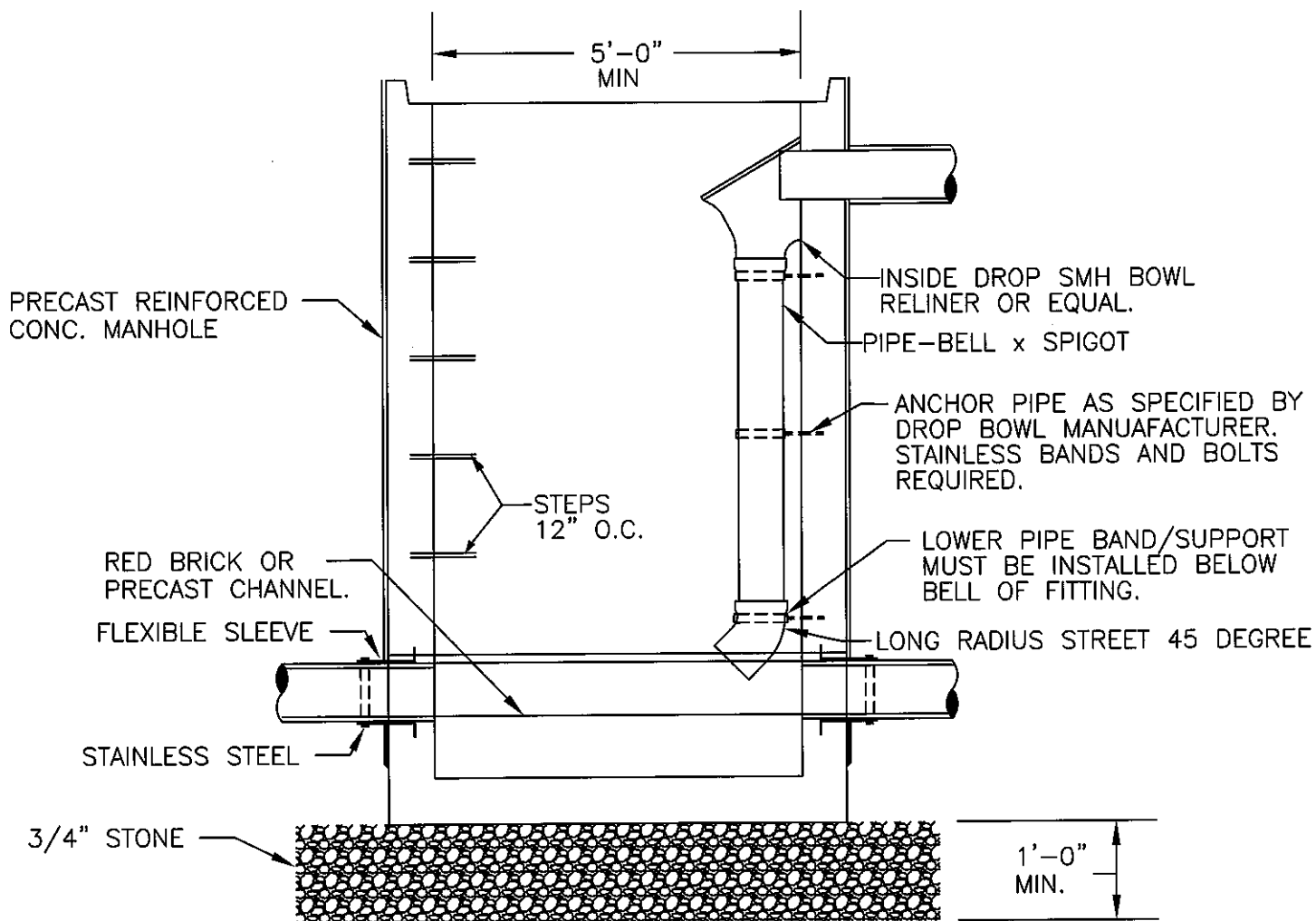


STANDARD PRECAST DROP MANHOLE

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

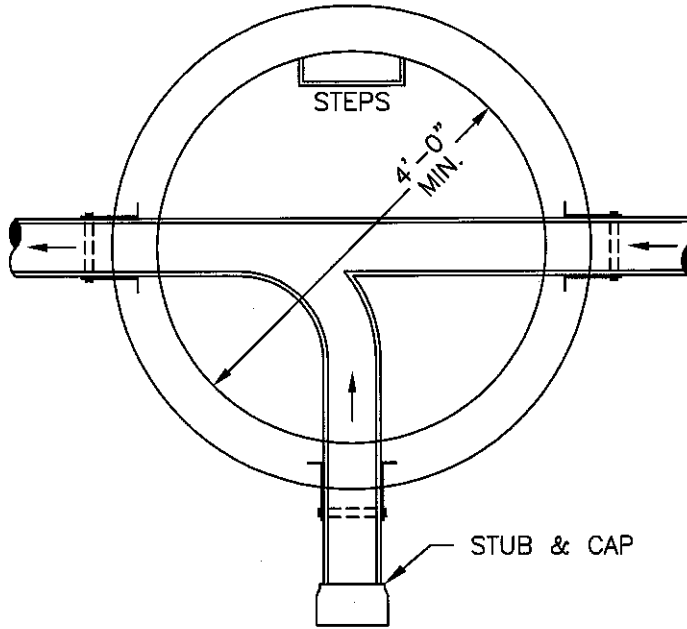
SECTION V.7



NOTE: OUTSIDE DROP SEWER MANHOLES WILL REQUIRE APPROVAL BY GAUD ENGINEERING DEPARTMENT.

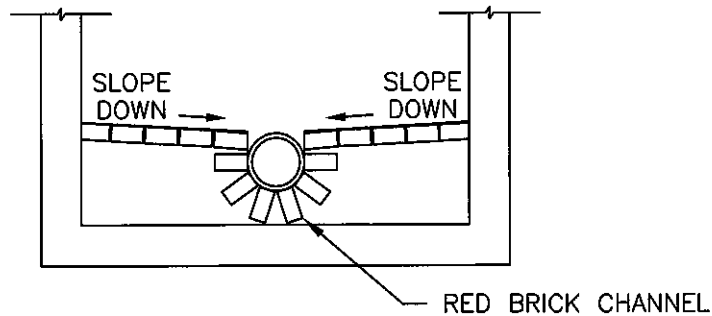
STANDARD INVERT & BRICK CHANNEL

GREATER AUGUSTA UTILITY DISTRICT
REVISED FEB. 2017 NTS



MANHOLE AND INVERT

NOT TO SCALE
SECTION V.7



BRICK CHANNEL

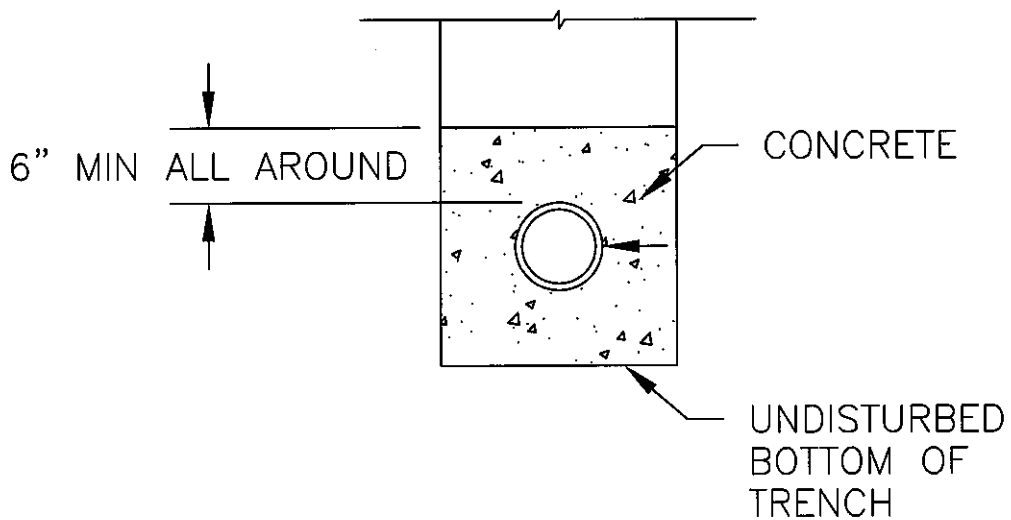
NOT TO SCALE
SECTION V.7

CONCRETE ENCASEMENT

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

SECTION V.12

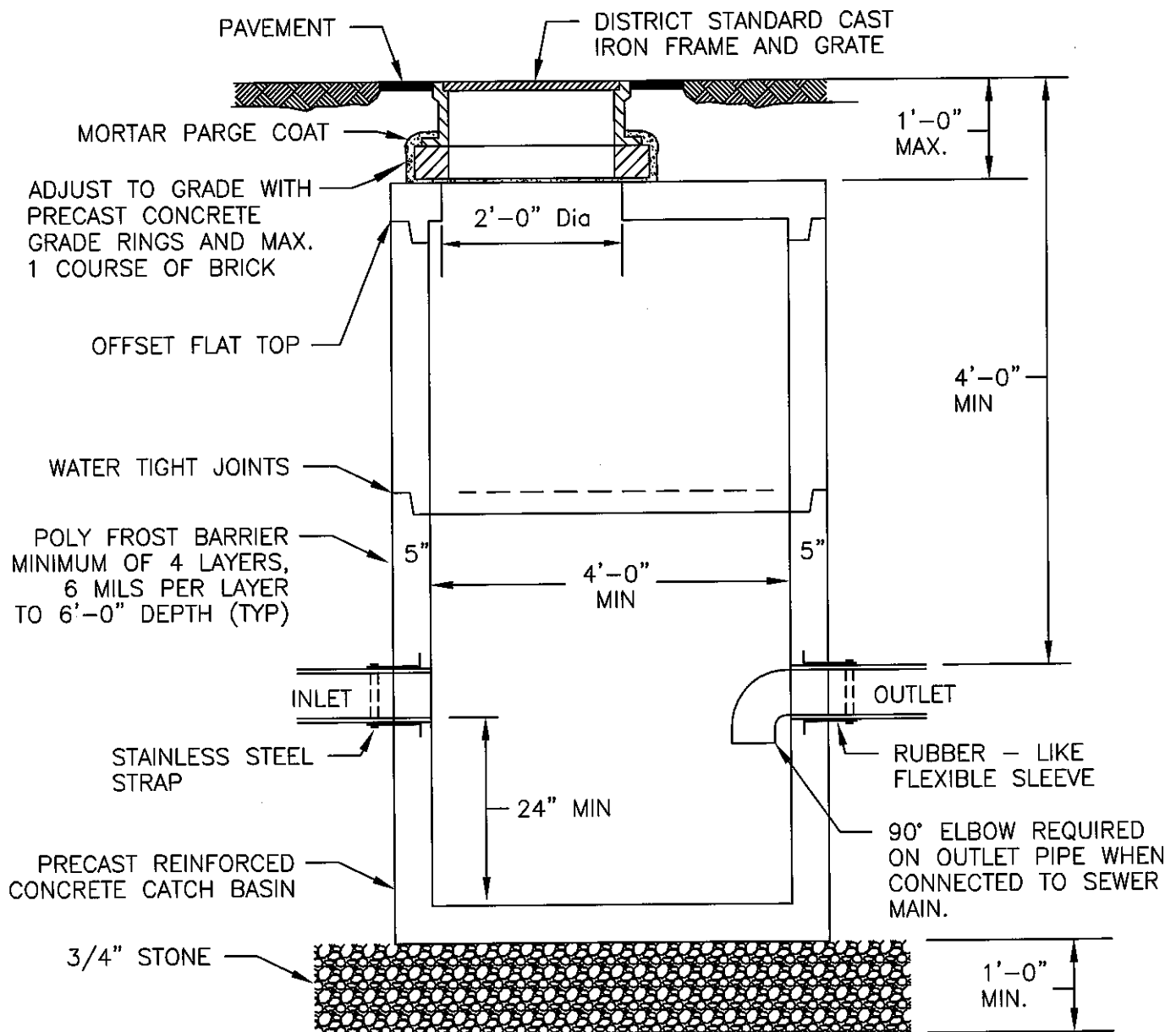


PRECAST CATCH BASIN

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

SECTION V.8



CATCH BASINS CONNECTED TO THE SEWER SYSTEM MUST BE PRE-APPROVED BY THE DISTRICT PRIOR TO INSTALLATION.

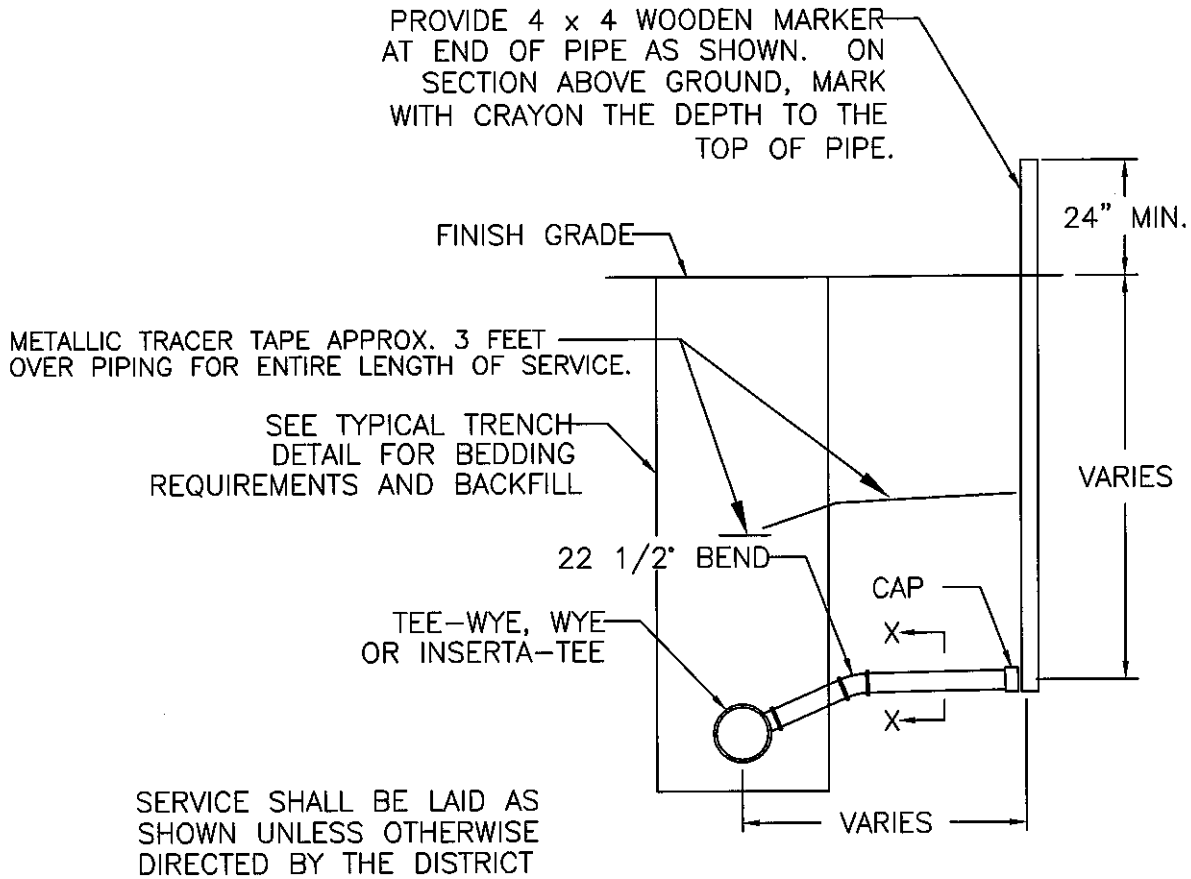
NEW SEWER CONNECTION

GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017

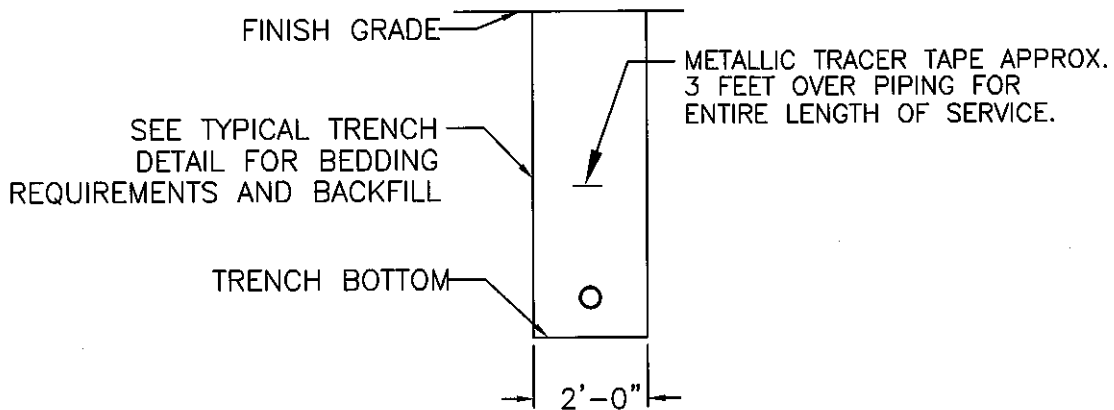
NTS

SECTION V.9



SEWER CONNECTION

SCALE: NONE



SECTION X-X

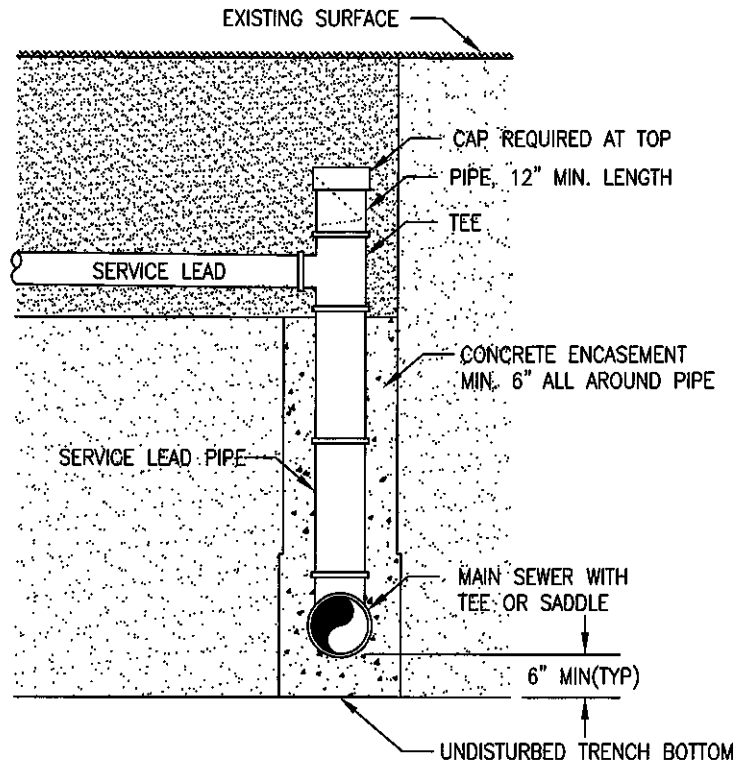
SCALE: NONE

NEW SEWER CONNECTION - CHIMNEYS

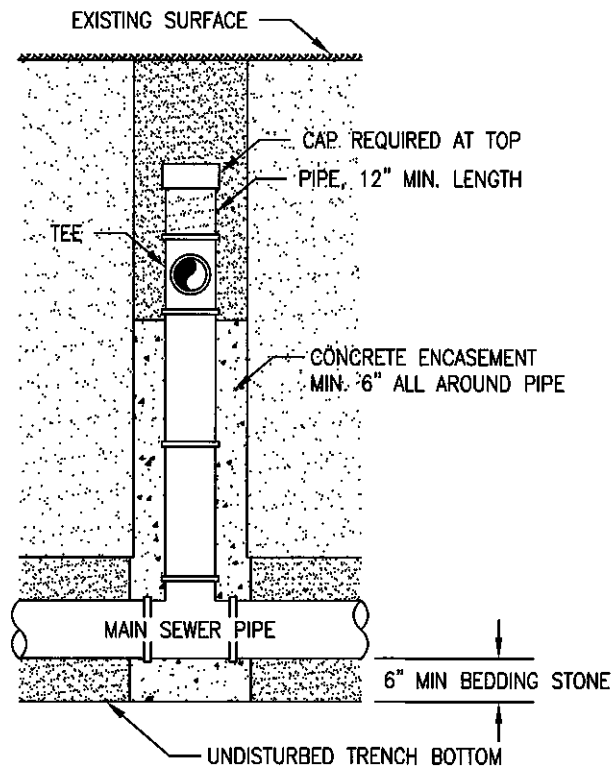
GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

SECTION V.9



THE USE OF CHIMNEYS FOR ANY SEWER SERVICE CONNECTION MUST BE PREAPPROVED BY THE DISTRICT PRIOR TO INSTALLATION..

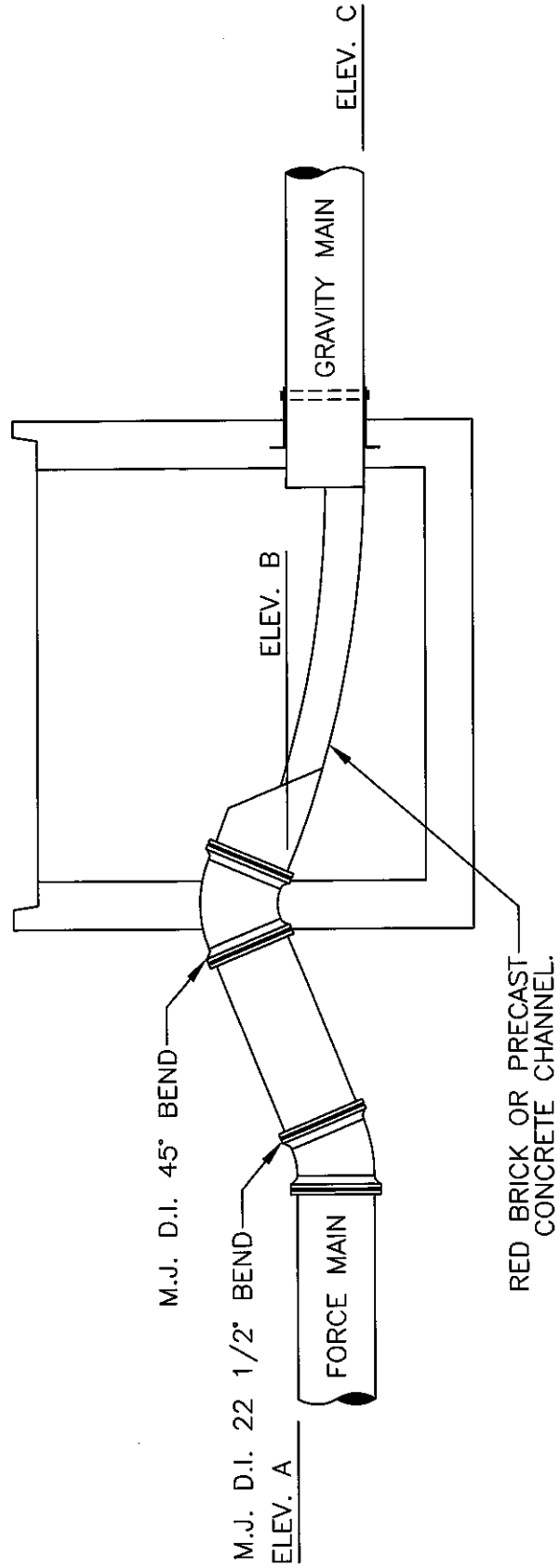


FORCE MAIN TERMINUS GREATER AUGUSTA UTILITY DISTRICT

REVISED FEB. 2017 NTS

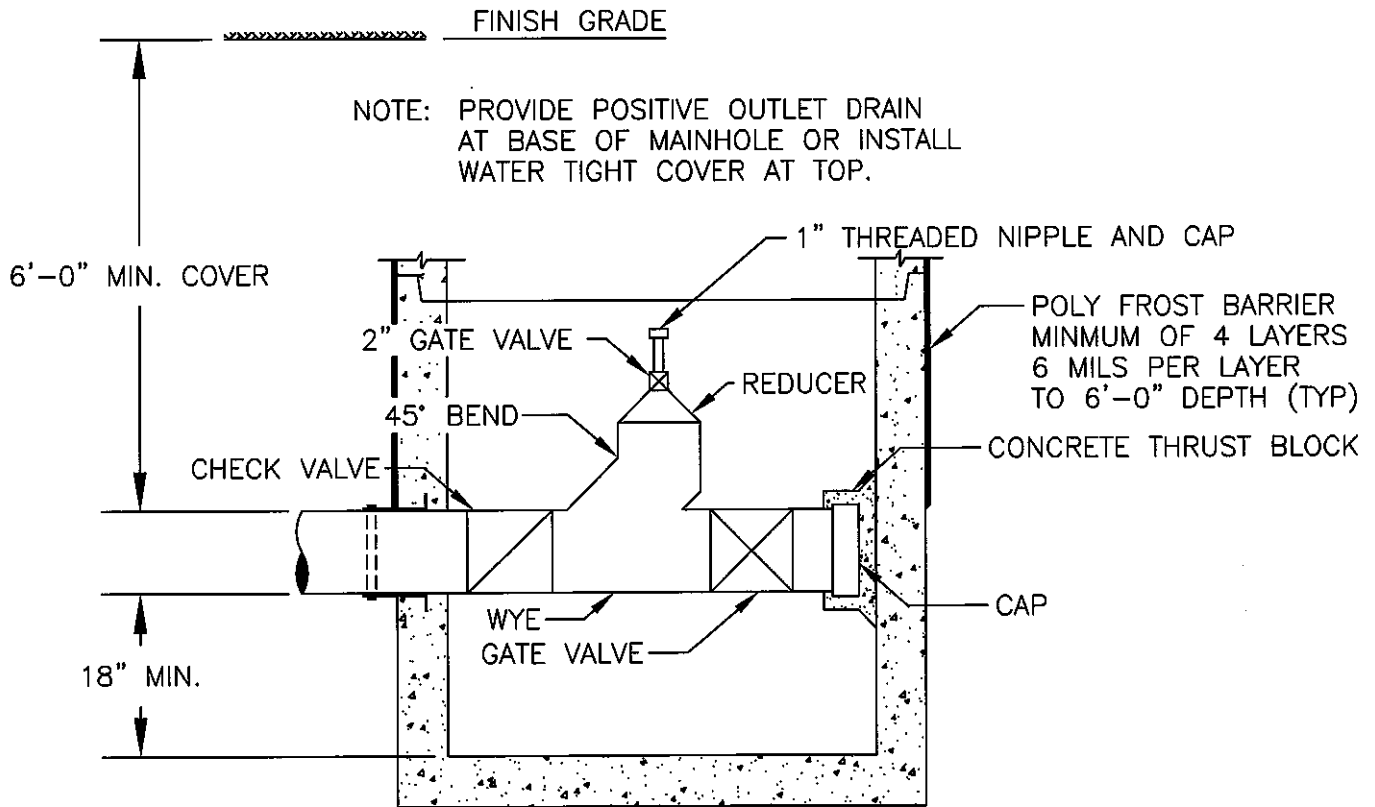
SECTION V.6

NOTE: ELEV. B TO BE 1" HIGHER THAN ELEV. A
ELEV. C TO BE A MIN. OF 8" BELOW ELEV. B



PRECAST CLEANOUT MANHOLE - 4' DIA.

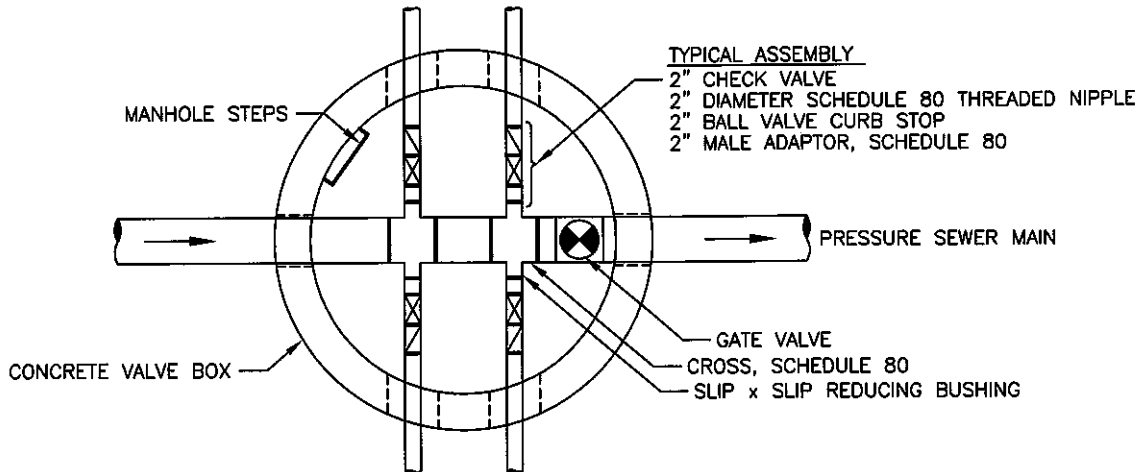
GREATER AUGUSTA UTILITY DISTRICT
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FORCE MAIN SERVICE VALVE BOX

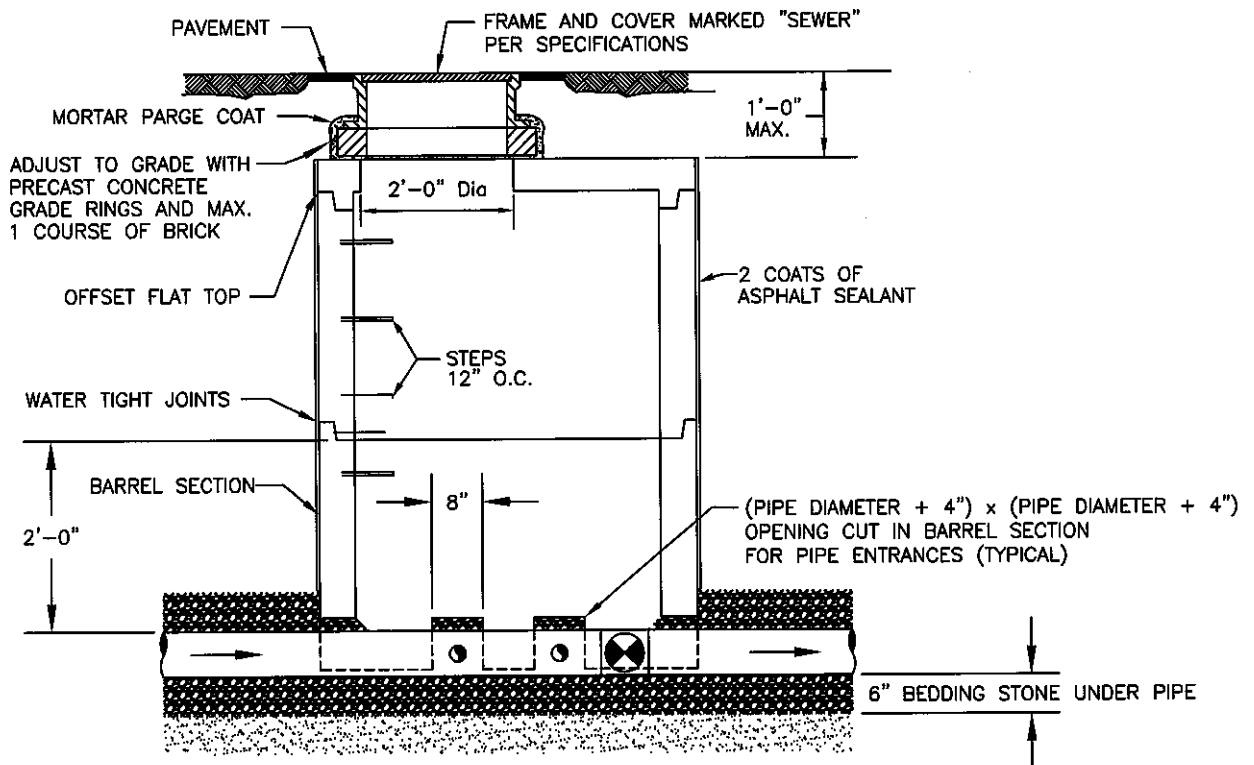
GREATER AUGUSTA UTILITY DISTRICT

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PLAN

NOT TO SCALE

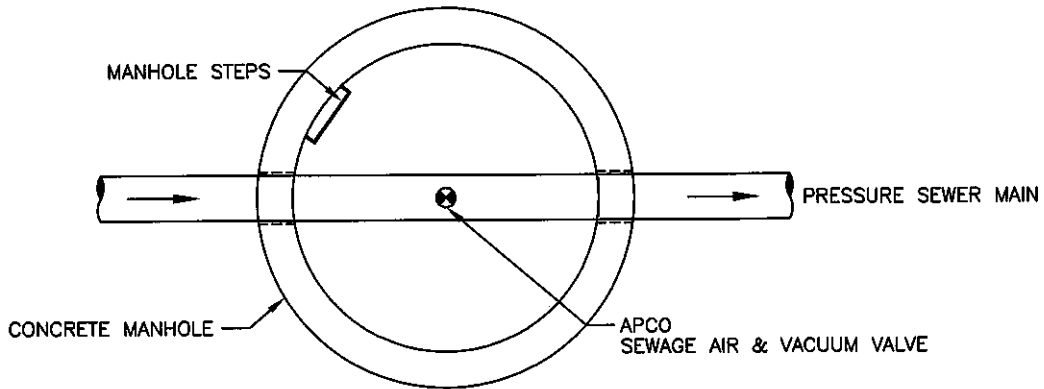


NOTE: TRACER WIRES FROM THE FORCE MAIN AND ALL SERVICE CONNECTIONS SHALL BE BROUGHT TO THE SURFACE INSIDE THE FRAME & COVER AND SECURED IN PLACE. ALL WIRES MUST BE LABELED TO DESIGNATE WHICH PIPE THEY ARE ATTACHED TO.

AIR RELEASE MANHOLE

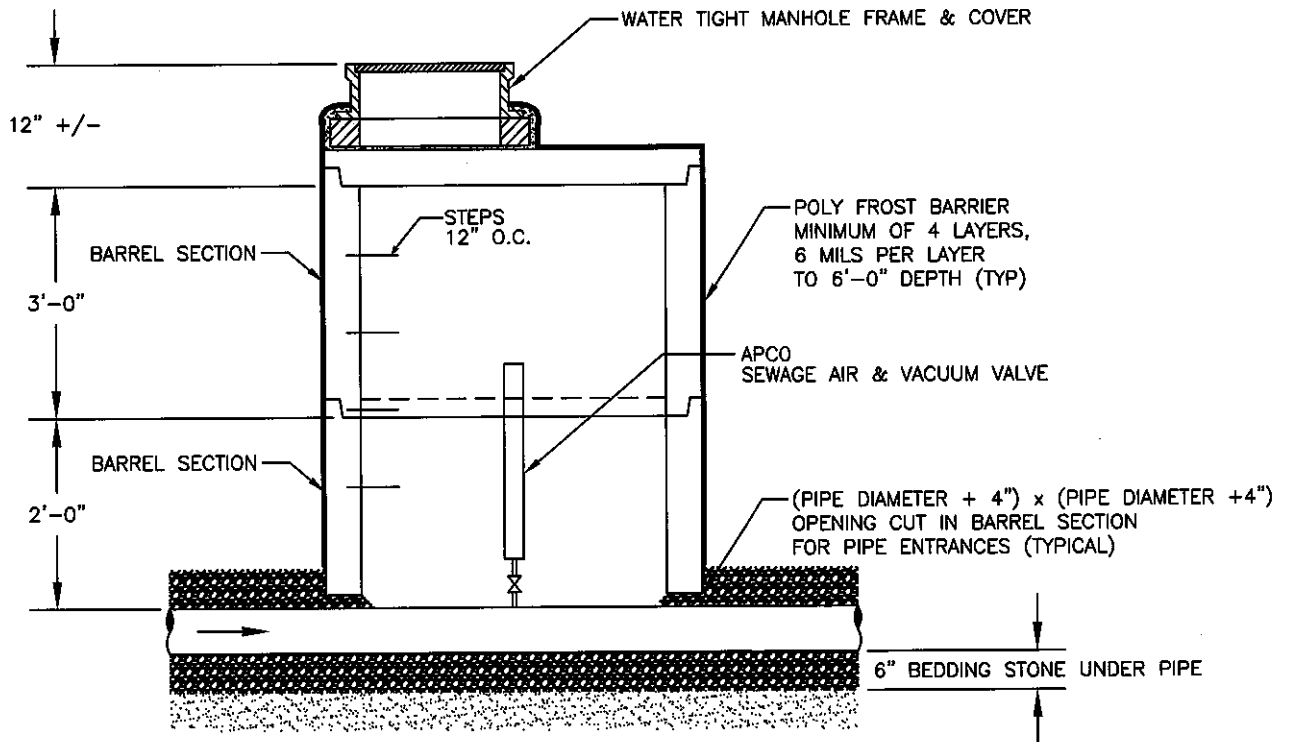
GREATER AUGUSTA UTILITY DISTRICT

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PLAN

NOT TO SCALE



NOTE: TRACER WIRE FROM SEWER FORCE MAIN SHALL BE BROUGHT TO THE SURFACE INSIDE THE FRAME & COVER AND SECURED IN PLACE.